Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor
DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada
DOE/EIS-0369D

Summary

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy (DOE)

TITLE: *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (DOE/EIS-0250F-S2D; the Nevada Rail Corridor SEIS), and *Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0369D; the Rail Alignment EIS)

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Information about this document is available on the Internet at the Yucca Mountain Project web site at *http://www.ocrwm.doe.gov* and on the DOE National Environmental Policy Act (NEPA) web site at *http://eh.doe.gov/nepa/*.

ABSTRACT: The Nevada Rail Corridor SEIS (DOE/EIS-0250F-S2D) analyzes the potential impacts of constructing and operating a railroad to connect the Yucca Mountain repository site to an existing rail line near Wabuska, Nevada (in the Mina rail corridor). The Nevada Rail Corridor SEIS analyzes the Mina rail corridor at a level of detail commensurate with that of the rail corridors analyzed in the Final *Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F). The Nevada Rail Corridor SEIS also updates relevant information regarding other rail corridors previously analyzed in the Yucca Mountain FEIS (Carlin, Jean, and Valley Modified) to identify any significant new circumstances or information relevant to environmental concerns.

The Rail Alignment EIS (DOE/EIS-0369D) analyzes the potential impacts of railroad construction and operation along common segments and alternative segments within the Caliente (selected in a previous Record of Decision, 69 *Federal Register* 18557) and Mina rail corridors for the purpose of determining an alignment for the construction and operation of a railroad for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from an existing rail line in Nevada to a geologic repository at Yucca Mountain. The Rail Alignment EIS also analyzes the potential impacts of constructing and operating support facilities.

COOPERATING AGENCIES: The U.S. Bureau of Land Management, the Surface Transportation Board, and the U.S. Air Force are cooperating agencies in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS.

PUBLIC COMMENTS: A 90-day comment period on this document begins with the publication of the Environmental Protection Agency Notice of Availability in the *Federal Register*. DOE will consider comments received after the 90-day period to the extent practicable. The Department will hold public hearings to receive comments on the document at the times and locations announced in local media and the DOE Notice of Availability. Written comments may also be submitted by U.S. mail to the U.S. Department of Energy at the above address in Las Vegas, via the Internet at *http://www.ymp.gov*, or by facsimile at 1-800-967-0739. This public comment period and the public hearings coincide with those of the *Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1D).

FOREWORD

The U.S. Department of Energy (DOE or Department) has prepared two draft National Environmental Policy Act (NEPA) documents associated with the proposed disposal of spent nuclear fuel and high-level radioactive waste in a geologic repository at the Yucca Mountain Site in Nye County, Nevada:

Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS-0250F-S1; the Repository SEIS)

Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor (Part 1) (DOE/EIS-0250F-S2D; the Nevada Rail Corridor SEIS), and *Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (Part 2) (DOE/EIS-0369D; the Rail Alignment EIS).

The Repository SEIS evaluates the potential environmental impacts of constructing and operating the Yucca Mountain repository under the current repository design and operational plans, the purpose of which is to assist the U.S. Nuclear Regulatory Commission (NRC) in adopting, to the extent practicable, any EIS prepared pursuant to Section 114(f)(4) of the Nuclear Waste Policy Act, as amended (NWPA; 42 United States Code 10101 *et seq.*).

The Nevada Rail Corridor SEIS and the Rail Alignment EIS evaluate the potential environmental impacts of constructing and operating a railroad for shipments of spent nuclear fuel and high-level radioactive waste from an existing rail line in Nevada to the repository at Yucca Mountain, the purpose of which is to help the Department decide whether to construct and operate a railroad, and if so, within which corridor and along which alignment.

Background and Context

The NWPA directs the Secretary of Energy, if the Secretary decides to recommend approval of the Yucca Mountain site for development of a repository, to submit a final EIS with any recommendation to the President. To fulfill that requirement, the Department prepared the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F, February 2002) (Yucca Mountain FEIS).

On February 14, 2002, the Secretary transmitted to the President his recommendation (including the Yucca Mountain FEIS) for approval of the Yucca Mountain site for development of a geologic repository. The President considered the site qualified for application to the NRC for construction authorization and recommended the site to the U.S. Congress. Subsequently, Congress passed a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. On July 23, 2002, the President signed the joint resolution into law (Public Law 107-200). The Department is now in the process of preparing an application for submittal to the NRC seeking authorization to construct the repository, as required by the NWPA (Section 114(b)).

Since completion of the Yucca Mountain FEIS in 2002, DOE has continued to develop the repository design and associated construction and operational plans. As now proposed, the newly designed surface and subsurface facilities would allow DOE to operate the repository following a primarily canistered approach in which most commercial spent nuclear fuel would be packaged at the reactor sites in transport, aging, and disposal (TAD) canisters. Any commercial spent nuclear fuel arriving at the repository in packages other than TAD canisters would be repackaged by DOE at the repository into TAD canisters. DOE would construct the surface and subsurface facilities over a period of several years (referred to as phased construction) to accommodate an increase in spent nuclear fuel and high-level radioactive waste receipt rates as repository operational capability reaches its design capacity. To address the current repository design and operational plans, the Department announced its intent to prepare a Supplement to the Yucca Mountain FEIS (DOE/EIS-0250F-S1), consistent with NEPA and the NWPA. (*Supplement to the Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV*; 71 *Federal Register* [*FR*] 60490, October 13, 2006). The Repository SEIS supplements the Yucca Mountain FEIS by considering the potential environmental impacts of the construction, operation and closure of the repository under the current repository design and operational plans, and by updating the analysis and potential environmental impacts of transporting spent nuclear fuel and high-level radioactive waste to the repository, consistent with transportation-related decisions the Department made following completion of the Yucca Mountain FEIS.

On April 8, 2004, the Department issued a Record of Decision announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain FEIS as the primary means of transporting spent nuclear fuel and high-level radioactive waste to the repository (*Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV*; 69 *FR* 18557, April 8, 2004). Implementation of the mostly rail scenario ultimately would require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. To that end, in the same Record of Decision, the Department also selected the Caliente rail corridor from several corridors considered in the Yucca Mountain FEIS as the corridor in which to study possible alignments for a rail line. On the same day DOE selected the Caliente corridor, it issued a Notice of Intent to prepare an EIS under NEPA to study alternative alignments within the Caliente corridor (the Rail Alignment EIS; DOE/EIS-0369) (*Notice of Intent to Prepare an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV*; 69 *FR* 18565, April 8, 2004).

During the subsequent public scoping process, DOE received comments suggesting that other rail corridors be considered, in particular, the Mina route. In the Yucca Mountain FEIS, DOE had considered but eliminated the Mina route from detailed study because a rail line within the Mina route could only connect to an existing rail line in Nevada by crossing the Walker River Paiute Reservation, and the Tribe had informed DOE that it would not allow nuclear waste to be transported across the Reservation.

Following review of the scoping comments, DOE held discussions with the Walker River Paiute Tribe and, in May 2006, the Tribal Council informed DOE that it would allow the Department to consider the potential impacts of constructing and operating a railroad to transport spent nuclear fuel and high-level radioactive waste across its reservation. On October 13, 2006, after a preliminary evaluation of the feasibility of the Mina rail corridor, DOE announced its intent to expand the scope of the Rail Alignment EIS to include the Mina corridor (*Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV*; 71 *FR* 60484). Although the expanded NEPA analysis, referred to as the Nevada Rail Corridor SEIS and the Rail Alignment EIS, evaluate the potential environmental impacts associated with the Mina rail corridor, DOE has identified the Mina alternative as nonpreferred because the Tribe has withdrawn its support for the EIS process.

Relationships Among the EISs

The Yucca Mountain FEIS, the Repository SEIS, and the Nevada Rail Corridor SEIS and the Rail Alignment EIS are related in several respects. The Nevada Rail Corridor SEIS supplements the rail corridor analysis of the Yucca Mountain FEIS by analyzing the potential environmental impacts associated with constructing and operating a railroad within the Mina corridor. The Nevada Rail Corridor SEIS analyzes the Mina corridor at a level of detail commensurate with that of the rail corridor analysis in the Yucca Mountain FEIS, and concludes that the Mina corridor warrants further study in the Rail Alignment EIS to identify an alignment for the construction and operation of a railroad.

The Nevada Rail Corridor SEIS also updates relevant information regarding three other rail corridors previously analyzed in the Yucca Mountain FEIS (Carlin, Jean, and Valley Modified). The update demonstrates that there are no significant new circumstances or information relevant to environmental concerns associated with these three rail corridors, and that they do not warrant further consideration in the Rail Alignment EIS. The Caliente-Chalk Mountain rail corridor, which also was included in the Yucca Mountain FEIS, would intersect the Nevada Test and Training Range, and was eliminated from further consideration because of U.S. Air Force concerns that a rail line within the Caliente-Chalk Mountain corridor would interfere with military readiness testing and training activities.

The Rail Alignment EIS tiers from the broader corridor analysis in both the Yucca Mountain FEIS and the Nevada Rail Corridor SEIS, consistent with the Council on Environmental Quality regulations (see 40 Code of Federal Regulations 1508.28). Under the Proposed Action considered in the Rail Alignment EIS, DOE analyzes specific potential impacts of constructing and operating a railroad along common segments and alternative segments within the Caliente and Mina corridors for the purpose of determining an alignment in which to construct and operate a railroad for shipments of spent nuclear fuel and high-level radioactive waste from an existing rail line in Nevada to a geologic repository at Yucca Mountain.

The Repository SEIS includes the potential environmental impacts of national transportation, and the potential impacts from the construction and operation of a rail line along specific alignments in either the Caliente or the Mina corridor, as described in the Rail Alignment EIS, to ensure that the Repository SEIS considers the full scope of potential environmental impacts associated with the proposed construction and operation of the repository. Conversely, the Rail Alignment EIS includes the potential impacts of constructing and operating the repository as a reasonably foreseeable future action in its cumulative impacts analysis. To ensure consistency, the Repository SEIS, the Nevada Rail Corridor SEIS, and the Rail Alignment EIS use the same inventory of spent nuclear fuel and high-level radioactive waste and the same number of rail shipments for analysis. Thus, the associated occupational and public health and safety impacts within the Nevada rail corridors under consideration are the same in both documents. Furthermore, to promote conformity, where appropriate, consistent analytical approaches were used in both documents to evaluate the various resource areas.

The figure that follows summarizes the relationship among the EISs.

Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS-0250F)

Proposed Action:

- DOE would construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain.
- Repository operations would include transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain nationally and in Nevada by either mostly rail or mostly truck

Record of Decision

- Mostly rail nationally and in Nevada
- Caliente rail corridor to determine a rail alignment

Repository SEIS (DOE/EIS-0250F-S1)

1. Supplements the Yucca Mountain FEIS in its entirety, as modified by:
   - Record of Decision (mostly rail, Caliente rail corridor) (69 *FR* 18557)
   - Outcome of the Nevada Rail Corridor SEIS (Mina rail corridor)
2. Otherwise the Proposed Action remains unchanged:
   - DOE would construct, operate and monitor, and eventually close a repository
   - During repository operations, shipments would occur by mostly rail
   - In Nevada, rail shipments would occur on a railroad to be constructed along an alignment within either the Caliente or the Mina rail corridor
   - Shipments also would arrive at repository by truck
3. To supplement Nevada transportation analysis, Repository SEIS incorporates by reference relevant information from the Rail Alignment EIS:
   - Affected environments for Caliente and Mina rail alignments
   - Environmental impacts from constructing and operating a railroad along Caliente or Mina rail alignment
   - Cumulative impacts associated with Caliente and Mina rail alignments

Nevada Rail Corridor SEIS (Part 1) (DOE/EIS-0250F-S2)

1. Supplements the Nevada transportation analysis of the Yucca Mountain FEIS, as modified by:
   - Record of Decision (mostly rail) (69 *FR* 18557)
   - Proposed consideration of Mina rail corridor
2. Under the Proposed Action, DOE would construct and operate a railroad to connect the Yucca Mountain repository to an existing rail line near Wabuska, Nevada (the Mina rail corridor)
   - Mina corridor information and analyses at a level of detail commensurate with that of the other corridors in the Yucca Mountain FEIS
3. Considers other corridors in the Yucca Mountain FEIS for significant new circumstances or information relevant to environmental concerns
   - Review environmental information available since the Yucca Mountain FEIS
4. Conclusion:
   - Whether the Mina rail corridor warrants further detailed study to determine an alignment based on impact analysis
   - Whether there are significant changes or new information relevant to environmental concerns for the other corridors that would warrant further detailed study to determine an alignment

Rail Alignment EIS (Part 2) (DOE/EIS-0369)

1. Tiers from the Yucca Mountain FEIS and the Nevada Rail Corridor SEIS
2. Proposed Action based on Record of Decision (69 *FR* 18557)
   - Under the Proposed Action, DOE would determine an alignment for the construction and operation of a railroad
     - ⇒ Caliente Implementing Alternative (preferred)
     - ⇒ Mina Implementing Alternative (nonpreferred)

Relationship between the Repository SEIS, the Nevada Rail Corridor SEIS, and the Rail Alignment EIS.

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SUMMARY OF NEVADA RAIL CORRIDOR SEIS AND RAIL ALIGNMENT EIS

This document summarizes the Nevada Rail Corridor SEIS and the Rail Alignment EIS. Volumes I, II, III, and IV provide detailed background information; descriptions of existing environments and environmental analyses; analytical methods and assumptions; a list of technical references; a glossary of terms; supporting appendixes, and an index.

S.1 INTRODUCTION

The U.S. Department of Energy (DOE or the Department) has prepared the *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (for brevity, referred to as the Nevada Rail Corridor SEIS) and the *Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (for brevity, referred to as the Rail Alignment EIS) to evaluate the potential environmental impacts of constructing and operating a railroad for shipments of spent nuclear fuel and high-level radioactive waste from an existing rail line in Nevada to a geologic repository at Yucca Mountain. The purpose of the evaluation is to assist the Department in deciding whether to construct and operate a railroad in Nevada, and if so, in which corridor and along which specific alignment within the selected corridor.

Spent nuclear fuel is fuel that has been withdrawn from a reactor following irradiation.

- **Commercial spent nuclear fuel** comes from civilian nuclear power plants that generate electricity.
- **DOE spent nuclear fuel** comes from DOE production reactors (such as defense nuclear material production reactors), naval reactors, and university- and government-owned test and experimental reactors.

High-level radioactive waste is the highly radioactive material that results from the reprocessing of spent nuclear fuel and other highly radioactive material, which the U.S. Nuclear Regulatory Commission determines by rule requires permanent isolation.

The Nevada Rail Corridor SEIS supplements the analysis in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS; DOE/EIS-0250F, February 2002) . The Rail Alignment EIS, analyzes the potential environmental impacts associated with constructing and operating a railroad along specific alignments within the Caliente and Mina rail corridors.

Section S.2 summarizes the Nevada Rail Corridor SEIS. Section S.3 summarizes the Rail Alignment EIS.

Rail corridor: A strip of land 400 meters (0.25 mile) wide within which DOE would determine an alignment for the construction of a rail line.

Rail alignment: An engineered refinement of a rail corridor in which DOE would identify the location of a rail line. A rail alignment is comprised of common segments and alternative segments.

Railroad: A transportation system incorporating the rail line, rail line operations support facilities, rail cars, locomotives, and other related property and infrastructure.

Rail line: An engineered feature incorporating the track, ties, ballast, and subballast at a specific location.

S.1.1 Background

The United States has focused a national effort on siting and developing a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste and on developing systems for transporting these materials from their present locations throughout the country to that repository.

The Nuclear Waste Policy Act of 1982 (Public Law 97-425) acknowledged the Federal Government's responsibility to provide for the disposal of the Nation's spent nuclear fuel and high-level radioactive waste, and initiated a process to select sites for technical study as potential geologic repository locations. In 1987, Congress amended the Nuclear Waste Policy Act. This Act, as amended (42 U.S.C. 10101 *et seq.*), which the Supplemental Nevada Rail Corridor EIS and Rail Alignment EIS refers to as the NWPA, identifies the Yucca Mountain Site in Nye County, Nevada, as the site to be studied as a potential location for a geologic repository.

After completion of site characterization studies at Yucca Mountain, the Secretary of Energy found the site to be scientifically and technically suitable for development of a repository. On February 14, 2002, the Secretary submitted his recommendation, along with a comprehensive statement of the basis for the recommendation, to the President of the United States, George W. Bush, for approval of the Yucca Mountain Site for the development of a nuclear waste repository. As required by the NWPA, the U.S. Department of Energy (DOE) had prepared an EIS, *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS), to accompany the Secretary's recommendation to the President.

On February 15, 2002, the President, in accordance with the NWPA, approved the Secretary of Energy's recommendation of the Yucca Mountain Site for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. On July 23, 2002, the President signed into law a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain Site for development as a geologic repository (Yucca Mountain Development Act of 2002, Public Law 107-200).

As part of its obligations under the NWPA, DOE is responsible for developing a system to transport spent nuclear fuel and high-level radioactive waste to the repository. In the Yucca Mountain FEIS, DOE analyzed a proposed action to construct, operate, monitor, and eventually close a geologic repository at Yucca Mountain in southern Nevada for the disposal of spent nuclear fuel and high-level radioactive waste. As part of that action, DOE evaluated various modes of transporting spent nuclear fuel and high-level radioactive waste from 72 commercial sites and five DOE sites nationwide to the Yucca Mountain Site. (Note: DOE now plans to move all spent nuclear fuel from Fort St. Vrain to Idaho National Laboratory prior to packaging for shipment to Yucca Mountain. Therefore, the number of DOE sites is four.)

After the Yucca Mountain Site was designated, DOE initiated preparation of a license application to be submitted to the U.S. Nuclear Regulatory Commission seeking authorization to construct the repository. In addition, to be in a position to transport spent nuclear fuel and high-level radioactive waste to the repository if the Commission granted the Department a construction authorization (and subsequently authorization to receive these materials), DOE proceeded with certain decisions related to transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain.

The Yucca Mountain FEIS examined various national transportation scenarios and Nevada transportation alternatives to evaluate potential transportation impacts to human health and the environment. DOE evaluated two national transportation scenarios, referred to as the "mostly legal-weight truck scenario" and the "mostly rail scenario," and three Nevada transportation scenarios, referred to as the "Nevada mostly legal-weight truck scenario," the "Nevada mostly rail scenario," and the "Nevada mostly heavy-haul truck scenario." Following completion of the Yucca Mountain FEIS, DOE identified the mostly rail scenario as its preferred mode of transportation, both nationally and in Nevada, due in part to lower potential impacts on the health and safety of workers and the public (*Notice of Preferred Nevada Rail Corridor* [68 *Federal Register* {*FR*}74951, December 29, 2003]). In the same *Federal Register* notice, DOE announced its preference for the Caliente rail corridor.

In 2004, DOE announced the selection of the mostly rail scenario analyzed in the Yucca Mountain FEIS for transporting spent nuclear fuel and high-level radioactive waste nationally and within Nevada (*Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV*, 69 *FR* 18557, April 8, 2004). As part of implementing that decision, DOE recognized that it would need to construct a rail line to connect the repository site to an existing rail line in Nevada. DOE also announced in that Record of Decision that it had selected the Caliente rail corridor for further evaluation for the construction and operation of a railroad in Nevada. (Note: The Record of Decision referred to construction and operation of a rail line. However, the Rail Alignment EIS refers to construction and operation of a railroad, which better describes the total transportation system, including the infrastructure required under the Proposed Action.) The Caliente rail alignment is an engineered refinement of the Caliente rail corridor analyzed in the Yucca Mountain FEIS.

At present, there is no rail line to the Yucca Mountain Site. In the Yucca Mountain FEIS, DOE evaluated in detail five potential rail corridors within the State of Nevada in which the Department could construct a rail line to link an existing rail line to Yucca Mountain: Caliente, Carlin, Caliente–Chalk Mountain, Jean, and Valley Modified rail corridors. DOE did not include the Mina rail corridor it the detailed evaluation because a rail line in the Mina rail corridor would need to cross the Walker River Paiute Reservation. In 1995, the Department eliminated the Mina rail corridor from further study because the Walker River Paiute Tribe had stated that it would not allow DOE to transport spent nuclear fuel and high-level radioactive waste across the Walker River Paiute Reservation.

However, the Mina rail corridor became feasible when, in a May 2006 letter, the Walker River Paiute Tribal Council informed DOE that it would allow the Department to consider the potential impacts of constructing and operating a railroad to transport spent nuclear fuel and high-level radioactive waste across its Reservation. DOE prepared a preliminary feasibility study of the Mina rail corridor and announced its intent to expand the scope of the Rail Alignment EIS to incorporate analysis of the potential environmental impacts associated with constructing and operating a railroad along an alignment in the Mina rail corridor (*Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV*, 71 *FR* 60484, October 13, 2006).

Because the Mina rail corridor was not included in the detailed Yucca Mountain FEIS analysis, the Department decided it was appropriate to supplement the Yucca Mountain FEIS with a corridor-level analysis of the Mina rail corridor commensurate with that performed for the other rail corridors analyzed in the FEIS. In addition, the Department decided it was appropriate to update the analyses of the Carlin, Jean, and Valley Modified rail corridors to identify any significant new information or circumstances that could change the range or magnitude of potential environmental impacts described in the Yucca Mountain FEIS. DOE eliminated the Caliente-Chalk Mountain rail corridor, which would cross part of the Nevada Test and Training Range, from further consideration because of U.S. Air Force concerns that a rail line would interfere with military mission activities.

On April 17, 2007, the Tribal Council for the Walker River Paiute Tribe announced a resolution withdrawing support for the Tribe's participation in the EIS process. The Tribal Council based its decision on review of information gathered to that time and input from members of the tribe. The Council's resolution also renewed the Tribe's past objection to the transportation of nuclear waste through the Walker River Paiute Reservation. Accordingly, DOE has identified the Mina rail corridor and the Mina Implementing Alternative as nonpreferred in the Rail Alignment EIS.

S.1.2 Cooperating Agencies

Council on Environmental Quality (CEQ) regulations at 40 Code of Federal Regulations (CFR) 1501.6, emphasize agency cooperation early in the NEPA process and allow a lead agency (in this case, DOE) to request the assistance of other agencies that either have jurisdiction by law or have special expertise regarding issues considered in an EIS. The Bureau of Land Management (BLM or the Bureau), the Surface Transportation Board (STB), and the U.S. Air Force are cooperating agencies in the development of the Supplemental Nevada Rail Corridor EIS and Rail Alignment EIS, pursuant to CEQ regulations, and have participated in its preparation.

Cooperating agencies that could issue decisions concerning the Proposed Action and alternatives to the Proposed Action could adopt the Supplemental Nevada Rail Corridor EIS and Rail Alignment EIS in whole or in part and use it as a basis for their decisions. These agencies have management and regulatory authority over lands and resources that would be crossed by or close to the proposed railroad, or they have special expertise related to the Proposed Action.

S.2 SUMMARY OF NEVADA RAIL CORRIDOR SEIS

S.2.1 Purpose and Need for Agency Action

The Nevada Rail Corridor SEIS has two purposes, as follows:

1. To analyze the Mina rail corridor, which was not previously analyzed in detail, at a level of detail commensurate with that of the rail corridors analyzed in the Yucca Mountain FEIS to determine if it warrants further detailed evaluation at the alignment level
2. To update relevant information regarding the Carlin, Jean, and Valley Modified rail corridors to identify any significant new circumstances or information relevant to environmental concerns associated with these three rail corridors that would warrant their further detailed evaluation at the alignment level

On April 8, 2004, the Department announced that it would ship most spent nuclear fuel and high-level radioactive waste to the repository by rail (train) and announced its selection of the Caliente rail corridor as the preferred corridor (69 *FR* 18557). On October 13, 2006, the Department issued an *Amended Notice of Intent To Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (71 *FR* 60484). In that notice, the Department announced its intent to incorporate analyses for the Mina rail corridor.

DOE did not analyze the Mina rail corridor in the Yucca Mountain FEIS; therefore, the Department has prepared a supplement (DOE/EIS-0250F-S2) to the Yucca Mountain FEIS, which considers the potential environmental impacts of a railroad in the Mina rail corridor at the same level of analysis as that for the Carlin, Jean, and Valley Modified rail corridors in the Yucca Mountain FEIS. Figure S-1 shows the rail corridors analyzed in the Yucca Mountain FEIS and the Mina rail corridor.

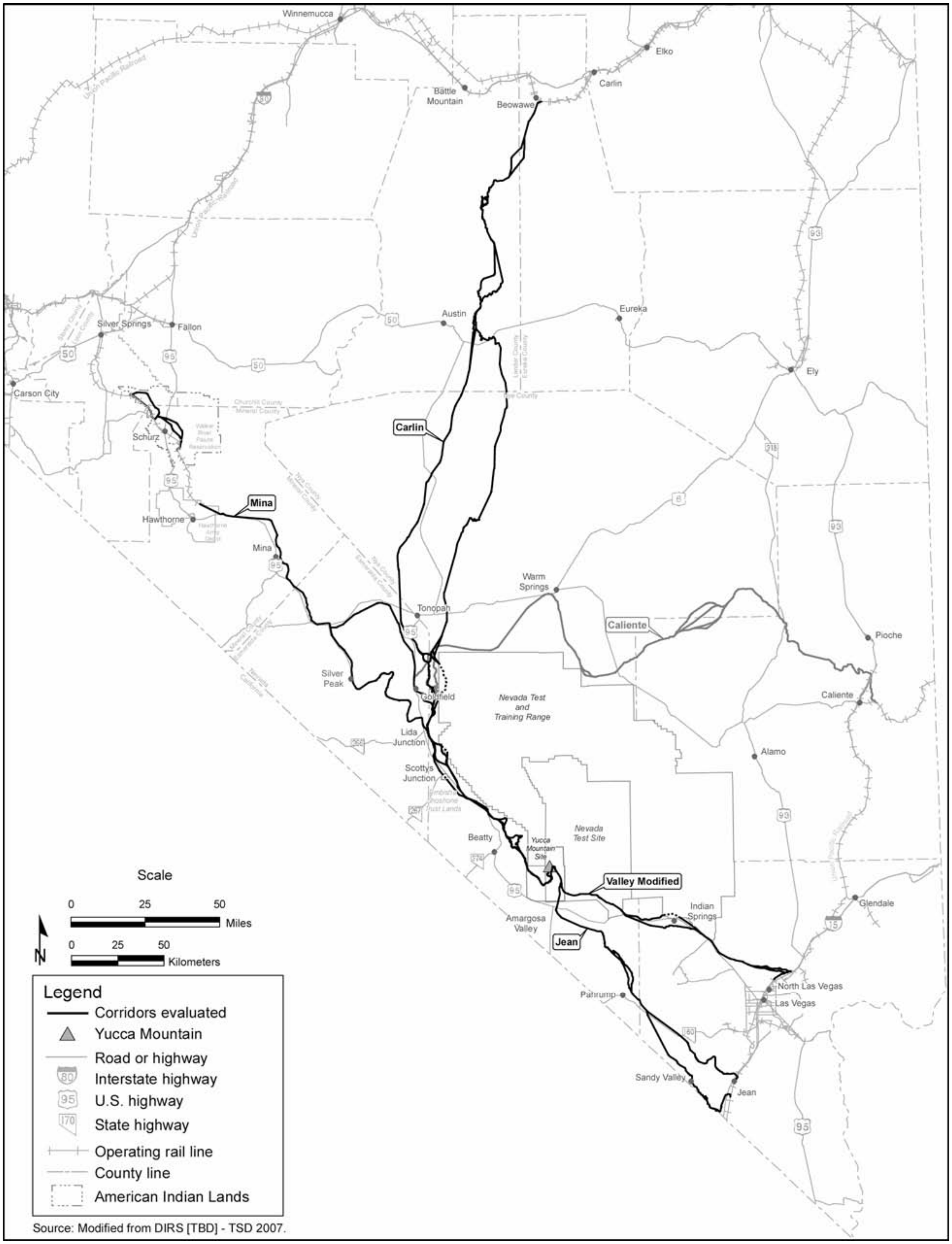


Figure S-1. Carlin, Jean, Valley Modified, Caliente, and Mina rail corridors (pre-scoping, October 2006).

The purpose of the DOE action is to construct and operate a railroad for the transportation of spent nuclear fuel and high-level radioactive waste that connects an existing rail line in the State of Nevada to the Yucca Mountain Site. In this regard, the Department is evaluating the Mina rail corridor so it can determine if the attributes, characteristics, and potential impacts of railroad construction and operation in the Mina rail corridor would be such that DOE should proceed with analyses of specific alignments within the corridor in the Rail Alignment EIS. At the same time, the Department has updated relevant environmental information for the Carlin, Jean, and Valley Modified rail corridors to determine whether there are significant new circumstances or information that would warrant consideration of these three rail corridors at the alignment level.

S.2.2 Proposed Action and Alternatives

The Nevada Rail Corridor SEIS evaluates a Proposed Action and a No-Action Alternative. It supplements the Yucca Mountain FEIS to the extent that it analyzes the potential impacts of the Proposed Action to construct and operate a railroad to connect the Yucca Mountain Site to an existing rail line near Wabuska, Nevada, in the Mina rail corridor. Under the Proposed Action, DOE has analyzed the Mina rail corridor at a level of detail commensurate with that of the rail corridors (Caliente, Caliente-Chalk Mountain, Carlin, Jean, and Valley Modified) analyzed in the Yucca Mountain FEIS.

CEQ and DOE regulations that implement the procedural requirements of NEPA require consideration of the alternative of no action. Under the Nevada Rail Corridor SEIS No-Action Alternative, DOE would not select a rail alignment within the Mina rail corridor for the construction and operation of a railroad. Therefore, the No-Action Alternative provides a basis for comparison to the Proposed Action.

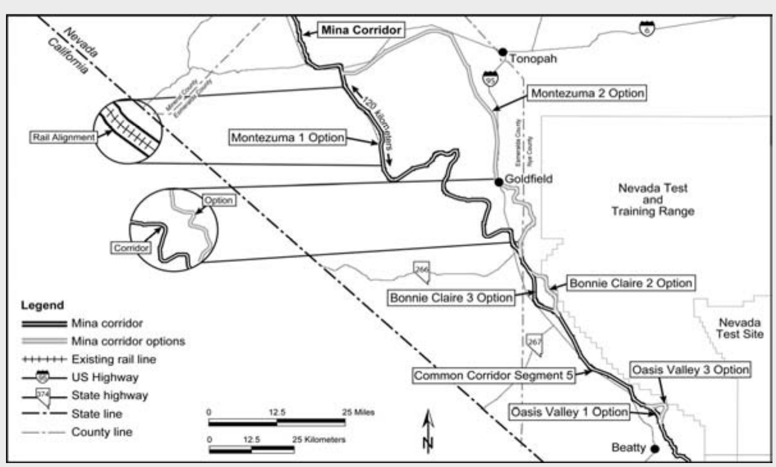
In response to the May 2006 letter from the Walker River Paiute Tribe, DOE initiated a study to consider the feasibility of the Mina rail corridor and to identify a specific corridor and associated preliminary options. The Department completed the feasibility study in October 2006. Based on the information in the feasibility study, DOE expanded the scope of the Rail Alignment EIS (DOE/EIS-0369) to incorporate analysis of the Mina rail corridor as a supplemental EIS.

The Nevada Rail Corridor SEIS also updates relevant information for the corridors already analyzed in the Yucca Mountain FEIS.

The Department identified rail corridor options on the Walker River Paiute Reservation to bypass the town of Schurz (Schurz bypass options), around the Montezuma Range (Montezuma options), north of Scottys Junction (Bonnie Claire options), and in Oasis Valley (Oasis Valley options). Figure S-2 shows the Mina rail corridor and its options.

Option – In the Yucca Mountain FEIS the terms for describing separate routes within a corridor were alternates, variations and options. For the Nevada Rail Corridor SEIS, only option is used and is applied more generally; option refers to a strip of land from one point along a corridor to another point on the same corridor that provides a different route.

Common corridor segment – Geographic region for which a single route has been identified.



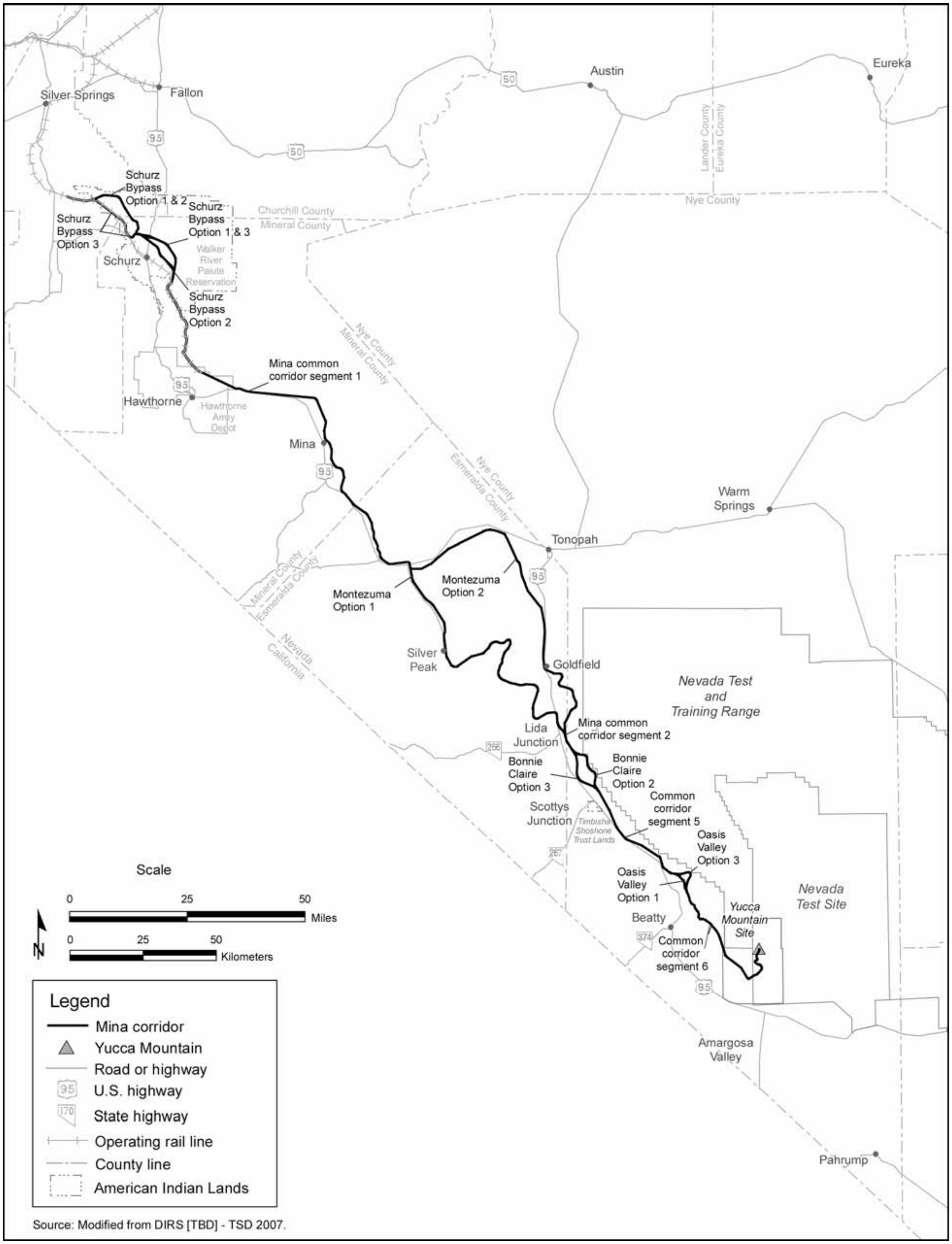


Figure S-2. Mina rail corridor and options (as defined prior to the October 2006 scoping meetings described Section S.2.3.1).

Construction of a rail line in the Mina rail corridor would begin near Wabuska, Nevada, and proceed southeast across the Walker River Paiute Reservation, along one of three options that would bypass the town of Schurz. Mina common corridor segment 1 would begin north of Hawthorne and would trend southeast before turning east at U.S. Highway 95. It would trend east along U.S. Highway 95 through Soda Springs Valley for approximately 40 kilometers (25 miles). Continuing to parallel U.S. Highway 95, the rail line would cross State Route 361 and turn south for approximately 64 kilometers (40 miles). It would pass the towns of Luning and Mina, which are along U.S. Highway 95. The rail line would then turn east before crossing U.S. Highway 95 with a grade-separated crossing in the area of Blair Junction and continue for about 1.5 kilometers (1 mile) before joining one of the Montezuma options. Mina common segment 1 would be approximately 120 kilometers (72 miles) long.

Near Blair Junction, the rail line would follow one of two options that would go around the Montezuma Range, and then move on to Lida Junction. Mina common corridor segment 2 would begin at the end of the selected Montezuma option and run roughly southeast as a single route for about 3.4 kilometers (2.1 miles) before reaching the Bonnie Claire area. At that point the corridor would follow one of two options until forming a single route in the vicinity of Scottys Junction. The corridor would then trend southeast to Oasis Valley, and would follow one of two options through the Oasis Valley before turning north-northeast to Yucca Mountain as a single route. For purposes of analysis, the region of influence for the Mina rail corridor extends to Hazen, Nevada, where shipments to Yucca Mountain would leave the Union Pacific Railroad Mainline.

The Mina rail corridor would be from about 410 to 450 kilometers (255 to 280 miles) long, depending on the combination of options. However, construction of new rail line would range from between about 386 and 400 kilometers (240 and 264 miles) because the corridor would include the existing U.S. Department of Defense Branchline from Wabuska to the Hawthorne Army Depot in Hawthorne, Nevada.

S.2.3 Issues Raised by the Public

S.2.3.1 PUBLIC SCOPING

On April 8, 2004 (69 *FR* 18565), DOE issued a Notice of Intent to prepare an EIS under NEPA for the alignment, construction, and operation of a railroad for shipments of spent nuclear fuel, high-level radioactive waste, and other materials related to the construction and operation of a repository from a site near Caliente, Nevada, to a geologic repository at Yucca Mountain, Nevada (the Rail Alignment EIS; DOE/EIS-0369). DOE received more than 4,100 comments during this first public scoping period for the Rail Alignment EIS, and some after the close of the scoping period. The Department considered the content of all substantive comments in determining the scope of the EIS. During this scoping period, DOE also received comments suggesting that other rail corridors be considered in the Rail Alignment EIS, in particular the Mina rail corridor. Public comments provided compelling arguments that the Mina rail corridor should be given a full evaluation.

On October 13, 2006, after a preliminary evaluation of the feasibility of the Mina rail corridor, DOE announced its intent to expand the scope of the Rail Alignment EIS to incorporate analysis of the potential environmental impacts associated with constructing and operating a railroad within the Mina rail corridor (71 *FR* 60484). DOE also announced that it would update, as appropriate, the information and analysis for other rail corridors analyzed in the Yucca Mountain FEIS. The scoping period for the expanded NEPA analysis began on October 13, 2006, and ended on December 12, 2006. The Department received approximately 790 comments during the public scoping period for the Supplemental Nevada Rail Corridor EIS and Rail Alignment EIS, and some comments after the close of the scoping period. The Department considered the content of all substantive comments in determining the scope of the expanded NEPA analysis.

S.2.3.2 TRIBAL INTERACTIONS

In 1987, DOE initiated the Native American Interaction Program to solicit input from and interact with tribes and organizations on the characterization of the Yucca Mountain Site and the possible construction and operation of a repository. These tribes and organizations—Southern Paiute; Western Shoshone; and Owens Valley Paiute and Shoshone people from Arizona, California, Nevada, and Utah—have cultural and historic ties to both the Yucca Mountain area and to the larger region that includes portions of the Mina rail corridor as well as the Carlin, Jean, and Valley Modified rail corridors. Ethnographic efforts eventually led to the involvement of 17 tribes and organizations in the Yucca Mountain Project American Indian and cultural resource studies. Those tribes formed the Consolidated Group of Tribes and Organizations, which consists of tribal representatives responsible for presenting issues concerning their respective tribal concerns and perspectives to DOE. DOE interactions with Tribes have produced several reports that record the regional history of American Indian people and the interpretation of American Indian cultural resources in the Yucca Mountain region. On June 2, 2004, DOE met with the Consolidated Group of Tribes and Organizations to introduce the proposed railroad project and learn of its members concerns and issues.

The American Indian Writers Subgroup, a subgroup of the Consolidated Group of Tribes and Organizations, prepared the *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy Yucca Mountain Project* providing insight into American Indian viewpoints and concerns regarding cultural resources along the Caliente rail alignment and long-term impacts of the DOE selection of a rail system to transport spent nuclear fuel and high-level radioactive waste to a geologic repository at Yucca Mountain. That document is a supplement to the American Indian Writers Subgroup document *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement*. The Department has held an ongoing series of meetings over the years with the Consolidated Group of Tribes and Organizations, and most recently on November 29, 2006, to present the proposed inclusion of the Mina rail corridor for analysis in this Supplemental Rail Corridor and Rail Alignment EIS and to provide an update on the ongoing analysis of the Caliente rail alignment. In addition DOE met with Walker River Paiute tribal representatives on several occasions in 2006 to discuss their interest in allowing DOE to evaluate a potential rail corridor, the Mina rail corridor, which would cross the Walker River Paiute Reservation. Tribal members toured the Yucca Mountain Site and attended scoping meetings.

S.2.4 Environmental Impacts

The first component of the Nevada Rail Corridor SEIS is the corridor-level analysis of the Mina rail corridor.

S.2.4.1 POTENTIAL IMPACTS OF THE MINA RAIL CORRIDOR

Where practical, DOE has quantified potential impacts and other characteristics of a Proposed Action to construct and operate a railroad in the Mina rail corridor. In other instances, it is not practical to quantify impacts and DOE provides a qualitative assessment of potential impacts. In the Nevada Rail Corridor SEIS, the Department has used the following descriptors to qualitatively characterize impacts where quantification of impacts was not practical:

- **Small** - For the issue, environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- **Moderate** - For the issue, environmental effects would be sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

- **Large** - For the issue, environmental effects would be clearly noticeable and would be sufficient to destabilize important attributes of the resource.

Unless otherwise noted, potential impacts would be adverse.

S.2.4.1.1 Land Use and Ownership

Construction of a railroad in the Mina rail corridor would disturb approximately 37 to 41 square kilometers (9,000 to 10,000 acres) of land, depending on the combination of options. The corridor would cross up to 15 separate grazing allotments. The approximate disturbance area associated with the Mina rail corridor would constitute less than 1 percent of the land within those 15 grazing allotments. Within this regional perspective of nearby existing and reasonably foreseeable land uses and land ownership, the commitment of land for the proposed Mina rail corridor would constitute a minor proportion of overall land commitment.

A railroad in the Mina rail corridor would impact approximately 1.6 to 2.7 square kilometers (400 to 670 acres) of private land in the corridor, depending on the combination of options. This private land is used primarily for agricultural and mineral development purposes, and none contains private residences. If in locating the final alignment DOE could not avoid private lands, the Department would need to acquire access to those lands. If the rail line would divide private property, access to the property could be disrupted.

The Mina rail corridor would not cross or affect any Wilderness Areas, Wilderness Study Areas, or Areas of Critical Environmental Concern. A railroad in the Mina rail corridor would be consistent with the goals and policies of the resource management plans in the BLM-administered areas through which it would pass.

The Mina rail corridor would cross land on the Walker River Paiute Reservation. Railroad construction and operations activities on this land would require land agreements between DOE, the Bureau of Indian Affairs, and the Walker River Paiute Tribe. Prior to construction, DOE would be required to obtain both the permission to survey for a right-of-way and a right-of-way grant in accordance with 25 CFR Part 169, "Rights-of-Way Over Indian Lands." These regulations state that "Rights-of-way for railroads shall not exceed 15 meters (50 feet) in width on each side of the centerline of the road, except where there are heavy cuts and fills, when they shall not exceed 30 meters (100 feet) in width on each side of the road."

A portion of the Mina rail corridor, approximately 13 kilometers (8 miles) long, would cross through the Hawthorne Army Depot. A right-of-way grant to construct and operate a railroad through this area would require an agreement with between the Department of Defense and the U.S. Army Corps of Engineers for the use of the land and the existing rail line.

Approximately 27 kilometers (17 miles) of common corridor segment 6 would be within the boundaries of the Nevada Test Site, which is managed by DOE. Railroad construction in this area would require land-use authorization from the DOE Nevada Site Office and the BLM.

The BLM would require DOE to obtain a right-of-way grant to construct and operate a railroad on public land. The Department would adjust the project footprint (the area of disturbance) where practicable to avoid or minimize land-use conflicts and restrictions. Railroad construction and operation in the Mina rail corridor through existing road or utility rights-of-way would require an evaluation of impacts to the road or utility or use of the right-of-way with both the right-of-way holder and the BLM. DOE would protect existing utility rights-of-way from damage so that disruption to utility service or damage to lines would be at most small and temporary.

The implementation of several mining engineering practices in these areas could allow access to mining claims without affecting the claimant or the rail line, depending on the exact locations of the claims and access needs.

Rail line construction would result in loss of forage. Because the corridor would intersect grazing allotments, a rail line could create a barrier to livestock movement. Livestock could have difficulty accessing water if there was a deep cut or a high fill associated with the rail line. Ranch operations and livestock rotations could be disrupted. Livestock could be lost due to collisions with vehicles along roads used during the construction and operations phases and from collisions with trains during the operations phase.

Construction and operation of a railroad in the Mina rail corridor would impact access to land used by the public for recreation, requiring individuals to alter their access routes.

S.2.4.1.2 Air Quality

The Mina rail corridor would pass through rural parts of Nevada in areas that the U.S. Environmental Protection Agency considers to be in attainment or unclassifiable for criteria air pollutant National Ambient Air Quality Standards. Most rural areas of the United States are either in attainment or unclassifiable for all pollutants.

Impacts to air quality during railroad construction and operations in the Mina rail corridor would be small. During the relatively short construction phase, equipment emissions would result in a very small contribution of criteria air pollutants to the region. These pollutants would primarily come from the operation of construction equipment in rural areas or areas that are currently inhabited. Construction activities would also emit fugitive dust that would require DOE to implement dust suppression measures. Concentrations of criteria air pollutants and the generation of fugitive dust would decrease as the construction phase ended and the railroad became operational. During the operations phase, impacts to air quality would be smaller but would last longer.

S.2.4.1.3 Hydrology

Hydrologic hazards in the Mina rail corridor could include flash floods. Impacts to surface water associated with the alteration of drainage patterns or changes to erosion and sedimentation rates or locations would be small and localized. Any impacts on surface-water resources resulting from construction activities would generally be small and limited to the nominal width of the rail line construction right-of-way. DOE would use appropriate engineering standards and construction practices to avoid or minimize any potential impacts to surface water resources.

The groundwater analysis for the Nevada Rail Corridor SEIS based its calculations of water demand during the construction phase on earthwork needs and water that would be needed for soil compaction. Based on these considerations, total water demand for the Mina rail corridor would be approximately 7.32 million cubic meters (5,950 acre-feet). Groundwater use during the construction phase could result in a short-term decrease in the amount of available water in some hydrologic basins. To avoid adverse impacts to groundwater resources in the region, DOE would request the Nevada State Engineer to approve any potential plans to pump groundwater from new or existing wells or plans to otherwise obtain groundwater from other regional resources.

Groundwater demands during the operations phase would be small and limited to water needed to support maintenance activities and the smaller operations workforce. Operations water needs would be small and would have little effect on regional resources.

S.2.4.1.4 Biological Resources and Soils

The Mina rail corridor would primarily cross through remote areas that are characterized by a variety of vegetation communities, special status species (plants and animals including their habitats), game habitats, surface-water flows, and soil conditions along the route. The corridor would cross only one riparian area along the Walker River and one spring near Goldfield.

Some vegetation communities would be disturbed during construction activities in the Mina rail corridor. With the exception of the few riparian areas along the corridor, none of the vegetation communities are BLM-designated sensitive (unique or rare). The total land area disturbed within these vegetation communities in the corridor would be small compared to total land areas in Nevada that also support such vegetation communities.

The Mina rail corridor would cross through habitat that supports a low abundance of the desert tortoise (*Gopherus agasizii*), a federally listed threatened species under the Endangered Species Act. Disturbance of this habitat could disrupt normal tortoise movements or possibly result in mortality to some individual tortoises. DOE would work with the U.S. Fish and Wildlife Service to limit any impacts to the desert tortoise.

The Mina rail corridor would also cross riparian habitat for the Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*), a federally listed threatened species under the Endangered Species Act. Construction of a bridge over the Walker River, downstream of Walker Dam, would have to occur when the water flow was low and the species was rare or absent. Construction activities could degrade downstream water quality, but these impacts would be temporary and small. Any impacts to springs near the Mina rail corridor would be small.

The Mina rail corridor would cross habitat for some game species including big horn sheep, pronghorn sheep, mule deer, and mountain lions, and herd management areas for wild horses and burros. During the construction phase, these game animals would likely move away from the area due to noise and land disturbance. Noise from passing trains during the operations phase could disturb some animals. Any impacts would be small and would likely diminish over time because animals would become accustomed to the noise.

Land disturbance within the rail line construction right-of-way could increase the potential for soil erosion. DOE would use erosion control and dust suppression methods to reduce the potential for erosion, and would control the use of hazardous materials to limit the potential for soil contamination. Impacts to soil in the Mina rail corridor would be temporary and small.

S.2.4.1.5 Cultural Resources

Based on recent DOE searches of existing records, there are several cultural resources, which include archaeological and historic sites and structures, in the Mina rail corridor that are eligible or potentially eligible for listing on the *National Register of Historic Places*. Construction activities could degrade, cause the removal of, or alter the setting of cultural resources sites and cause the loss of cultural resources.

Before starting construction in the Mina rail corridor, DOE would perform additional field surveys and inventories to further locate and identify cultural resources. The Department would work closely with other federal agencies, tribal authorities, and state agencies to avoid and mitigate any potential adverse impacts to known cultural resources and those that might be discovered during construction activities.

DOE would not expect railroad operations and maintenance activities to result in any additional impacts to cultural resources in the Mina rail corridor.

S.2.4.1.6 Occupational and Public Health and Safety

The impact analysis for occupational health and safety focused on transportation impacts, worker industrial safety impacts, incident-free radiological impacts and nonradiological impacts, and radiological impacts in relation to accidents.

Nonradiological transportation impacts during the construction phase would be primarily from traffic accidents involving workers commuting to and from the construction sites, workers transporting construction materials to the construction sites, and from vehicle emissions produced by commuting workers and materials deliveries. DOE estimates that during the construction phase there could be 4 fatalities from traffic accidents and 0.54 latent cancer fatality from vehicle emissions. During railroad operations along the Mina rail corridor, there could be 3.6 vehicular-related fatalities.

DOE estimated nonradiological occupational health and safety impacts in relation to exposure of workers to physical hazards and nonradioactive hazardous chemicals over the region of influence for the Mina rail corridor. The Department based these estimates on the estimated number of hours worked and occupational incident rates for total recordable cases, lost workday cases, and fatalities. Industrial safety impacts resulting from railroad construction and operation are estimated to be about 0.92 fatality for the combined involved worker and noninvolved worker population.

The largest potential for radiological exposure during the railroad operations phase would be to workers involved in the transportation of spent nuclear fuel and high-level radioactive waste. That impact would be less 0.4 latent cancer fatality.

DOE estimated radiological impacts for members of the public along the Mina rail corridor. During 50 years of railroad operations, there would be less than one latent cancer fatality.

DOE estimated the radiological impacts from potential accident scenarios. For 50 years of railroad operations, the estimated number of worker and public latent cancer fatalities would be less than one.

S.2.4.1.7 Socioeconomics

The socioeconomic impacts analysis used a set of socioeconomic variables to provide a socioeconomic profile of conditions in the Mina rail corridor region of influence. Those variables considered changes to employment, population, economic measures, housing, and public services. The expected employment levels are a significant contributor to the analysis of socioeconomic impacts.

DOE estimated that during the railroad construction phase, workforce employment levels would range from about 340 to 2,100, depending on the length of the rail line, earthwork requirements, and phase of the project. Based on the identified levels of worker employment and the temporary and linear nature of the construction project, potential socioeconomics impacts to the local communities would be both short term and small.

DOE estimated that during the operations phase, workforce levels for operating and maintaining the railroad would be much less the levels estimated for the construction phase. There would be an estimated 42 workers involved in railroad operations. Given the relatively low number of employees necessary for railroad operations, the potential for socioeconomics impacts along the Mina rail corridor would be small.

These socioeconomic impacts for the construction and the operations phases are generally considered positive because of the jobs created, the increase disposable income, increases in gross regional product, and increases in services to local citizens as a result of increased tax revenue to local and state governments.

S.2.4.1.8 Noise and Vibration

Most of the Mina rail corridor would be in areas that are remote from human habitation. The distances from construction activities to the nearest receptors would be great; therefore, construction noise levels would be below the Federal Transit Administration noise guidelines.

DOE estimates that construction- and operations-train noise would be audible to receptors in Silver Peak and Goldfield. There would be no adverse noise impacts associated with these receptors because the noise levels would not exceed STB noise guidelines. Because transportation noise sources are audible throughout the United States, the audibility of train noise itself does not constitute an adverse noise impact.

Vibration levels during the railroad construction and operations phases would not exceed Federal Transit Administration damage or annoyance criteria.

S.2.4.1.9 Aesthetics

Railroad construction and operations in the Mina rail corridor would create small impacts to aesthetic resources, but would be consistent with BLM visual resource management objectives to retain the relative value of visual resources in the area.

S.2.4.1.10 Utilities, Energy, and Materials

Potential impacts to utilities, energy and materials would be small. Construction and operations needs would place limited demands on utilities such as public water and wastewater systems, telecommunications systems and providers of electric power. Regional service providers can be expected to adjust to any increasing needs. Needs for motor fuel during construction and operations activities would represent a very small fraction of Nevada’s motor fuel consumption and not affect regional availability. Raw materials, such as concrete, steel, and rock, consumed during the construction phase would be available from regional or national sources.

S.2.4.1.11 Waste Management

DOE would store and use hazardous materials such as oil, gasoline, diesel fuel, and solvents during railroad construction and operations, primarily for the operation and maintenance of equipment and cleaning of equipment and facilities. The use of hazardous materials would generate hazardous wastes. There is ample disposal capacity for hazardous wastes in the western United States.

DOE would dispose of nonrecyclable or nonreusable waste in permitted landfills. During the construction phase, it is likely that while some of the larger landfills would not see an appreciable change in the amount of waste received if they were utilized, some of the smaller landfills, if utilized, might see a substantial, although manageable, change in daily receipt of solid and industrial and special wastes. The estimated average daily disposal mass would be about 1.5 metric tons (1.7 tons).

During the railroad operations phase, generation of wastes would be substantially less than during the construction phase.

S.2.4.1.12 Environmental Justice

The largest concentration of low-income and minority populations in the Mina rail corridor is on the Walker River Paiute Reservation. However, most of the Mina rail corridor would cross BLM-administered public land or land owned by the Department of Defense, where there is sparse population. As a consequence, there are no concentrations of low-income or minority populations in Lyon, Mineral, Esmeralda, and Nye Counties that construction or operation of a railroad in the Mina rail corridor would be likely to affect.

Impacts from the rail line construction and operations in the Mina rail corridor would be small overall and would be unlikely to cause a disproportionately high and adverse effect on the low-income or minority populations along the corridor.

S.2.4.2 CUMULATIVE IMPACTS – NEVADA RAIL CORRIDOR SEIS

DOE evaluated public- and private-sector past, present, and reasonably foreseeable activities that could, when combined with the Nevada Rail Corridor SEIS Proposed Action, result in cumulative impacts. The DOE analysis of potential cumulative effects was primarily qualitative, but the Department quantified information to the extent feasible. The cumulative impacts regions of influence for analysis encompassed the Mina rail corridor, and areas with potential direct and indirect effects for each resource area. To assess potential cumulative impacts from other projects, DOE identified major projects within the regions of influence that could have interactions with the proposed railroad in space or time. Those major projects included a wide variety of projects including the proposed Yucca Mountain Repository, the Nevada Test and Training Range, the Nevada Test Site, and BLM land management (including rights-of-way).

> **Cumulative impacts**, as defined by the CEQ, "result from the incremental impact of [an] action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7). Cumulative impacts can result from individually minor but potentially significant actions that occur within a common context of time and space.

DOE determined that the cumulative impacts within most of the resource areas described in the Nevada Rail Corridor SEIS would be small in the Mina rail corridor region of influence unless noted otherwise.

In the Mina rail corridor region of influence, land use and management is changing because of increased construction and development, increased urbanization, and increased conversion of undeveloped land to other purposes or to multiple purposes. Federal agencies, primarily the BLM, will continue to be the major land manager throughout the regions of influence. The BLM has a major role in determining land use in the region though administration of federal lands, including development of resource management plans for the region. The incremental change to land use from constructing and operating the proposed railroad along the Mina rail corridor is projected to be small to moderate.

Overall, there is, and will continue to be, a broad contrast of how visual resource impacts are managed in the regions of influence, ranging from very little management for military mission-related activities to a formal visual resource management system on BLM-administered lands. DOE determined that operation of the proposed railroad would be visible in specific locations but would not dominate the viewsheds within the regions of influence. Changes to aesthetic resources in the regions of influence have already been affected by activities such as the Nevada Test and Testing Range, the Nevada Test Site, BLM management activities, and population growth. These changes will continue in future years, but the regions will generally maintain many of the remote and rural characteristics and conditions. The incremental change to aesthetic resources from constructing and operating the proposed railroad in the Mina rail corridor is projected to be small.

Cumulative impacts concerns regarding surface-water resources in the Mina rail corridor region of influence include changes to drainage patterns, infiltration rates, flood control, and spill/contamination potential. Impacts would generally be localized. Insufficient inflow from the Walker River into Walker Lake would continue to jeopardize Walker Lake's future as a viable fishery, with or without the proposed railroad in the Mina region of influence.

The Department anticipates that cumulative impacts to groundwater resources in the Mina rail corridor region of influence would range from small to large. Overall, the groundwater needs of the Proposed Action would represent a small portion of current cumulative water usage in the Mina rail corridor region of influence. However, in some proposed groundwater well locations for railroad use, cumulative demand would exceed perennial yield values. Water availability will continue to be a major regional cumulative impact issue in the coming years.

A railroad in the Mina rail corridor is projected to result in small to moderate incremental impacts to cumulative biological resources in their regions of influence. A railroad and other reasonably foreseeable and continuing projects in the region of influence would require coordinated mitigation and impact avoidance among project proponents to avoid and reduce cumulative biological impacts in the region of influence. BLM land management activities also play a major role in regional impact avoidance and mitigation.

The Proposed Action would be only one of the many reasonably foreseeable sources of socioeconomic change to portions of the regions of influence, and would be relatively less important to socioeconomic change than external economic development and population growth. The road systems in the regions of influence could experience higher traffic levels, possibly associated congestion, and increased road maintenance, but incremental impacts due to the proposed railroad would be small.

DOE anticipates that impacts to air quality in the Mina rail corridor region of influence would be small. DOE found that impacts from railroad construction in the Mina rail corridor would generate emissions of some criteria pollutants that could be higher than applicable air quality standards. While these effects would be localized in specific areas, any potential violation of air quality standards would be of concern in relation of both project-specific and cumulative impacts.

The proposed railroad would result in nonradiological and radiological health and safety impacts for workers and residents along the corridor. For members of the public situated along the Mina rail corridor, the radiological impacts during the operations phase would be a minimal contribution to the overall radiological impacts of the Yucca Mountain Repository, and incremental impacts of the proposed railroad would be small.

The Yucca Mountain FEIS evaluated the cumulative impacts of two additional inventories of spent nuclear fuel, high-level radioactive waste, and other radioactive wastes (Modules 1 and 2). These additional wastes would be above and beyond the amounts of wastes that have been analyzed for shipment, and their possible shipment could represent a cumulative impact on the resources analyzed. Although emplacement of this additional waste at Yucca Mountain would require legislative action by Congress, such shipment is a reasonably foreseeable action for purposes of NEPA analysis. Because the planned annual shipment rate of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository would be about the same as the Nevada Rail Corridor SEIS Proposed Action, the only cumulative impacts to arise would be due to the annual increase in the number of casks. Impacts from these additional casks would be similar to the generally small impacts summarized above.

S.2.4.3 SHARED USE

Construction and operation of a railroad in the Mina rail corridor could provide an option for shared use and operation of commercial rail service to serve the communities of Tonopah, Goldfield, and Beatty, and other Tribal, public, and commercial interests in the Mina rail corridor. The presence of a rail line could influence further development and land use in the corridor. Shared use would not require any changes in railroad design, and DOE anticipates that the small additional construction and operations activities would result in very little additional impacts over those described for the Proposed Action without shared use.

S.2.5 Comparison of the Proposed Action and the No-Action Alternative

CEQ NEPA implementing regulations state that agencies should provide a comparison of the environmental impacts of the Proposed Action and alternatives to the Proposed Action to sharply define the issues and provide a clear basis for choice. To that end, in the context within the Nevada Rail Corridor SEIS of a Proposed Action to evaluate the Mina rail corridor at a level of detail commensurate with that of the other rail corridors analyzed in the Yucca Mountain FEIS, Table S-1 provides an overview of potential impacts along the Mina rail corridor. Under the No-Action Alternative, there would be no impacts to existing conditions because DOE would not select a rail alignment within the Mina rail corridor for the construction and operation of a railroad.

Table S-1. Potentially affected resources - Mina rail corridor (page 1 of 3).

Resource	Impact/indicator
Land use	
Disturbed land[a]	9,000 to 10,000 acres (37 to 41 square kilometers), depending on rail corridor option
Land ownership/management authority	
Private land	400 to 670 acres (1.6 to 2.7 square kilometers) (1 to 2 percent of total ownership/authority)
Tribal trust lands and reservations	3,100 to 5,100 acres (12.5 to 20.5 square kilometers) (5 to 12 percent of total ownership/authority)
BLM-administered land	32,600 to 33,100 acres (132.1 to 133.9 square kilometers) (80 to 85 percent of total ownership/authority)
Department of Defense land (Hawthorne Army Depot)	1,200 acres (4.7 square kilometers) (3 percent of total ownership/authority)
DOE land (Nevada Test Site)	1,300 acres (5.3 square kilometers) (3 percent of total ownership/authority)
Air quality	
National Ambient Air Quality Standards attainment status	Areas in attainment or unclassifiable for air quality standards; small impacts from construction and operations
Hydrology	
Surface water	Small impacts associated with the alteration of drainage patterns or changes to erosion and sedimentation rates
Groundwater use	5,950 acre-feet (7.32 million cubic meters)
Biological resources and soils	Small impacts to habitat, wildlife, vegetation, and soils
Cultural resources (records search)	Five percent of area surveyed with 132 recorded sites; eligible affected sites would require mitigation during construction; indirect impacts would be small during operations phase.

Table S-1. Potentially affected resources - Mina rail corridor (page 2 of 3).

Resource	Impact/indicator
Occupational and Public Health and Safety	
Construction and Operations	
Industrial hazards	
Total recordable incidents	379
Lost workday cases	215
Fatalities	0.92 (combined involved and noninvolved workers)
Transportation (construction phase only)	
Traffic fatalities	4.0
Cancer fatalities	0.54
Incident-free radiological impacts (latent cancer fatalities)	
Operations phase only	
Public	0.00082
Workers	0.33
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	0.0000074
Cancer fatalities from vehicle emissions	0.40
Transportation accident fatalities	
Worker commuting and material delivery	3.3
Radiological waste transportation	0.31
Socioeconomics	Construction employment: 6,500 worker-years over a minimum 5-year construction phase, primarily from Clark County and the Carson City/Washoe County area. Construction economic measures: Less than a 2-percent increase in gross regional product, real disposable personal income, and spending by state and local governments Construction public services: Small increase in local populations Operations employment: 42 workers Operations economic measures: less than a 2-percent increase in gross regional product, real disposable personal income, and spending by state and local governments Operations public services: Small to moderate increase to local populations in Lyon, Mineral, Nye, and Esmeralda Counties
Noise and Vibration	Construction noise levels would be below the Federal Transit Administration noise guidelines. Construction- and operations-train noise would be audible to receptors in Silver Peak and Goldfield. No adverse impacts from vibration.
Aesthetics	Small; construction and operation of a railroad primarily in BLM visual resource management Class III and IV would be consistent with BLM management objectives for those areas.

Table S-1. Potentially affected resources - Mina rail corridor (page 3 of 3).

Resource	Impact/indicator
Utilities, energy, and materials	
Diesel	33 million gallons (125 million liters)
Gasoline	660,000 gallons (2.5 million liters)
Steel	74,000 tons (67,000 metric tons)
Concrete	287,000 tons (260,000 metric tons)
Wastes	
Construction-related municipal waste; limited quantities of other waste types	1.7 tons (1.5 metric tons) per day
Environmental justice (disproportionately high and adverse impacts)	None identified

a. Land disturbance is based on an average construction right-of-way of 100 meters (325 feet).

S.2.6 New Information Regarding Other Corridors

S.2.6.1 CARLIN, JEAN, AND VALLEY MODIFIED RAIL CORRIDORS

After DOE completed the preliminary evaluation of the feasibility of the Mina rail corridor, the Department announced its intent to expand the scope of the Rail Alignment EIS to include the Mina corridor (71 *FR* 60484, October 13, 2006). DOE also announced that it would update the Yucca Mountain FEIS analysis of the Carlin, Jean, and Valley Modified rail corridors to identify significant new information or circumstances relevant to environmental concerns in those rail corridors. The purpose of the update is to include new information that could change the range or magnitude of potential environmental impacts described in the Yucca Mountain FEIS. That update is the second component of the Nevada Rail Corridor SEIS. Figure S-1 shows the Carlin, Jean, and Valley Modified rail corridors and their options.

The Carlin rail corridor would originate at the Union Pacific Railroad Mainline near Beowawe, Nevada, in north-central Nevada. The corridor would travel south through Crescent, Grass, and Big Smoky Valleys, passing west of Tonopah and east of Goldfield. It would then travel south following and periodically crossing the western boundary of the Nevada Test and Training Range, passing through Oasis Valley and across Beatty Wash. It would travel across Crater Flats and along Fortymile Wash to Yucca Mountain.

Depending on the combination of options, the Carlin rail corridor would be approximately 530 kilometers (330 miles) long from its link with the Union Pacific Railroad Mainline to Yucca Mountain.

The Jean rail corridor would originate at the existing Union Pacific Railroad Mainline near Jean, Nevada. It would travel northwest near Pahrump, Town of Amargosa Valley, Jean, Goodsprings, Sand Spring, and Lathrop Wells before it reached Yucca Mountain. Depending on the combination of options, the Jean rail corridor would range from 180 to 200 kilometers (110 to 130 miles) long from its origin to Yucca Mountain.

The Valley Modified rail corridor would originate near the existing Apex rail siding off the Union Pacific Railroad Mainline. It would travel northwest and pass north of the City of North Las Vegas, the City of Las Vegas, and near Indian Springs and parallel to U.S. Highway 95 before it entered the southwest corner of the Nevada Test Site and reached Yucca Mountain. Depending on actual starting point and combination of options, the corridor would range from 157 to 163 kilometers (98 to 101 miles) long from its origin to Yucca Mountain.

S.2.6.2 UPDATE OF ENVIRONMENTAL INFORMATION

DOE reviewed and updated the affected environment information reported in the Yucca Mountain FEIS, as appropriate, using the same data sources to the extent practicable. Updated information for the Carlin, Jean, and Valley Modified rail corridors is commensurate in content and detail with the presentation of corridor-level information in the Yucca Mountain FEIS. However, since DOE completed the Yucca Mountain FEIS, many data-management systems have advanced and now provide more data and specificity. The more advanced Caliente rail alignment design and plans provided a basis for updating estimates of potential environmental impacts for the Carlin, Jean, and Valley Modified corridors. To do this, DOE used primary impact indicators (parameters that describe alignment characteristics, such as length and earthwork quantities) from the Caliente rail alignment analyses, and calculated ratios to estimate the data at a corridor level.

Tables S-2, S-3, and S-4 summarize the results of the update to the primary impact indicators for the Carlin, Jean, and Valley Modified rail corridors, respectively, and compare them with the corridor information reported in the Yucca Mountain FEIS. The information reflects the total for railroad construction and operations unless otherwise noted. Sections S.2.6.2.1 through S.2.6.2.12 briefly describe the updated information.

S.2.6.2.1 Land Use and Ownership

Land use and ownership conflicts have increased since DOE issued the Yucca Mountain FEIS. The greatest changes to land uses associated with the Carlin and Jean rail corridors would be the significant increase in unpatented mining claims and the proposed construction of the Southern Nevada Supplemental Airport, respectively. Much has changed in relation to land use and ownership in the Valley Modified rail corridor, most notably potential land-use conflicts with Creech Air Force Base and Apex Industrial Park, and the release of the Quail Springs and Nellis A, B, and C Wilderness Study Areas to the public for sale or transfer (BLM land disposal). Impacts to private land would continue to be large for the Carlin and Jean rail corridors, as reported in the Yucca Mountain FEIS.

S.2.6.2.2 Air Quality

The Carlin rail corridor would be in areas that are in attainment or unclassifiable for criteria air pollutants. Construction activities along the Jean rail corridor could affect air quality in the Pahrump Valley near Pahrump, and nonattainment areas in the Las Vegas Valley for particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}) and carbon monoxide. The Pahrump area in Nye County is now subject to a Memorandum of Understanding with local regulatory agencies for air quality. Construction of a rail line in the Jean rail corridor would generate fugitive dust and could affect air quality. Construction activities in the Valley Modified rail corridor could affect air quality attainment and maintenance efforts for PM_{10} and carbon monoxide in the Las Vegas Valley. Railroad operations would be small contributors of criteria air pollutants in the Carlin, Jean, and Valley Modified rail corridors.

S.2.6.2.3 Hydrology

Impacts to surface-water resources from railroad construction and operations in the Carlin, Jean, and Valley Modified rail corridors would be the same as those reported in the Yucca Mountain FEIS. Impacts

Table S-2. Updated environmental information for the Carlin rail corridor (page 1 of 2).

Resource	Changes from Yucca Mountain FEIS to this analysis
Corridor length	No change
Land ownership	
BLM-administered land	Yucca Mountain FEIS: 44,000 to 49,000 acres (180 to 200 square kilometers) (approximately 86 percent) Updated analysis: 44,000 to 52,000 acres (180 to 210 square kilometers) (88 to 94 percent)
Private land	Yucca Mountain FEIS: 1,000 to 3,700 acres (7.3 to 15 square kilometers) (approximately 6.7 percent) Updated analysis: 1,600 to 2,300 acres (6.4 to 9.4 square kilometers) (3.27 to 4.02 percent)
Nevada Test and Training Range land	Yucca Mountain FEIS: 0 to 2,700 acres (0 to 10.9 square kilometers) (approximately 5.2 percent) Updated analysis: 0 to 11.4 square kilometers (0 to 2,800 acres) (0 to 4.9 percent)
Nevada Test Site land	No change
American Indian trust lands and reservations	No change
Air quality	
National Ambient Air Quality Standards attainment status	No change
Hydrology	
Surface water	No change
Groundwater use (construction phase)	Yucca Mountain FEIS: 660 acre-feet (810,000 cubic meters) Updated analysis: 5,800 acre-feet (7.13 million cubic meters)
Biological resources and soils	Six additional sensitive species recorded
Cultural resources (records search)	Yucca Mountain FEIS: 110 recorded sites Updated analysis: 120 recorded sites
Occupational and public health and safety	
Industrial hazards (construction and operations)	
Total recordable cases	Yucca Mountain FEIS: 210 Updated analysis: 391
Lost workday cases	Yucca Mountain FEIS: 105 Updated analysis: 224
Fatalities	Yucca Mountain FEIS: 0.41 Updated analysis: 1
Transportation hazards (construction only)	
Traffic fatalities	Yucca Mountain FEIS: 1.1 Updated analysis: 4
Cancer fatalities	Yucca Mountain FEIS: 0.14 Updated analysis: 0.6

Table S-2. Updated environmental information for the Carlin rail corridor (page 2 of 2).

Resource	Changes from Yucca Mountain FEIS to this analysis
Occupational and public health and safety (continued)	
Incident-free radiological impacts (latent cancer fatalities) (operations only)	
Public	Yucca Mountain FEIS: 0.0012 Updated analysis: 0.000088
Workers	Yucca Mountain FEIS: 0.31 Updated analysis: 0.33
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	Yucca Mountain FEIS: 0.000000037 Updated analysis: 0.000001
Cancer fatalities from vehicle emissions	Yucca Mountain FEIS: 0.09 Updated analysis: 0.4
Nonradiological transportation accident fatalities	
Spent nuclear fuel and high-level radioactive waste transportation	Yucca Mountain FEIS: 0.54 Updated analysis: 0.31
Construction and operations workforce	Yucca Mountain FEIS: 0.7 Updated analysis: 3.3
Socioeconomics	
Estimated construction workforce	Yucca Mountain FEIS: 1,230 worker-years Updated analysis: 6,600 worker-years
Estimated operations workforce	Yucca Mountain FEIS: 47 workers per year Updated analysis: 42 workers per year
Noise and Vibration	No change
Aesthetics	No change
Utilities, energy, and materials (amount used)	
Diesel	Yucca Mountain FEIS: 10.6 million gallons (40 million liters) Updated analysis: 29 million gallons (110 million liters)
Gasoline	Yucca Mountain FEIS: 0.22 million gallons (0.82 million liters) Updated analysis: 0.63 million gallons (2.4 million liters)
Steel	Yucca Mountain FEIS: 82,000 tons (76,000 metric tons) Updated analysis: 95,000 tons (86,000 metric tons)
Concrete	Yucca Mountain FEIS: 456,000 tons (414,000 metric tons) Updated analysis: 364,000 tons (330,000 metric tons)
Waste Management	
Sanitary Solid Waste	Updated analysis: 1.7 tons (1.6 metric tons) per day
Environmental justice (disproportionately high and adverse impacts)	No change, none identified

Table S-3. Updated environmental information for the Jean rail corridor (page 1 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Corridor length	No change
Land ownership	
BLM-administered land	Yucca Mountain FEIS: 15,000 to 17,000 acres (60 to 69 square kilometers) (about 83 percent) Updated analysis: 15,000 to 18,000 acres (61 to 73 square kilometers) (85.5 to 87.2)
Private land	No change
Nevada Test Site land	No change
Air quality	
National Ambient Air Quality Standards attainment Status	The Pahrump area in Nye County is now subject to a Memorandum of Understanding with regulatory agencies to better control fugitive emissions of PM_{10} and thereby avoid being designated a nonattainment area.
Hydrology	
Surface water	No change
Groundwater use (construction)	Yucca Mountain FEIS: 405 acre-feet (500,000 cubic meters) Updated analysis: 3,380 acre-feet (4.17 million cubic meters)
Biological resources and soils	Four additional sensitive species recorded
Cultural resources (records search)	Yucca Mountain FEIS: 6 recorded sites Updated analysis: 45 recorded sites
Occupational and Public Health and Safety	
Industrial hazards (construction and operations)	
Total recordable cases	Yucca Mountain FEIS: 148 Updated analysis: 246
Lost workday cases	Yucca Mountain FEIS: 76 Updated analysis: 143
Fatalities	Yucca Mountain FEIS: 0.3 Updated analysis: 0.9
Transportation Hazards (construction only)	
Traffic Fatalities	Yucca Mountain FEIS: 0.7 Updated analysis: 2.5
Cancer Fatalities	Yucca Mountain FEIS: 0.09 Updated analysis: 0.3
Incident-free radiological impacts (latent cancer fatalities) (operations only)	
Public	Yucca Mountain FEIS: 0.00085 Updated analysis: 0.00019
Workers	Yucca Mountain FEIS: 0.22 Updated analysis: 0.21

Table S-3. Updated environmental information for the Jean rail corridor (page 2 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	Yucca Mountain FEIS: 0.000000015 Updated analysis: 0.0000018
Cancer fatalities from vehicle emissions	Yucca Mountain FEIS: 0.07 Updated analysis: 0.3
Nonradiological transportation accident fatalities	
Spent nuclear fuel and high-level radioactive waste transportation	Yucca Mountain FEIS: 0.019 Updated analysis: 0.11
Construction and operations workforce	Yucca Mountain FEIS: 0.5 Updated analysis: 2
Socioeconomics	
Estimated construction workforce	Yucca Mountain FEIS: 855 worker-years Updated analysis: 4,100 worker-years
Estimated operations workforce	Yucca Mountain FEIS: 36 workers per year Updated analysis: 32 workers per year
Noise and Vibration	No change
Aesthetics	No change
Utilities, energy, and materials (amount used)	
Diesel	Yucca Mountain FEIS: 6.9 million gallons (26 million liters) Updated analysis: 22.7 million gallons (86 million liters)
Gasoline	Yucca Mountain FEIS: 1.3 million gallons (0.5 million liters) Updated analysis: 4.2 million gallons (1.6 million liters)
Steel	Yucca Mountain FEIS: 28,000 tons (26,000 metric tons) Updated analysis: 33,000 tons (30,000 metric tons)
Concrete	Yucca Mountain FEIS: 165,000 tons (150,000 metric tons) Updated analysis: 132,000 tons (120,000 metric tons)
Waste Management	
Sanitary Solid Waste	Updated analysis: 1 ton (0.91 metric ton) per day
Environmental justice (disproportionately high and adverse impacts)	No change, none identified

Table S-4. Updated environmental information for the Valley Modified rail corridor (page 1 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Corridor length	No change
Land ownership	
BLM-administered land	Yucca Mountain FEIS: 7,400 to 9,100 acres (29.9 to 36.7 square kilometers (approximately 53 percent) Updated analysis: 7,700 to 8,900 acres (31 to 36 square kilometers) (51 to 53.7 percent)
Private land	Yucca Mountain FEIS: 49 acres (0.18 square kilometer) (about 3 percent) Updated analysis: 49 to 99 acres (0.2 to 0.4 square kilometer) (about 0.3 to 0.6 percent)
Nevada Test and Training Range land	Yucca Mountain FEIS: 900 to 1,900 acres (3.6 to 7.5 square kilometers) (about 11 percent) Updated analysis: 900 to 1,900 acres (4.3 to 9.4 square kilometers) (about 7.5 to 13.3 percent)
Nevada Test Site land	No change
U.S. Fish and Wildlife Service	No change
Air quality	
National Ambient Air Quality Standards attainment status	No change (potential for construction air quality impacts from PM_{10} and carbon monoxide)
Hydrology	
Surface water	No change
Groundwater use (construction)	Yucca Mountain FEIS: 395 acre-feet (395,000 cubic meters) Updated analysis: 320 acre-feet (3.44 million cubic meters)
Biological resources and soils	Additional records of sensitive species
Cultural resources (records search)	Yucca Mountain FEIS: 19 recorded sites Updated analysis: 45 recorded sites
Occupational and Public Health and Safety	
Industrial hazards (construction and operations)	
Total recordable cases	Yucca Mountain FEIS: 111 Updated analysis: 176
Lost workday cases	Yucca Mountain FEIS: 57 Updated analysis: 103
Fatalities	Yucca Mountain FEIS: 0.25 Updated analysis: 0.5
Transportation hazards (construction only)	
Traffic fatalities	Yucca Mountain FEIS: 0.4 Updated analysis: 1.5
Cancer fatalities	Yucca Mountain FEIS: 0.05 Updated analysis: 0.2

Table S-4. Updated environmental information for the Valley Modified rail corridor (page 2 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Incident-free radiological impacts (latent cancer fatalities) (operations only)	
Public	Yucca Mountain FEIS: 0.00065 Updated analysis: 0.00014
Workers	Yucca Mountain FEIS: 0.22 Updated analysis: 0.21
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	Yucca Mountain FEIS: 0.0000000029 Updated analysis: 0.0000013
Cancer fatalities from vehicle emissions	Yucca Mountain FEIS: 0.07 Updated analysis: 0.2
Nonradiological transportation accident fatalities	
Spent nuclear fuel and high-level radioactive waste transportation	Yucca Mountain FEIS: 0.016 Updated analysis: 0.095
Construction and operations workforce	Yucca Mountain FEIS: 0.5 Updated analysis: 1.3
Socioeconomics	
Estimated construction workforce	Yucca Mountain FEIS: 405 worker-years Updated analysis: 2,500 worker-years
Estimated operations workforce	Yucca Mountain FEIS: 36 workers per year Updated analysis: 32 workers per year
Noise and Vibration	No change
Aesthetics	No change
Utilities, energy, and materials (amount used)	
Diesel	Yucca Mountain FEIS: 3.4 million gallons (13 million liters) Updated analysis: 13 million gallons (49 million liters)
Gasoline	Yucca Mountain FEIS: 0.07 million gallons (0.27 million liters) Updated analysis: 0.26 million gallons (1 million liters)
Steel	Yucca Mountain FEIS: 24,000 tons (22,000 metric tons) Updated analysis: 29,000 tons (26,000 metric tons)
Concrete	Yucca Mountain FES: 143,000 tons (130,000 metric tons) Updated analysis: 110,000 tons (100,000 metric tons)
Waste Management	
Sanitary solid waste	Updated analysis: 0.7 tons (0.6 metric tons) per day
Environmental justice (disproportionately high and adverse impacts)	No change, none identified

associated with changes in drainage patterns or to erosion and sedimentation rates or locations would be small and localized.

Based on earthwork needs as opposed to terrain type, the estimated groundwater use for railroad construction in the Carlin, Jean, and Valley Modified rail corridors has increased substantially over that reported in the Yucca Mountain FEIS.

S.2.6.2.4 Biological Resources and Soils

There would be no differences in potential impacts to biological resources and soils from those reported in the Yucca Mountain FEIS for the Carlin, Jean, and Valley Modified rail corridors. DOE has identified additional records of sensitive species in all three corridors. Because all three corridors would cross some desert tortoise habitat, there would continue to be potential impacts to desert tortoise habitat and individuals of the species, as reported in the Yucca Mountain FEIS.

S.2.6.2.5 Cultural Resources

Since DOE completed the Yucca Mountain FEIS, there have been surveys that identified additional cultural resources in the Carlin, Jean, and Valley Modified rail corridors regions of influence. Grading and other construction activities could degrade, cause the removal of, or alter the setting of cultural resources sites and cause the loss of cultural resources.

S.2.6.2.6 Occupational and Public Health and Safety

The greatest potential impacts to health and safety would be from traffic accidents, mainly associated with commuting workers. In relation to industrial safety, the categories of worker impacts include total recordable incidents, lost workdays, and fatalities. Revised estimates of the number of workers needed to construct the railroad resulted in approximately a six-fold rise in the estimate of worker-years in comparison to the worker-years estimated in the Yucca Mountain FEIS (2,000 hours per worker-year). Since DOE completed the Yucca Mountain FEIS, there have been updates to the methods and data to estimate radiation doses for workers and members of the public. Because of the increase in the estimate of construction workers over that reported in the Yucca Mountain FEIS, there would be miminal increases in estimated traffic fatalities, and fatalities from exposure to vehicle emissions. DOE has estimated that radiological impacts to members of the public and workers from incident-free transportation and accident risks in the Carlin, Jean, and Valley Modified rail corridors would increase slightly over the estimate reported in the Yucca Mountain FEIS.

S.2.6.2.7 Socioeconomics

The Yucca Mountain FEIS discussion of socioeconomic impacts identified the number of employees that would be necessary to operate intermodal transfer stations. Based on the identified levels of employment, DOE concluded that the potential cumulative socioeconomic impacts to local communities would be small. Revised estimates of the number of workers needed to construct the rail line resulted in approximately a six-fold rise in the estimate of worker-years in comparison to the worker-years estimated in the Yucca Mountain FEIS (2,000 hours per worker-year).

In relation to employment levels for railroad construction in the Carlin, Jean, or Valley Modified rail corridor, the workforce requirements would vary based on the length of the corridor and earthwork requirements. Operations workforce levels for each corridor would change slightly from those reported in the Yucca Mountain FEIS. Given the short-term nature of construction and the relatively limited number of employees necessary for the railroad operations, the potential for socioeconomic impacts along a corridor would be both short-term and small. Clark County, which includes Las Vegas, dominates the region of influence with a 2006 estimated population of 1.89 million, which is approximately 7 percent more than the population DOE reported in the Yucca Mountain FEIS. Current population growth in Clark County would mask socioeconomic impacts due to the short-term growth in the workforce or the associated impact on population growth.

S.2.6.2.8 Noise and Vibration

Potential noise impacts would be small. The Carlin, Jean, and Valley Modified rail corridors mainly cross through unoccupied BLM-administered public lands. The number of trains per week on each line, approximately 17, would result in small impacts to potentially affected communities. DOE did not identify any significant new information or circumstances that would cause the affected environment or the estimated impacts from noise and vibration to change from that reported in the Yucca Mountain FEIS.

S.2.6.2.9 Aesthetics

Based on an evaluation of current BLM Resource Management Plans, there have been no changes to the visual setting classifications in the Carlin, Jean, and Valley Modified rail corridors since DOE completed the Yucca Mountain FEIS. Therefore, impacts to aesthetic resources would be the same as those reported in the Yucca Mountain FEIS. Most of the Carlin rail corridor would pass through BLM Visual Resource Management Class IV areas (the BLM designation that provides for management activities that require major modifications of the existing character of the landscape). Because the Jean rail corridor would cross Visual Resource Management Class II areas (the BLM designation that provides for the retention of the existing character of the landscape), impacts to the viewshed from railroad operations would cause a conflict with the visual resource classification. As reported in the Yucca Mountain FEIS, railroad operations in the Valley Modified rail corridor would have small impacts to visual resources in the area because the entire corridor would fall within the BLM-designated Class III areas (the BLM designation that provides for the partial retention of the existing character of the landscape).

S.2.6.2.10 Utilities, Energy, and Materials

Construction activities would use motor fuel, concrete, and steel. Quantities would be small in comparison to regional use and capacity, which would not be affected. Railroad operations would consume relatively small quantities of motor fuel and would not affect regional consumption. Estimates of steel and concrete consumption increased over those reported in the Yucca Mountain FEIS. The estimated impacts to utilities, energy, and materials from the railroad operations in the Carlin, Jean, or Valley Modified rail corridor would be small and similar to that reported in the Yucca Mountain FEIS. The estimated use of motor fuel by locomotives would has increased over that reported in the Yucca Mountain FEIS due to more weekly train trips, but overall motor fuel use impacts would remain small.

S.2.6.2.11 Waste Management

The Yucca Mountain FEIS evaluated waste management impacts that would be common to all rail corridors rather than for individual corridors. Information is now more readily available to differentiate between corridor–specific waste-management impacts. Therefore, DOE has included this information at a level of analysis similar to that of the Yucca Mountain FEIS. Construction activities would generate about 1.6 metric tons (1.7 tons) of municipal solid waste per day in the Carlin rail corridor, about one metric ton (1.1 tons) per day in the Jean rail corridor, and less than 1 metric ton (less than 1 ton) per day in the Valley Modified rail corridor. This volume could affect the capacity and closure dates of small rural landfills. Nevada has extensive waste disposal capacity and land for new capacity. DOE could transport waste to existing landfills with ample capacities, such as Apex. Volumes of other types of waste would be small, with no expected strain on disposal capacity.

Railroad operations would generate minimal amounts of waste. The Yucca Mountain FEIS estimated that the peak annual generation would be 910 metric tons (1,000 tons) of sanitary solid waste for each rail corridor; the updated estimates of post recycling waste for each corridor now average about half that amount.

S.2.6.2.12 Environmental Justice

The Yucca Mountain FEIS did not identify potential impacts to minority or low-income populations in the Carlin, Jean, and Valley Modified rail corridors. The environmental impacts updates for those rail corridors did not identify any new minority or low income populations or special pathways for impacts to such populations. Because no new impacts were identified, it is unlikely there would be any disproportionately high and adverse impacts to minority or low-income populations from railroad construction and operations along the Carlin, Jean, or Valley Modified rail corridors.

S.2.7 Issues to be Resolved

Within the context of the first purpose of the Rail Corridor SEIS, to analyze the Mina rail corridor at a level of detail commensurate with that of the rail corridors analyzed the Yucca Mountain FEIS, there are no issues that remain to be resolved. However, under the overarching Proposed Action to construct and operate a railroad in Nevada in the Mina rail corridor to transport spent nuclear fuel, high-level radioactive waste, and other materials to a repository at Yucca Mountain, it remains unresolved whether the BLM would choose to authorize DOE access to sufficient lands for railroad construction and operation under the right-of-way grant applied for by DOE. DOE would also need to apply to the Bureau of Indian Affairs to acquire a right-of-way in which to construct a rail line on the Walker River Paiute Reservation.

S.2.8 Areas of Controversy

The Yucca Mountain Project, including the transport of spent nuclear fuel and high-level radioactive waste along any chosen rail corridor through Nevada, has remained a controversial issue since its inception some 20 years ago, and has been strongly opposed in the State of Nevada by a variety of state, local, tribal, and citizen groups. A particular focus of controversy has been a state’s right to determine federal projects within its borders. Over the last decade the State of Nevada has filed multiple lawsuits against the federal government regarding the Yucca Mountain Project. In 2004, the State of Nevada petitioned the United States Court of Appeals for the District of Columbia Circuit to review the Yucca Mountain FEIS and the portion of the DOE Record of Decision governing the transportation of nuclear waste. The State of Nevada alleged that the FEIS was procedurally flawed, violated NEPA, and ignored STB railroad regulations. The State of Nevada also challenged the Record of Decision under the Administrative Procedure Act in determining a “mostly rail” plan to be the preferred means of shipping waste to the site, and argued that DOE exceeded its authority in selecting the Caliente corridor. On August 8, 2006, the Court denied Nevada’s petition.

In April 2007 the Tribal Council of the Walker River Paiute Tribe announced a resolution withdrawing their participation in the Rail Corridor SEIS and the Rail Alignment EIS, and renewing the Tribe’s past objection to the transportation of nuclear waste through its Reservation. Thus, in the Rail Alignment EIS, DOE has identified the Mina rail corridor as a nonpreferred alternative.

The Consolidated Group of Tribes and Organizations has consistently opposed the siting of a repository at Yucca Mountain and transportation of spent nuclear fuel and high-level radioactive waste to such a repository. Construction and operation of the proposed repository the proposed railroad are viewed to constitute an intrusion on the holy lands of the Southern Paiute, Western Shoshone, and Owens Valley

Paiute and Shoshone people; a disturbance to cultural, biological, botanical, geological, and hydrological resources; and intrusion on American Indian viewscapes, songscapes, storyscapes, and traditional cultural properties. DOE accepts these viewpoints as responsible opposing viewpoints. These issues could continue to be viewed as unresolved within the forum of American Indian cultures and beliefs.

S.2.9 Major Conclusions

DOE concludes that the Mina rail corridor warrants further study at the alignment level under NEPA, although as a nonpreferred alternative. In reaching this conclusion, DOE considered the environmental conditions and associated potential impacts of constructing and operating a railroad for each of 12 environmental resource areas, and found overall that impacts would be small. The Mina rail corridor coincides in part with an abandoned rail line and follows relatively flat terrain over much of its length, which would minimize the amount of cuts and fills and tend to reduce environmental impacts. However, cumulative impacts to groundwater resources for railroad construction and operations in the Mina rail corridor would be small to moderate.

On April 17, 2007, the Walker River Paiute Tribal Council passed a resolution withdrawing support for the Tribe's participation in the Supplemental Yucca Mountain Nevada Rail Corridor EIS and Rail Alignment EIS preparation process. The Tribal Council's resolution also renewed the Tribe's past objection to the transportation of nuclear waste through its Reservation. Accordingly, DOE has identified the Mina Implementing Alternative as nonpreferred in the Supplemental Yucca Mountain Nevada Rail Corridor EIS and Rail Alignment EIS.

DOE also concludes that, based on the analysis in the Nevada Rail Corridor SEIS, there are no significant new circumstances or information relevant to environmental concerns that would warrant further consideration of the Carlin, Jean, and Valley Modified rail corridors at the alignment level. In reaching this conclusion, the Department has updated the information for 12 environmental resource areas for those three rail corridors, which were evaluated in detail in the Yucca Mountain FEIS. Overall, the environmental conditions and associated potential environmental impacts for each rail corridor remain unchanged from, or are substantially similar to, those reported in the Yucca Mountain FEIS. Notably, however, potential land use and ownership conflicts in the Jean and Valley Modified rail corridors have increased, and although the amount of private land within the Carlin rail corridor appears to have decreased (based on a more refined analysis using land ownership databases), the complex land-ownership pattern (mix of private and public lands that would be crossed) remains unchanged. Such land-use and ownership conflicts and complexity increase the potential to adversely affect construction of a railroad, and increase the potential for delays that could affect the availability of a railroad in these corridors. Moreover, air quality management goals within the Jean rail corridor have changed since DOE completed the Yucca Mountain FEIS, and construction of a railroad could increase the potential for conflicts with these goals.

S.3 SUMMARY OF THE RAIL ALIGNMENT EIS

S.3.1 Purpose and Need for Agency Action

Based on its obligations under the NWPA and its decision to select the mostly rail scenario for the transportation of spent nuclear fuel and high-level radioactive waste, DOE needs to ship these materials by rail in Nevada to a repository at Yucca Mountain.

At present, there is no railroad to the Yucca Mountain Site. In the Yucca Mountain FEIS, DOE evaluated in detail five potential rail corridors within Nevada in which the Department could construct a railroad to link an existing rail line to Yucca Mountain: Caliente, Carlin, Caliente–Chalk Mountain, Jean, and Valley Modified rail corridors. Figure S-3 shows the five rail corridors analyzed in the Yucca Mountain FEIS.

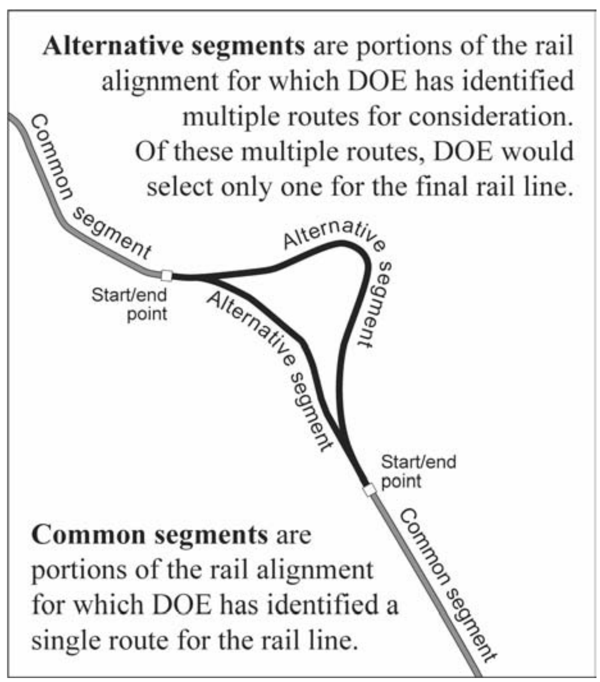
DOE prepared the Rail Alignment EIS to provide the background, data, information, and analyses to help decisionmakers and the public understand the potential environmental impacts that could result from constructing and operating a railroad for shipment of spent nuclear fuel, high-level radioactive waste, and other materials from an existing rail line in Nevada to a repository at Yucca Mountain. This railroad would consist of a rail line, railroad operations support facilities, and other related infrastructure. DOE will use the Rail Alignment EIS to decide whether to construct and operate the proposed railroad, and if so, to:

- Select a rail alignment (Caliente rail alignment or Mina rail alignment) in which to construct the railroad.
- Select the common segments and alternative segments within either a Caliente rail alignment or a Mina rail alignment. The Department would use the selected common segments and alternative segments to identify the public lands to be included in right-of-way applications.
- Decide where to construct proposed railroad operations support facilities.
- Decide whether to restrict use of the rail line to DOE trains, or whether to allow commercial shippers to operate over the rail line (Shared-Use Option).
- Determine what mitigation measures to implement.

S.3.2 Proposed Action and Alternatives

Under the Rail Alignment EIS Proposed Action, DOE would construct and operate a railroad in Nevada to transport spent nuclear fuel, high-level radioactive waste, and other materials to a repository at Yucca Mountain. DOE would also use the railroad to transport materials needed for construction, operation, and maintenance of the repository and rail line.

Under the Proposed Action Caliente Implementing Alternative (the **preferred alternative**), DOE would construct and operate a railroad along the Caliente rail alignment to run from a site in or near the City of Caliente, Nevada, to Yucca Mountain. The rail line would extend north from Caliente, Nevada, turn in a westerly direction and head to near the northwest corner of the Nevada Test and Training Range, and then continue south-southeast to Yucca Mountain. The rail line could range in length from approximately 528 to 541 kilometers (328 to 336 miles) depending on the combination of alternative segments (see Figure S-3).



Under the Proposed Action Mina Implementing Alternative (the **nonpreferred alternative**), DOE would construct and operate a railroad along the Mina rail alignment to run from a site near Wabuska, Nevada, to Yucca Mountain. The rail line would extend from near Wabuska, Nevada, in a southeasterly direction to Yucca Mountain. The total length of the Mina rail alignment could range from approximately

452 to 502 kilometers (281 to 312 miles), which includes portions of an existing rail line currently operated by the Department of Defense. Additionally, railroad operations along the Mina rail alignment would require DOE to operate trains on the Union Pacific Railroad Hazen Branchline, which extends from Hazen, Nevada, south to Wabuska (see Figure S-4).

Under the Shared-Use Option, the Department would allow commercial use of the rail line in under either implementing alternative.

The Rail Alignment EIS also considers the potential environmental impacts of a No-Action Alternative, under which DOE would not construct a railroad along the Caliente rail alignment or the Mina rail alignment.

Figure S-5 shows the two implementing alternatives and the rail line segments that would be the same under either implementing alternative.

For each rail alignment, DOE considered a series of common segments and a range of alternative segments (Figures S-3 and S-4, respectively). DOE applied various engineering, environmental, and design criteria to identify the common segments and alternative segments to be evaluated in the Rail Alignment EIS.

The Proposed Action includes acquiring a right-of-way grant from the BLM, which would authorize DOE access to sufficient lands for the rail alignment and railroad construction and operations support facilities. Under the Mina Implementing Alternative, DOE would need to obtain right-of-way access from the Walker River Paiute Tribe and the Bureau of Indian Affairs to access lands on the Walker River Paiute Reservation. Implementation of the Proposed Action would also require that DOE obtain access to some private land.

During construction of the proposed railroad, a right-of-way would be established that would occupy an approximately 300-meter (1,000-foot)-wide strip of land centered on the rail alignment within the rail corridor. During the railroad operations phase, the right-of-way would be reduced to an approximately 120-meter (400-foot)-wide strip.

Under the Proposed Action DOE would construct and operate the proposed railroad in accordance with applicable federal and State of Nevada laws and regulations, and in compliance with all stipulations and conditions in associated permits. To help ensure compliance with applicable requirements, DOE would implement an array of best management practices as part of the Proposed Action. Best management practices would include practices such as dust suppression and the use of silt fencing to control soil erosion during construction activities. DOE has identified potential mitigation measures to reduce environmental impacts where analyses indicate the potential for environmental impacts after DOE implemented engineering, site evaluation and planning practices, and best management practices.
Under the Proposed Action without shared use, the rail line would be restricted to DOE shipments. DOE would use the rail line to ship approximately 9,500 casks containing spent nuclear fuel and high-level radioactive waste from the Caliente or Wabuska area to the repository for up to 50 years of operations. DOE would also ship approximately 29,000 railcars of other materials, which would include repository construction materials, materials necessary for day-to-day operations of the railroad and the repository, and waste materials for disposal, such as scrap metal and solid waste. DOE anticipates that an average of approximately 17 one-way trains per week would travel along either rail line. (A one-way train means a single trip in either direction.)

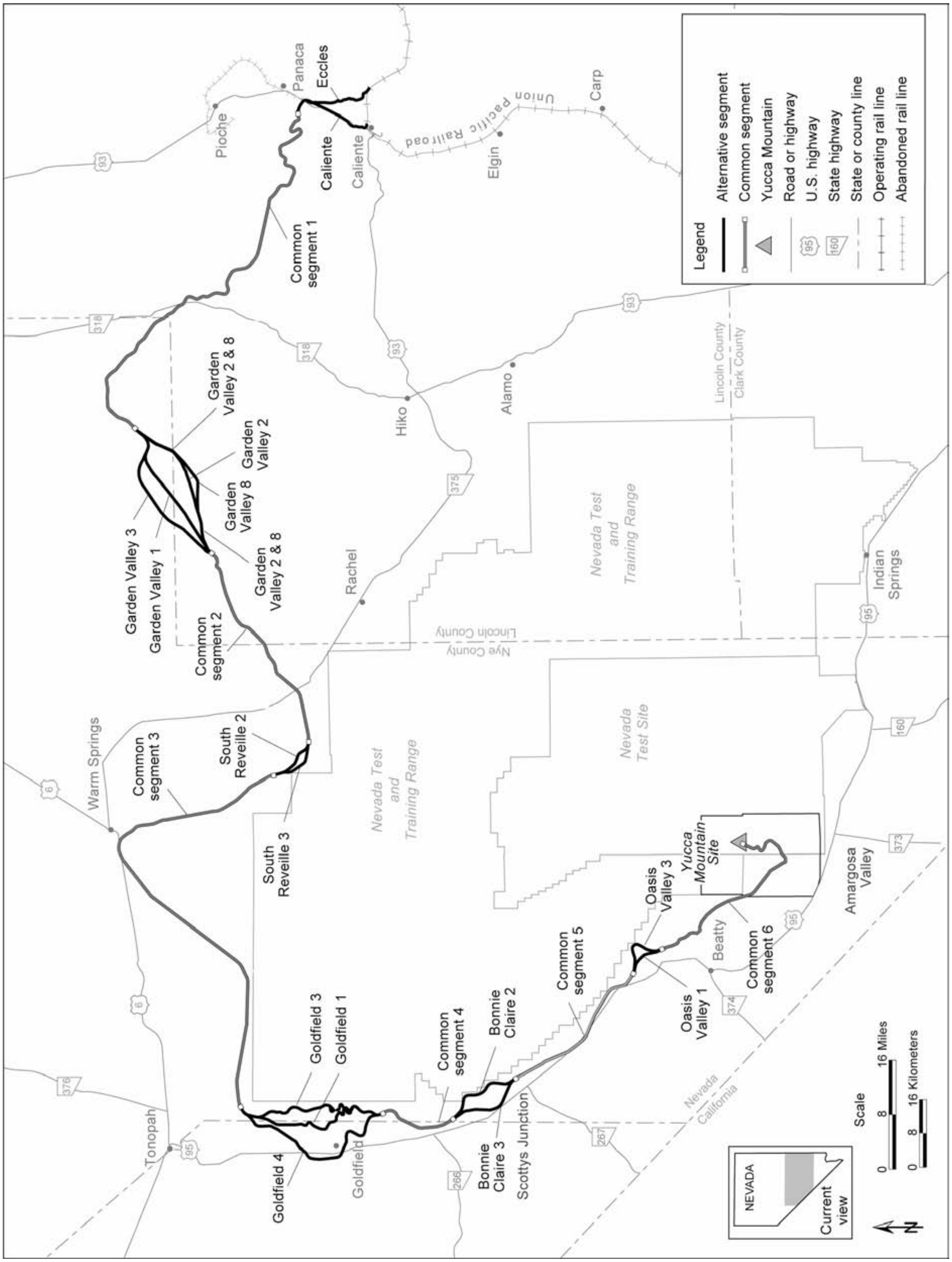


Figure S-3. Caliente rail alignment analyzed in the Rail Alignment EIS.

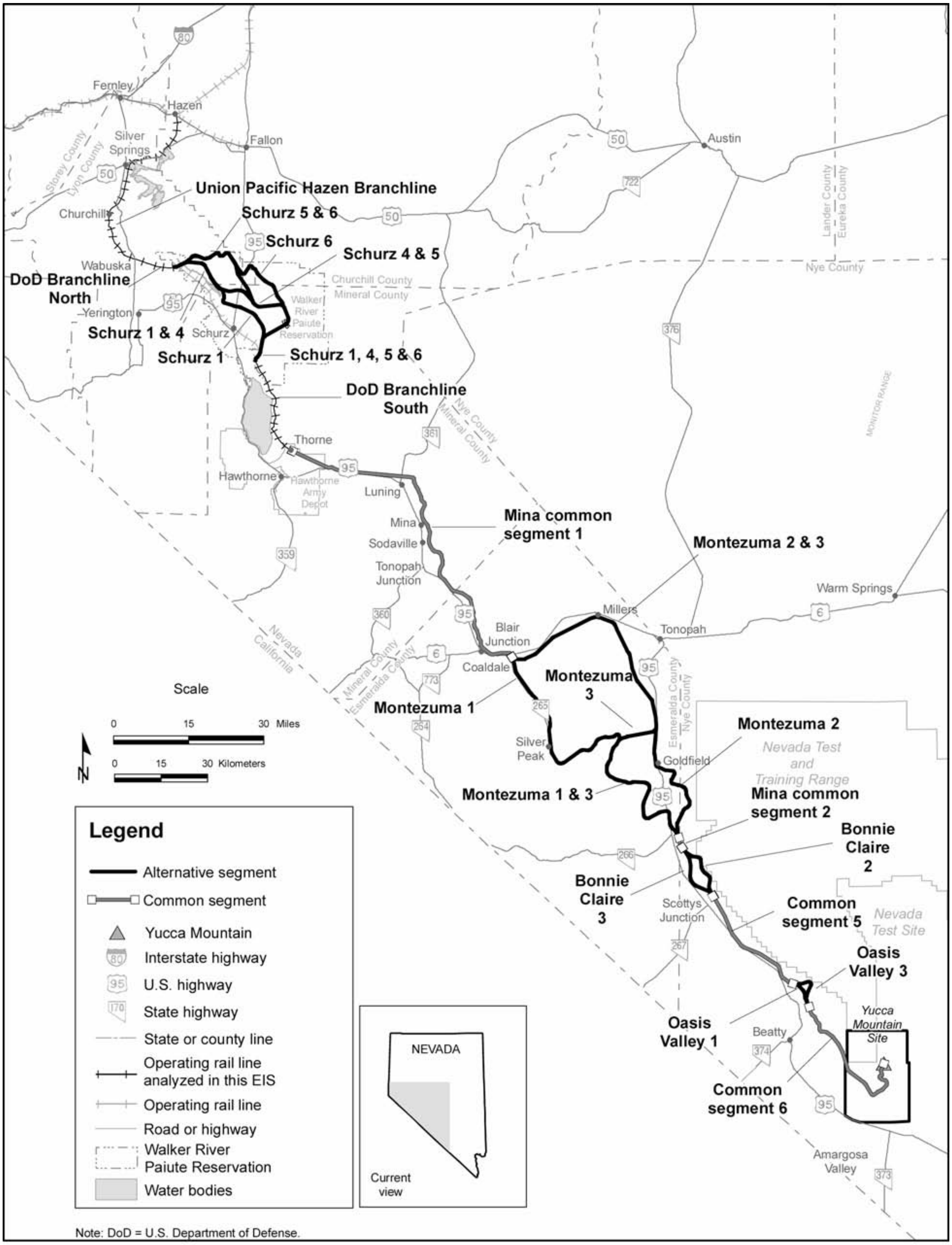


Figure S-4. Mina rail alignment analyzed in the Rail Alignment EIS.

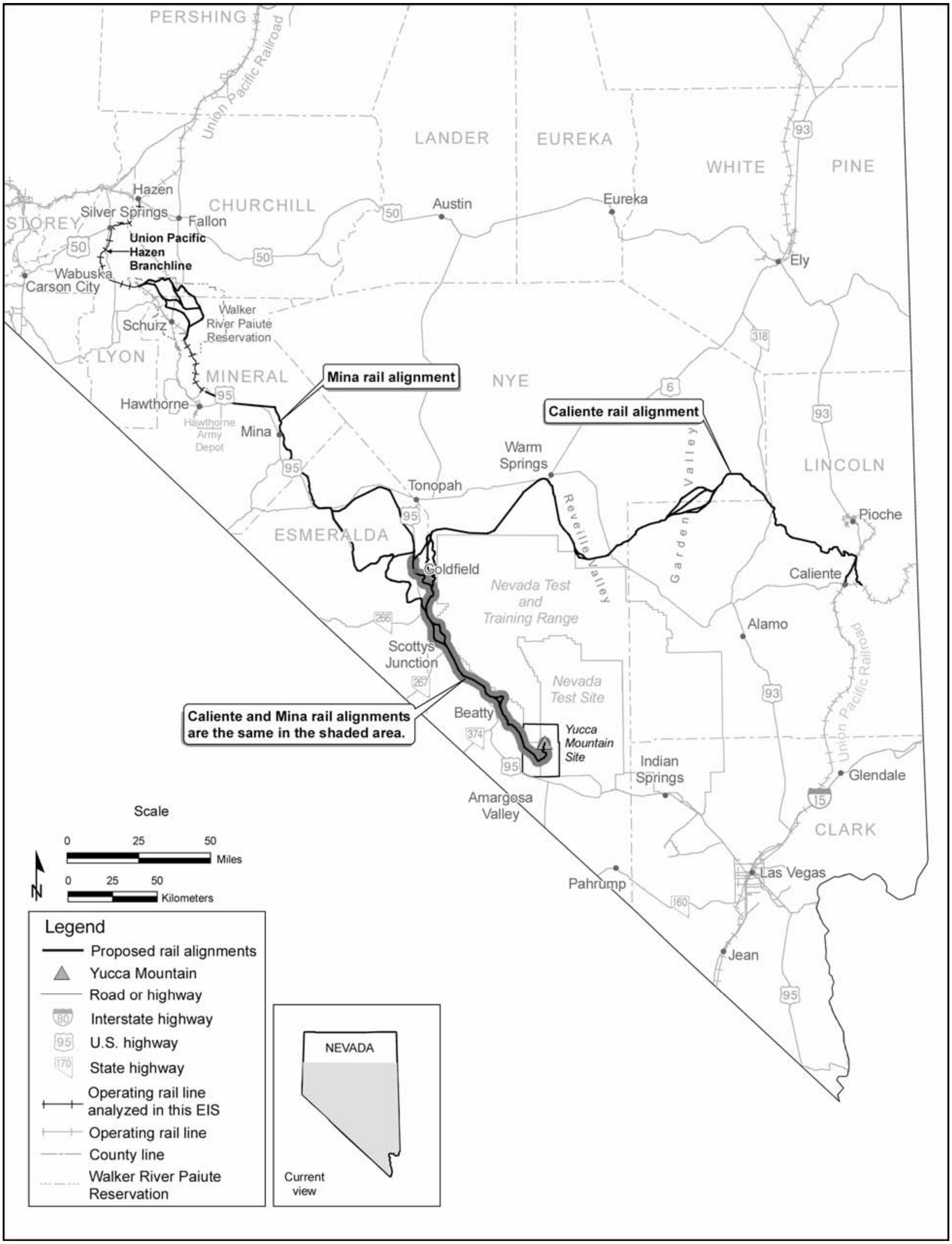


Figure S-5. The proposed Caliente and Mina rail alignments.

Both the Caliente and Mina Implementing Alternatives would require railroad operations support facilities. Under the Caliente Implementing Alternative, facilities would include:

- Interchange Yard
- Staging Yard
- Maintenance-of-Way Facilities
- Rail Equipment Maintenance Yard
- Cask Maintenance Facility
- Nevada Railroad Control Center and National Transportation Operations Center

Under the Mina Implementing Alternative, facilities would include:

- Staging Yard (which would encompass the Interchange Yard)
- Maintenance-of-Way Facility
- Rail Equipment Maintenance Yard
- Cask Maintenance Facility
- Nevada Railroad Control Center and National Transportation Operations Center.

Ballast is the coarse rock that is placed under the railroad tracks to support the railroad ties and improve drainage along the rail line.

Subballast is a layer of crushed gravel that is used to separate the ballast and roadbed for the purpose of load distribution and drainage.

The Department estimates the total cost to construct the railroad within the Caliente rail alignment would be approximately $2.2 billion (in year 2005 dollars with no escalation), whereas the total cost to construct the railroad within the Mina rail alignment would be approximately $1.7 billion (in year 2005 dollars with no escalation).

S.3.2.1 RAILROAD CONSTRUCTION

DOE anticipates that it would take 4 to 10 years to construct the proposed railroad along either rail alignment. Construction of the railroad would include construction of the rail line, the infrastructure necessary to support the construction and operation of the railroad (for example, construction camps, water wells, and ballast quarries), and operations support facilities. Construction activities would occur inside the 300-meter (1,000-foot)-wide construction right-of-way, except in some areas requiring deep cuts or high fills, which could extend beyond typical widths. The total construction footprint resulting from establishing this construction right-of-way under the Caliente Implementing Alternative would be approximately 170 square kilometers (41,000 acres) and under the Mina Implementing Alternative approximately 140 square kilometers (35,000 acres), but would vary depending on the final alternative segments selected. DOE would implement best management practices during this entire construction process.

Construction of the rail line would require obtaining water, ballast, subballast, steel for bridges, concrete ties, and rail. For purposes of analysis, DOE assumed that water would be obtained by pumping groundwater from new water-supply wells along the rail alignment. Under the Caliente Implementing Alternative, a maximum of 107 well sites would be required to supply the 6,100 acre-feet of water necessary for construction. Under the Mina Implementing Alternative, a maximum of 74 well sites would be required to supply the 5,950 acre-feet of water necessary for construction.

DOE would obtain ballast primarily by constructing new quarries along the rail alignment. New quarry sites would occupy a footprint of approximately 0.97 to 3.8 square kilometers (240 to 930 acres). Under the Caliente Implementing Alternative, the Department would construct up to four quarries from six potential locations along the rail alignment. Additionally, DOE is considering obtaining ballast from an existing quarry operation in Utah and shipping it to the proposed rail line. Under the Mina Implementing

Alternative, the Department would construct up to two quarries from five potential locations along the rail alignment.

Under either the Caliente or the Mina Implementing Alternative, DOE would obtain subballast from existing borrow sites along the rail alignment; waste rock generated at ballast quarry sites; from materials excavated during rail roadbed construction; or from the development of new subballast borrow sites established inside the construction right-of-way. Some of the borrow sites for the Mina Implementing Alternative would lie outside of the construction right-of-way. The Department would obtain steel, concrete ties, and rail from existing commercial sources.

DOE would construct the rail line in two major steps: (1) rail roadbed construction and (2) track construction. The rail roadbed would form the base upon which the subballast, ballast, concrete ties, and rail would be laid. Construction of the rail roadbed would require clearing, cuts and fills, and excavating earth. Track construction would involve the placement of subballast, ballast, concrete ties, and rail on top of the rail roadbed, building access roads, and establishing power and communication systems. Construction of the rail line would require DOE to establish construction camps along the rail alignment to provide housing for workers and a logistical base from which to conduct construction activities. Under the Caliente Implementing Alternative, the Department would establish up to 12 construction camps. Under the Mina Implementing Alternative, the Department would establish up to 10 construction camps. Each camp would occupy approximately 0.10 square kilometer (25 acres).

Under either the Mina or Caliente Implementing Alternative, DOE would construct bridges, ***culverts***, and at-grade and ***grade-separated*** road crossings. Under the Caliente Implementing Alternative, the Department would construct up to 240 bridges ranging in length from 7.3 to 300 meters (24 to 1,000 feet); up to 138 large culverts; and up to five grade-separated crossings of highways along the rail alignment. Under the Mina Implementing Alternative, the Department would construct up to 69 bridges ranging in length from 16 to 300 meters (50 to 1,000 feet); up to 60 large culverts; and up to four grade-separated crossings of highways along the rail alignment.

Crossings at other paved public roadways would be at-grade and DOE would install active warning devices, such as flashing lights and gates. For crossings at unpaved roads and private crossings, DOE would install passive warning devices, such as crossbucks and stop signs.

A **culvert** is a conduit for conveying surface water through an embankment. The typical culvert that would be utilized during construction is a box culvert, which is rectangular in cross section. Circular culverts, which are circular in cross section, would also be used when appropriate.

A **grade-separated crossing** occurs when a roadway and a rail line cross paths and one passes over or under the other via an overpass or underpass.

A **siding** is a track that runs parallel to the main line for a short distance and is used for passing and overtaking trains to prevent backups and keep traffic flowing.

Under either the Caliente or Mina Implementing Alternative, DOE would construct approximately 12 passing ***sidings*** approximately every 40 kilometers (25 miles) along the rail alignment. Under the Mina Implementing Alternative, DOE would also install sidings along the existing Department of Defense Branchline. Under either implementing alternative, DOE would construct temporary construction sidings at camps, quarries, and material laydown areas.

Table S-5 lists the attributes associated with rail line construction for each implementing alternative.

Table S-5. Project attributes associated with construction[a] of the proposed rail line.

Attribute	Caliente Implementing Alternative	Mina Implementing Alternative
Estimated number of bridges	Approximately 215 to 240, ranging in length from 3 to 7.3 meters (24 to 1,000 feet)	Approximately 58 to 69, ranging in length from 3 to16 meters (50 to 1,000 feet)
Estimated number of culverts	Approximately 96 to 138	Approximately 38 to 60
Communications towers	Approximately every 16 to 32 kilometers (10 to 20 miles) along the rail alignment, approximately 23 to 30 meters (75 to 100 feet) tall	
Estimated number of water wells needed to satisfy construction water demand	Minimum: 94 well sites containing 150 wells Maximum: 107 well sites containing 176 wells	Minimum: 58 well sites containing 77 wells Maximum: 74 well sites containing 110 wells
Sidings	12 sidings, ranging in length from 2,100 to 3,700 meters (7,000 to 12,000 feet)	12 sidings, ranging in length from 2,100 to 5,800 meters (7,000 to 19,000 feet)
Alignment access roads	The railroad alignment is planned to have an access road along most of its length. This road would be used primarily to support maintenance of the railroad infrastructure. In situations where rerouting existing roads to a common crossover point would be appropriate, DOE could use the access road to facilitate routing roads to a single crossing.	
Construction camps	Number: up to 12, with up to 6 operating at one time	Number: up to 10, with up to 6 operating at one time
	Function: To house the rail line construction workers and provide a logistical support area for construction. Location: One approximately every 50 kilometers (30 miles) along the rail alignment Employment: Up to 360 per camp (106 support staff and 254 contractors) Disturbed area: 0.10 square kilometer (25 acres) per camp	
Ballast quarries	Number: If necessary, up to four would be developed from six potential sites. Locations: One near Caliente; two in South Reveille Valley; one west of Goldfield; and two northeast of Goldfield	Number: If necessary, up to two would be developed from five potential sites. Locations: Two east of Hawthorne; one east of Silver Peak; and two west of Goldfield.
	Employees: Up to 30 at each quarry Disturbed Area: 0.32 to 0.49 square kilometer (80 to 120 acres) per site	
Construction train traffic	Ballast trains: Approximately 8 one-way trains[b] per day Concrete tie trains: Approximately 2 one-way trains per day Rail section trains: Approximately 4 one-way trains per day Other materials trains: Approximately 2 one-way trains per day Total: Approximately 16 one-way trains per day	
Total construction employment (required over the entire construction phase)	8,100 employees (the maximum number of employees in one year is 2,160)	7,600 employees (the maximum number of employees in one year is 2,160)

a. Construction would take place over a 4- to 10-year period.
b. A one-way train means a single trip in either direction.

S.3.2.2 RAILROAD OPERATIONS AND MAINTENANCE

Under the Proposed Action, the railroad would be expected to operate for up to 50 years for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials to the repository at Yucca Mountain. DOE would operate an average of 17 one-way trains per week to transport approximately 9,500 casks of spent nuclear fuel and high-level radioactive waste, and approximately 29,000 railcars of construction materials, diesel fuel, and supplies for the repository and facilities.

Under the Caliente Implementing Alternative, trains would arrive at the Interchange Yard on the Union Pacific Railroad Mainline near Caliente and proceed to the Staging Yard along either the Caliente or the Eccles alternative segment. Under the Mina Implementing Alternative, trains would arrive on the Union Pacific Railroad Mainline near Hazen and proceed to the Staging Yard at Hawthorne via the Union Pacific Railroad Hazen Branchline, the Department of Defense Branchline North, the selected Schurz alternative segment, and the Department of Defense Branchline South. Under the Caliente Implementing Alternative, two facilities (the Interchange Yard and the Staging Yard) would be required to fulfill the functional requirements of exchanging railcars between the Union Pacific Railroad Mainline and the proposed railroad. This is because there is not enough space where the Caliente rail alignment would intersect the Union Pacific Railroad Mainline to house all of the necessary functions of these facilities in one location. However, under the Mina Implementing Alternative, there is enough space to locate all the functions in a single facility (the Staging Yard) at Hawthorne. Once at a Staging Yard, Union Pacific Railroad locomotives would uncouple from cask cars and return to the mainline. The cask cars would go through all appropriate inspections in accordance with Federal Railroad Administration regulations (49 CFR Part 232 and 49 CFR Part 215). A DOE cask train would typically consist of two or three 4,000-horsepower diesel-electric locomotives followed by a buffer car; one to five cask cars followed by another buffer car; and one escort car carrying security personnel, as illustrated in Figure S-4. Naval spent nuclear fuel trains would typically include two or three locomotives, one to 12 cask cars, a buffer car in front of the first cask car and after the last cask car, and one to two escort cars.

Under either implementing alternative, following inspection and assembly of cask trains, trains would depart the Staging Yard and travel for less than 10 hours along the railroad to the Rail Equipment Maintenance Yard at the Yucca Mountain Site. Casks would then be transferred to control of the geologic repository operations area to be unloaded for repository storage. Empty casks would be transferred back to railroad control, and before they were returned to the Staging Yard for onward shipment, could be sent to a Cask Maintenance Facility for testing, inspection, maintenance, minor decontamination, and routine repair of the casks. The National Transportation Operations Center would oversee the shipment of casks from sites throughout the United States; train movements, rail operations, and emergency response operations along the proposed railroad would be coordinated from the Nevada Railroad Control Center. Both would be located either at the Rail Equipment Maintenance Yard or at the Staging Yard.

Under the Caliente Implementing Alternative, most rail line maintenance and inspection activities would be conducted in the Maintenance-of-Way Facilities, which consist of the Maintenance-of-Way Trackside Facility, Maintenance-of-Way Headquarters Facility, and two Satellite Maintenance-of-Way Facilities. Under the Mina Implementing Alternative, the Maintenance-of-Way Trackside Facility and the Maintenance-of-Way Headquarters Facility would be combined and housed in a single Maintenance-of-Way Facility. All maintenance and inspection activities would be performed out of this facility and two Satellite Maintenance-of-Way Facilities, one at the Staging Yard and one at the Rail Equipment Maintenance Yard. Maintenance activities along the Mina rail alignment would include maintaining the existing Department of Defense Branchline as needed.

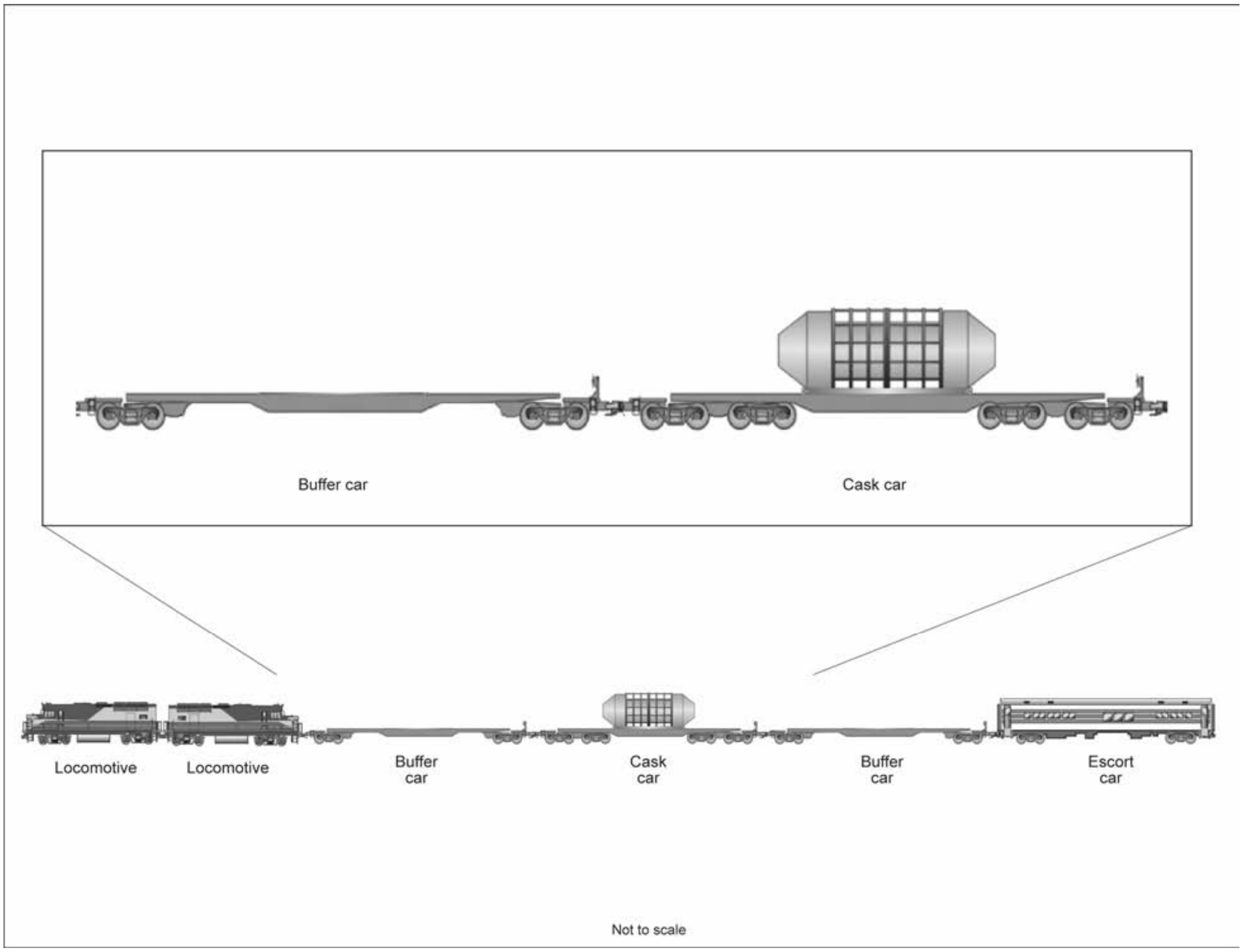


Figure S-4. Artist's conception of a repository train carrying one cask.

Table S-6 lists the rail facilities along the Caliente and Mina rail alignments and details their functions, their locations, and the number of personnel needed to operate each facility.

S.3.2.3 SHARED-USE OPTION

Under both implementing alternatives, DOE has analyzed a Shared-Use Option, under which (subject to STB approval) the Department would allow commercial shippers to use the rail line to ship general freight. The Shared-Use Option would require construction of commercial sidings to provide access for potential commercial shippers, and facilities for operation of commercial rail service. Funding for construction and commercial rail service could be provided by either the private sector or other government sources. The DOE design for the rail line (for example, grade and curvature) would accommodate shared use.

Commercial railcars would be hauled in trains that are separate from trains carrying spent nuclear fuel and high-level radioactive waste, but could be hauled with trains carrying other repository-related materials (for example, construction materials, water, and fuel). During the operations phase, trains carrying spent nuclear fuel and high-level radioactive waste would have priority over trains carrying commercial shipments.

Table S-6. Railroad operations support facilities – Caliente and Mina rail alignments (page 1 of 2).

Facility	Location	General function	Number of employees required for operations
Facilities along the Caliente rail alignment (excluding facilities common to the Caliente and Mina rail alignments)			
Facilities at the Interface with the Union Pacific Railroad Mainline			
Interchange Yard	Caliente or Eccles alternative segments Lincoln County	Handling point for the exchange of railcars containing construction and other materials between the Union Pacific Railroad Mainline and the proposed railroad	0 (employees would be based at the Staging Yard)
Staging Yard	Caliente alternative segment: Indian Cove or Upland option Eccles alternative segment: Eccles-North Lincoln County	Transfer point for casks and other materials delivered to the proposed railroad from around the country	50 (including employees for the potential Nevada Railroad Control Center and National Transportation Operations Center)
Maintenance-of-Way Facilities			
Maintenance-of-Way Headquarters Facility	South of Tonopah, near the intersection of U.S. Highway 95 and U.S. Highway 6 Esmeralda County	Coordination center for all maintenance activities along the proposed railroad	10
Maintenance-of-Way Trackside Facility	Common segment 3; 48 kilometers (30 miles) southeast of Tonopah Nye County	Base of operations for most maintenance activities along the rail alignment	40
Satellite Maintenance-of-Way Facility	Rail Equipment Maintenance Yard and Staging Yard Nye County and Lincoln County	Dispatch point for maintenance activities along the first third and final third of the rail line	0 (employees housed at the Maintenance-of-Way Trackside and Headquarters Facilities)
Staging Yard	Mina common segment 1 near Hawthorne Mineral County	Transfer point for casks and other materials delivered to the proposed railroad from around the country Handling point for the exchange of railcars containing construction and other materials between the Union Pacific Railroad and the proposed railroad	40

Table S-6. Rail line operations support facilities – Caliente and Mina rail alignments (page 2 of 2).

Facility	Location	General function	Number of employees required for operations
Facilities along the Mina rail alignment (excluding facilities common to the Caliente and Mina rail alignments)			
Maintenance-of-Way Facilities			
Maintenance-of-Way Facility	Montezuma alternative segment 1: Silver Peak option Montezuma alternative segments 2 and 3: Klondike option Esmeralda County	Coordination center and base of operations for all maintenance activities along the proposed railroad	40
Satellite Maintenance-of-Way Facility	Rail Equipment Maintenance Yard and Staging Yard Nye County and Lincoln County	Dispatch point for maintenance activities along the first third and final third of the rail line	0 (employees based at the Maintenance-of-Way Facility)
Facilities common to both the Caliente and Mina rail alignments			
Rail Equipment Maintenance Yard	Less than 1.6 kilometers (1 mile) south of the southern boundary of the geologic repository operations area Nye County	Receiving point for casks and other freight from the proposed railroad to the Yucca Mountain Repository; would also store, service, and maintain the rail cars and locomotives operating on the proposed railroad	40 (including employees for the potential Nevada Railroad Control Center and the National Transportation Operations Center)
Cask Maintenance Facility	Collocated with the Rail Equipment Maintenance Yard	Processing location for all transportation casks, including inspection, certification, maintenance and decontamination	30
Nevada Railroad Control Center and National Transportation Operations Center	Collocated with the Rail Equipment Maintenance Yard or the Staging Yard Nye County or Lincoln County	The Nevada Railroad Control Center would control operations along the proposed railroad; the National Transportation Operations Center would coordinate the national shipment of casks and other materials to the proposed railroad	15

Based on a study of potential commercial users, DOE estimated that approximately 8 one-way commercial trains could run per week along the Caliente rail alignment. For the Mina rail alignment, which would have the greater commercial potential, DOE estimated that approximately 18 one-way commercial trains could run on the rail line per week, 8 of which would travel only on the northern portion of the alignment.

S.3.2.4 RAILROAD ABANDONMENT

If DOE proposed to abandon the railroad after the operations phase, the Department could decide to remove ballast, track, ties, signaling, and other related materials. In addition, the Department could decide to decommission and dismantle facilities (for example, the Cask Maintenance Facility). The Department might not remove the rail roadbed, although the lands disturbed by the abandonment process would be reclaimed as required. If the Department decided to abandon the railroad, it would relinquish its regulatory right-of-way on BLM lands and the BLM would continue to manage the land. Abandonment of the railroad would be conducted in consultation with land-management entities, as appropriate, at the time of abandonment.

A decision about whether to abandon the railroad would be made near the completion of the shipping campaign, when more information would be available from the communities or the private business sector regarding the usefulness of maintaining portions of the rail line or individual facilities.

S.3.2.5 NO-ACTION ALTERNATIVE

CEQ regulations (40 CFR 1502.14) require that the alternatives analysis in an EIS include the alternative of no action. The No-Action Alternative provides a basis for comparison with a Proposed Action.

Under the Rail Alignment EIS No-Action Alternative, DOE would not select a rail alignment within the Caliente or the Mina rail corridor for the construction and operation of a railroad. DOE would relinquish public lands in the Caliente rail alignment that were withdrawn for study under Public Land Order 7653, and would also relinquish the public lands segregated from surface and mineral entry for 2 years in the Caliente and Mina rail alignments. The BLM would continue to manage public land for multiple uses. The location and extent of new mining claims and the associated development of mineral commodities, although not known with any certainty, would no longer be limited by the Public Land Orders.

Under the No-Action Alternative, there would be no impacts to land uses, natural, human health, social, economic, or cultural resources from construction and operation of a railroad in Nevada for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from an existing rail line to a geologic repository at Yucca Mountain.

In the event that DOE were not to select a rail alignment in the Caliente corridor or in the Mina rail corridor, the future course that it would pursue to meet its obligations under the NWPA is uncertain.

S.3.3 Issues Raised by the Public

S.3.3.1 PUBLIC SCOPING

DOE provided two public scoping periods for the Rail Alignment EIS (the first between April 8 and June 1, 2004; the second between October 13 and December 12, 2006). DOE solicited written comments and held five public scoping meetings in Nevada in May 2004 (69 *FR* 18565).

In May 2006, the Walker River Paiute Tribal Council informed DOE that it would allow DOE to evaluate the environmental impacts of transporting nuclear waste across the Walker River Paiute Reservation in the Mina rail corridor. Following a preliminary evaluation, DOE solicited written comments on an expanded scope of the Rail Alignment EIS, and held one public scoping meeting in Washington, D.C., in October 2006, and eight in Nevada during November 2006 (71 *FR* 65785). In addition to publications in the *Federal Register*, DOE extensively advertised all meetings in a broad range of other media such as newspapers, letters, and press releases.

DOE received more than 4,100 comments from the first scoping period and nearly 800 from the second. Most of the comments DOE received during the second scoping period were similar to those from the first.

A number of commenters mentioned a variety of alternative segments that either should be considered or dismissed. DOE considered changes to alternative segments identified in the Notices of Intent, considered suggested new alternative segments, added some alternative segments, and adjusted or eliminated some alternative segments. Some commenters expressed concern about environmental resources to be considered that encompassed land-use issues, some specific land-use suggestions, air quality, socioeconomics, health and safety. DOE has conducted extensive analysis to encompass these issues. Other commenters expressed support for public or commercial use of the proposed rail line, and some commenters expressed the opposite viewpoint. DOE has therefore also analyzed a Shared-Use Option to allow a decision to be made on shared use. Various commenters noted best management practices and mitigation issues surrounding impacts associated with the construction and operation of the railroad (for example, to livestock, waterways and washes, and mining). In response DOE has developed a series of mitigation measures to avoid, minimize, rectify, reduce, and/or compensate for potential impacts, such as limiting fencing on public lands to those areas where grazing permittees might request it for livestock safety, positioning temporary pipelines so they would not obstruct natural drainage channels, and notifying all patented minerals lessees and claimants, and consulting with owners of active local mines and mining claims to ensure that impacts are minimized during construction. In addition, DOE and the BLM have solicited comments on potential mitigation measures from grazing permittees along the proposed rail line and considered these when developing mitigation measures.

Other commenters suggested that DOE identify and analyze the entire infrastructure necessary to construct and operate the proposed rail lines, including construction camps, ballast sources, borrow and fill areas, access roads, rail yards, maintenance facilities, and an operations center. DOE has done so. Commenters requested inclusion of detailed maps and plans, and to that end DOE has prepared a detailed map atlas as a reference to the Rail Alignment EIS. Comments specifically addressing the Mina rail alignment suggested that the scope of analysis should be from Hazen to Yucca Mountain. DOE has analyzed environmental impacts from Hazen to Yucca Mountain in the Rail Alignment EIS.

DOE considered the content all comments received during both public scoping periods in determining the scope of the Rail Alignment EIS.

S.3.3.2 TRIBAL UPDATE MEETINGS

DOE held a Tribal update meeting on June 2, 2004, to obtain comments from Tribal representatives from the Consolidated Group of Tribes and Organizations composed of 17 tribes and organizations with traditional ties to the Yucca Mountain area that have appointed representatives to represent their respective tribal concerns and perspectives. During the second scoping comment period for the Rail Alignment EIS, DOE held another meeting for the Consolidated Group of Tribes and Organizations on November 29, 2006, in Pahrump, Nevada. The Department considered all comments submitted during the meetings in the development of the scope of the EIS. Commenters called for continued consultation with tribes that would be culturally affected by the transportation of spent nuclear fuel and high-level radioactive waste. DOE is committed to continuing the consultation process throughout the development of the Rail Alignment EIS and plans to continue consultation with American Indians to ensure that tribal concerns and perspectives are considered.

S.3.3.3 BLM PUBLIC MEETINGS

On December 29, 2003, the BLM announced the receipt of an application from DOE requesting that approximately 1,249 square kilometers (308,600 acres) of public land in Nevada be withdrawn from surface and mineral entry for a period of 20 years to evaluate the land for the potential construction, operation, and maintenance of a rail line for the transportation of spent nuclear fuel and high-level radioactive waste (*Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada* (68 *FR* 74965, December 29, 2003). The *Federal Register* notice stated that the BLM had segregated the land from surface and mineral entry for up to 2 years while various studies and analyses are conducted to support a final decision on the withdrawal application. In a May 21, 2004, Notice of Public Meetings (69 *FR* 29323), the BLM invited the public to submit written comments on the proposed withdrawal and possible land-use plan amendments by June 30, 2004. The BLM held two public scoping meetings on the proposed withdrawal and possible land-use plan amendments. On January 10, 2007, the BLM issued a notice (72 *FR* 1235) of a DOE application for the withdrawal of 842 square kilometers (208,037 acres) of land (an additional 278 square kilometers [68,646 acres] of public lands for the Caliente rail corridor and 564 square kilometers [139,391 acres] of public lands for evaluation along the Mina rail corridor. Many of the public comments submitted to the BLM were similar to those at submitted DOE scoping meetings. DOE considered all the comments the BLM received in developing the scope for the Rail Alignment EIS; some of those comments led to the actions already described.

S.3.3.4 ADDITIONAL OUTREACH

In addition to the DOE and BLM scoping meetings, and comments from the Tribal Update Meetings, DOE used other information to define the scope of the Rail Alignment EIS. DOE worked with the Central Nevada Community Protection Working Group to gain the assistance of Nye, Lincoln, and Esmeralda Counties and the City of Caliente in obtaining information to support the EIS. Under a cooperative agreement with DOE, Lincoln County led an effort to interview landowners, business owners, county officials, elected officials, and other potentially interested parties. Comments received during these interviews closely mirrored the comments submitted to both DOE and the BLM. In addition, Nye County surveyed property owners along the Caliente rail corridor under a cooperative agreement with DOE. The surveys solicited comments on potential impacts of the proposed rail line and possible measures to mitigate those impacts. Also, the BLM interviewed grazing permittees along the Caliente rail corridor and asked for their comments on potential impacts associated with construction and operation of the proposed rail line and for their input on potential mitigation measures. DOE used the information obtained through these interviews and surveys to help define the scope of this Rail Alignment EIS.

S.3.4 Environmental Impacts

In the Rail Alignment EIS, potential impacts are identified as either direct or indirect, and either short term or long term. Where practicable, DOE has quantified potential impacts. In cases where it is not practical to quantify impacts, DOE provides a qualitative assessment of potential impacts. In the Rail Alignment EIS, DOE has used the following descriptors to qualitatively characterize impacts where quantification of impacts was not practical:

- ***Small***. Environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- ***Moderate***. Environmental effects would be sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- ***Large***. Environmental effects would be clearly noticeable and would be sufficient to destabilize important attributes of the resource.

DOE would meet all applicable regulatory requirements during construction and operation of the rail line, and would implement an array of best management practices to help ensure compliance with requirements. In addition, DOE could implement measures to mitigate impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices. Sections S.7.1 through S.7.15 summarize environmental impacts for each resource area DOE analyzed.

S.3.4.1 PHYSICAL SETTING

DOE examined the region of influence for physical setting to determine the potential for impacts on physiography, geology, and soils. The region of influence for physical setting includes the areas that would be directly and indirectly affected by construction and operation of the proposed railroad, and incorporates the nominal width of the rail line construction right-of-way (300 meters [1,000 feet] centered on the rail alignment). It also includes the footprints of construction camps, quarry sites, facility sites, access roads, and water wells that would be outside of the nominal width of the construction right-of-way.

DOE determined that land disturbance would be 55 to 61 square kilometers (14,000 to 15,000 acres) for the Caliente rail alignment and 40 to 48 square kilometers (9,900 to 12,000 acres) for the Mina rail alignment. Lands that are currently relatively undisturbed would be extensively graded, which would result in topsoil loss and increased potential for erosion. However, DOE would implement best management practices to minimize erosion and sedimentation during construction activities. DOE assessed that impacts from soil erosion would be small.

Perlite, a locally important mineral, occurs in the area of the Caliente rail alignment Caliente and Eccles alternative segments, and other minerals, such as limestone, metallic commercial minerals, and geothermal resources have been identified in some nearby mountains. Although no mineral resources would be removed, placement of the rail line could reduce the availability of perlite or limestone for mining. The Goldfield alternative segments would cross mining areas and could limit the boundaries for mining if mineral resources extend under the rail line.

Neither railroad construction nor operations would reduce the availability for mining of metallic minerals that have been identified in surrounding mountains. The Montezuma alternative segments would cross mining areas in the Goldfield Hills area, and limit the boundaries for mining if mineral resources extended under the rail line.

Along the Caliente rail alignment, construction in the Caliente or Eccles alternative segment and Caliente common segment 1 would result in a small loss of up to 1.4 kilometers (340 acres) of prime farmland soil. These prime farmland soils are found in isolated pockets and are unfarmed. In the Mina rail alignment, construction of Schurz alternative segment 1, 4, 5, or 6 would impact soils characterized as prime farmland directly adjacent to the banks of the Walker River. These areas are not farmed and DOE expects no change in their current agricultural land use. DOE expects that impacts to prime farmland soils would be small (up to 0.014 square kilometer [3.5 acres] would be lost). There would be a potential for leaks and spills that could contaminate soils during railroad operations; however, DOE would implement best management practices and consider mitigation measures to reduce any impacts.

The Shared-Use Option would require the construction of additional rail sidings within the rail line construction right-of-way in areas of relatively flat terrain. DOE determined that implementation of the Shared-Use Option would increase the surface disturbance area by less than 0.1 percent for either the Caliente or Mina rail alignment, and would add no impacts to physical setting beyond the permanent alterations already described.

S.3.4.2 LAND USE AND OWNERSHIP

The region of influence for land use and ownership is the nominal width of the rail line construction right-of-way and includes all private land, American Indian land, and public land fully or partially within that area. It also includes lands outside the nominal width of the rail line construction right-of-way, where there would be facilities, quarries, and wells to support construction and long-term operation of the railroad.

DOE would need to gain access to private land—up to 0.72 square kilometer (178 acres) for the Caliente rail alignment and up to 0.59 square kilometer (146 acres) for the Mina rail alignment. For the Caliente rail alignment, another possible 1.15 square kilometers (284 acres) of private land would be required to accommodate support facilities. Neither rail alignment would displace existing or planned land uses over a substantial area, nor would they substantially conflict with applicable land-use plans or goals. The areas with the highest density of private land either rail alignment would cross are the City of Caliente (Caliente rail alignment) and Goldfield (both rail alignments). For the Caliente alternative segment, some structures at the existing Union Pacific train yard and three structures along the former Pioche and Prince Branchline would need to be demolished or relocated. The Caliente alternative segment would also occupy portions of the access road and parking lot of the Caliente Hot Springs Motel. The motel could be adversely affected because of the rail line's proximity. Alternative segments near Goldfield would cross vacant private land, including patented mining claims and state and county land.

In response to concerns from the Timbisha Shoshone Tribe, DOE avoided Timbisha Shoshone Trust Lands during the development of the Caliente and Mina rail alignments. The closest rail line segment along either rail alignment would be common segment 5, which would be approximately 3 kilometers (2 miles) east of Timbisha Shoshone Trust Lands near Scottys Junction. DOE initially studied the Mina rail alignment with the permission of the Walker River Paiute Tribe and the Department designed the Schurz alternative segments with the aim of removing the existing Department of Defense Branchline through the town of Schurz in accordance with the Tribe's request. The Schurz alternative segments would utilize up to 0.5 percent of the land area of the Reservation (up to 5.3 square kilometers [1,300 acres]).

The Caliente rail alignment would utilize up to 162 square kilometers (40,000 acres) of BLM-administered land out of a total construction footprint of approximately 170 square kilometers (41,000 acres), and the Mina rail alignment would utilize up to 113 square kilometers (28,000 acres) of BLM-administered land out of a total construction footprint of approximately 125 square kilometers (31,000 acres).

The Mina rail alignment would cross 4.6 square kilometers (1,150 acres) of land within the Hawthorne Army Depot near its northern border, where it would not pose a conflict with the Depot's mission or land uses. Railroad construction would result in surface disturbance across a number of grazing allotments on BLM-administered land. However, because the land would be restored after the construction phase and the operations right-of-way would be smaller than the construction right-of-way, long-term impacts would be small. Individual rail line segments would result in less than a 2-percent loss of animal unit months (a measure of the amount of forage needed to sustain one animal for 1 month) across all affected allotments for either rail alignment. The rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn new routes and acclimate to and cross the rail line. The rail line could pose additional risk to ranching operations because livestock could be struck by passing trains. DOE or the railroad's commercial operator would reimburse ranchers for such losses, as appropriate.

Most of the local mining activity along both the Caliente and Mina rail alignments would be outside the rail line construction right-of-way. DOE would need to negotiate the surface rights to cross the few affected unpatented mining claims the rail line would intersect. Along the Caliente rail alignment, the rail line would intersect unpatented mining claims along South Reveille alternative segments 2 and 3; Caliente common segment 3; Goldfield alternative segments 1, 3, and 4; Oasis Valley alternative segments 1 and 3; and common segment 6. The Mina rail alignment would intersect unpatented mining claims along Montezuma alternative segments 1, 2 and 3; Oasis Valley alternative segments 1 and 3; and common segment 6. The rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design, DOE would perform a survey to verify the locations of mining tunnels and shafts and implement measures to avoid adverse impacts.

Rail alignments have been developed to avoid Wilderness Areas and other scenic and recreational areas. Under either implementing alternative, DOE would construct crossings to prevent the rail line from obstructing access to private and public land. While there could be temporary road closures or detours during the construction phase, there would be no impact to land access during the operations phase. In addition, organized off-highway vehicle events permitted in the past by the BLM might need to alter their routes to avoid the rail line.

The rail alignments would cross a number of utility rights-of-way. DOE would negotiate crossing agreements with right-of-way holders and the BLM. DOE would protect existing utilities from damage so that disruption to utility service or damage to lines would be at most small and temporary. The project would require a BLM right-of-way outside existing BLM planning corridors for utilities; this right-of-way would be outside of right-of-way avoidance areas. Under the longest potential routes, approximately 25 percent of the Caliente rail alignment and 44 percent of the Mina rail alignment (new construction on BLM-managed land) would fall within existing planning corridors. In addition, to avoid the proliferation of new rights-of-way, the BLM could elect to grant future rights-of-way for new utilities adjacent to the proposed rail line.

S.3.4.3 AESTHETIC RESOURCES

DOE considered the region of influence for the aesthetic resources as the viewshed around all common segments, alternative segments, and facilities along the Caliente and Mina rail alignments. To ensure that seldom-seen views were included in this analysis, DOE used a conservative region of influence extending 40 kilometers (25 miles) on either side of the centerline of all common segments and alternative segments, and around facilities. Most of the lands that would be affected by the Proposed Action are BLM-administered public lands, including those on which the proposed railroad would be constructed. For this reason, DOE used BLM visual resource management classifications and contrast rating methodologies to evaluate aesthetic impacts to the surrounding viewshed. The BLM assigns visual resource management classes to lands under it jurisdiction, based on scenic quality and other factors, that range from Class I to Class IV, with Class I representing the highest visual values. Each class comes with specific visual resource management objectives that indicate the levels of project-related contrast that are acceptable. In this analysis, the primary basis for identifying potential adverse impacts to aesthetic resources was inconsistency with these BLM visual resource management objectives. The Department assessed the potential visual contrast between existing conditions and conditions expected during the project from key locations and compared these levels of contrast with the visual resource management objectives associated with the BLM classifications of the surrounding viewshed.

Along both the Caliente and the Mina rail alignments, DOE found that the contrast that would be caused by the rail line and support facilities would remain consistent with BLM visual resource management objectives during the operations phase, but could be inconsistent in certain locations during the construction phase. Along the Caliente rail alignment, a conveyor crossing of U.S. Highway 93 near the Caliente-Indian Cove location of the Staging Yard and along some portions of Garden Valley alternative segments 1, 2, 3, and 8, construction would temporarily not meet BLM visual resource management objectives for Class II areas.

Along the Mina rail alignment, DOE determined that construction of Schurz alternative segment 6 crossing of U.S. Highway 95 on the Walker River Paiute Reservation would temporarily not meet BLM objectives for Class III areas.

Overall, DOE anticipates that short-term visual impacts during the construction phase would range from small to large, and long-term impacts during the operations phase would range from small to moderate and would be consistent with applicable BLM visual resource management objectives.

Impacts to aesthetic resources during the construction phase under the Shared-Use Option would generally be the same as those under the Proposed Action without shared use. Construction of additional sidings would create small impacts to the visual setting because of the short duration of construction. Impacts to aesthetic resources during the construction phase under the Shared-Use Option for both the Caliente and Mina rail alignments would be generally the same as those under the Proposed Action without shared use. Construction of additional sidings would create small impacts to the visual setting because of the short duration of construction.

S.3.4.4 AIR QUALITY AND CLIMATE

The air quality and climate region of influence for the Caliente rail alignment encompasses Lincoln, Nye, and Esmeralda Counties. The air quality and climate region of influence for the Mina rail alignment encompasses Lyon, Mineral, Esmeralda, and Nye Counties, a small portion of Churchill County near Hazen, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions within Lyon and Churchill Counties. The Caliente and Mina rail alignments would cross desert and semi-desert areas that generally have abundant hours of cloud-free days, low annual precipitation, and large daily ranges in temperature. All portions of the Caliente and Mina rail alignments would be within areas classified by the U.S. Environmental Protection Agency as in attainment for all National Ambient Air Quality Standards (NAAQS).

DOE examined emissions inventories to determine county-level increases in air pollutant emissions, and performed air quality simulations to determine potential changes in air pollutant concentrations at specific (population-center) receptors. An adverse impact to air quality would occur if it were shown that a proposed action would conflict with or obstruct implementation of a state or regional air quality management plan, or would exceed an NAAQS primary standard or contribute to existing or projected exceedances. DOE determined air pollutant concentrations that could result from railroad construction and operation along the Caliente and Mina rail alignments using the Environmental Protection Agency-recommended model for regulatory applications (AERMOD dispersion modeling system version 07026). To assess potential air quality impacts from railroad construction and operations along the Caliente rail alignment, DOE modeled emissions and resultant concentrations of criteria air pollutants where there are two population centers that would be near the rail line: Caliente in Lincoln County and Goldfield in Esmeralda County, and then compared the modeling results to the National Ambient Air Quality Standards. DOE likewise modeled air quality for the Mina rail alignment near the population centers that would be relatively close to the rail line: Schurz, Hawthorne, and Mina in Mineral County; and Silver Peak and Goldfield in Esmeralda County. DOE also performed modeling for the Caliente rail alignment for construction-related activities at a potential quarry site northwest of Caliente and a potential quarry site in South Reveille Valley; and for the Mina rail alignment at the potential Garfield Hills and Malpais Mesa quarry sites.

The analysis showed that criteria air pollutant concentrations along the Caliente or Mina rail alignments would not exceed the NAAQS during the construction or operation phases, with the following possible exceptions. During the construction phase for the Caliente rail alignment, the 24-hour NAAQS for PM_{10} (particulate matter with an aerodynamic diameter equal to or less than 10 micrometers) could be exceeded during quarry operations in South Reveille Valley. During the construction phase for the Mina rail alignment, the 24-hour NAAQS for both PM_{10} and $PM_{2.5}$ (particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers) could be exceeded near the construction right-of-way at Mina and Schurz during the relatively short (less than 6 months) construction period, at the Staging Yard at Hawthorne, and at the potential Garfield Hills quarry. However, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan issued by the State of Nevada Department of Environmental Protection prior to quarry and Staging Yard development. It is likely that requirements in the plan would reduce fugitive dust emissions, thus reducing the possibility of an NAAQS exceedance.

For the Caliente rail alignment, DOE determined that the highest increase in air pollutant emissions would occur during the construction phase. During the operations phase for the Caliente rail alignment, the highest increase would occur in the vicinity of the railroad operations support facilities. The highest increase in criteria air pollutant emissions would be for nitrogen oxides in Nye County, where construction emissions could be as much as 8,100 metric tons (8,900 tons) per year over the county's 2002 annual nitrogen oxides emissions. However, these emissions would be distributed over the entire length of the rail alignment in the county and no air quality standard would be exceeded.

For the Mina rail alignment, DOE determined that the highest increase in air pollutant emissions would occur during the construction phase. During the operations phase for the Mina rail alignment, the highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities. The highest increase in criteria air pollutant emissions would be for nitrogen oxides in Esmeralda County, where construction emissions could be 3,570 metric tons (3,940 tons) per year higher than the 2002 county-wide nitrogen oxides emissions. However, these emissions would be distributed over the entire length of the rail alignment in the county and no air quality standard would be exceeded.

DOE determined that railroad construction and operations along either the Caliente or Mina rail alignment would not cause conflicts with state or regional air quality management plans.

Under the Shared-Use Options for both the Caliente and Mina rail alignments**,** total emissions would be increased marginally. DOE anticipates that impacts to air quality along the Caliente or Mina rail alignment under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

S.3.4.5 SURFACE-WATER RESOURCES

The region of influence for surface-water resources would be limited in most cases to the nominal width of the construction right-of-way within the Caliente rail alignment or the Mina rail alignment. Railroad construction and operations along either rail alignment would potentially result in both direct and indirect impacts to surface-water resources. Many of these impacts are common impacts that would occur along the entire length of the rail alignments. Direct impacts would result from temporary or permanent grading, dredging, re-routing, or filling of surface-water resources. Indirect impacts would include potential increases in surface flow and non-point source pollution resulting from runoff from areas where surface grades and characteristics would be changed.

DOE anticipates that during the construction phase along the Caliente rail alignment, the Staging Yard and the Interchange Yard along either the Caliente or the Eccles alternative segment would require channelization of natural drainage surface waters to keep water out of railroad operations support facility sites. Changes in drainage patterns could result in changes in erosion and sedimentation rates or locations. However, in all instances where the rail alignment would come close to or cross a surface-water feature, impacts would be substantially minimized by the implementation of engineering design standards and best management practices.

The Caliente alternative segment is adjacent to wetlands and some wetland fill would be unavoidable. DOE proposes to construct the Caliente alternative segment over the abandoned Union Pacific Railroad roadbed, in part to minimize filling wetlands. Of the 0.28 square kilometer (68 acres) of wetlands delineated along the rail alignment, 0.05 square kilometer (12 acres) would be filled to construct the rail line. DOE could modify the final design of the rail line to avoid additional wetlands, such as those adjacent to the old rail roadbed along Meadow Valley Wash, by using a slightly narrower construction footprint; however, this would only slightly reduce the area of wetlands that would be filled.

Approximately 0.09 square kilometer (22 acres) of wetlands could be filled to construct a quarry siding at potential quarry CA-8B along the Caliente alternative segment. Approximately 0.19 square kilometer (47 acres) of wetlands would be filled for construction of the Staging Yard at Indian Cove near Caliente. The original wetland meadow area would be drained and built up above the level of the floodplain. Constructing an active drainage system and a channel around the site to keep the area dry and in a stable condition might be necessary. The proposed channel around the site would be approximately 1,680 meters (5,500 feet) long. These actions would require permits from the U.S. Army Corps of Engineers, and compliance with Section 404 of the Clean Water Act for stormwater runoff control measures.

The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. For a length of approximately 1,400 meters (4,600 feet) along the bed of this ephemeral creek (for construction of the interchange tracks) the fill would extend approximately 7.6 to 15 meters (25 to 50 feet) into the creek bed. For a length of approximately 900 meters (2,900 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks, (for construction of the interchange siding), the fill would extend approximately 8 meters (25 feet) into the creek. The total area that would be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres).

Along the Mina rail alignment, there could be temporary impacts from disturbance of about 2,000 square meters (0.55 acre) of wetlands along Schurz alternative segments 1 and 4, and 3,000 square meters (0.73 acre) of wetlands along Schurz alternative segments 5 and 6 during construction of a bridge at the rail line crossing of the Walker River. Permanent fill or loss of wetlands would total about 20 square meters (0.005 acre) for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

While some changes would be unavoidable, DOE would take steps to ensure that the alterations to natural drainage, sedimentation, and erosion processes would not increase future flood damage, increase the impact of floods on human health and safety, or cause identifiable harm to the function and values of floodplains. The Department would implement best management practices, including erosion control measures such as the use of silt fences and flow-control devices to reduce flow velocities and minimize erosion.

S.3.4.6 GROUNDWATER RESOURCES

The generally arid climate characterizing the southern Nevada region is consistent with a lack of shallow groundwater underlying much of the length of the Caliente and Mina rail alignments. The region of influence for groundwater resources includes portions of the aquifers that would be affected by groundwater withdrawals that DOE would make to obtain the water needed for railroad construction and operations. Groundwater resource features evaluated through impacts analysis include existing wells and nearby springs. Within the Caliente rail alignment region of influence, groundwater withdrawals for irrigation and agricultural purposes currently represent most of the groundwater usage. Within the Mina rail alignment region of influence, public supply-municipal, stock watering, and mining uses currently represent most of the groundwater usage.

To supply the approximately 7.5 billion cubic meters (6,100 acre feet) of water needed during the construction phase along the Caliente rail alignment, DOE estimates that it would need to install approximately 150 to 176 new wells. To supply the approximately 7.4 billion cubic meters (5,950 acre feet) of water needed during the construction phase along the Mina rail alignment, DOE estimates that it would need to install between approximately 77 and 110 new wells.

DOE analyses indicated that the effects of groundwater withdrawals from the proposed water-supply wells at the range of production rates that could be required to support a 4-year construction phase along either rail alignment would be localized in nature and extent, and hydrogeologic effects would be temporary. DOE determined that the short-term impacts caused by water withdrawals would be a series of localized drawdown cones of depression within the host aquifer surrounding each pumped well. DOE does not anticipate that proposed groundwater withdrawals would conflict with known regional or local aquifer management plans or the goals of governmental water authorities, and impacts from groundwater withdrawals on downgradient groundwater basins (or hydrographic areas) would tend to be very small.

DOE anticipates that the impact to groundwater resources from contaminants that might be released by construction equipment during the construction phase or during railroad operations would be small because of generally deep groundwater beneath most of the Caliente and Mina rail alignments.

Railroad operations along the Mina and Caliente rail alignments would result in small potential impacts to groundwater resources. The Department would discontinue operating most of the wells needed during the construction phase because there would not be a continued need for large-scale water production to support railroad operations. Additionally, groundwater withdrawal rates for those wells left in place to support operations would be expected to be very low.

Overall, water demands for railroad construction and operations along the Caliente or the Mina rail alignment would represent a small portion of current water-use amounts in their respective regions of influence, which would likely continue to be dominated by irrigation and agricultural withdrawals, with possibly increasing urban use from water transfers to the Las Vegas area. DOE determined that impacts to ground subsidence or groundwater quality that could result from railroad construction and operations along either rail alignment would be small.

Under the Shared-Use Option for either rail alignment, commercial-only facilities would require water for daily operation. The additional impacts to groundwater resources would be small, and overall would be similar to those described for the Proposed Action without shared use.

S.3.4.7 BIOLOGICAL RESOURCES

DOE considered two areas of assessment in analyzing the affected environment for biological resources: a region of influence consisting of the nominal width of the construction right-of-way and a larger study area consisting of a 16-kilometer (10-mile)-wide area extending 8 kilometers (5 miles) on either side of the centerline of the rail alignment to ensure the identification of sensitive habitat areas and transient or migratory wildlife. The Caliente and Mina rail alignments are situated within the "cold" Great Basin Desert that covers most of central and northern Nevada and the "hot" Mojave Desert that covers most of southern Nevada and much of southeastern California. Although the two deserts are distinguished climatically, they are also distinguished by their predominant vegetation and vegetation communities.

For both the Caliente rail alignment and the Mina rail alignment, DOE determined that there would be some indirect adverse impacts due to the potential for the introduction and spread of noxious and invasive weed species during construction activities; however, the Department would minimize or avoid impacts through implementation of best management practices and BLM-prescribed methods. DOE concluded that there would be a small mostly short-term indirect impact to game species during railroad construction and operations along either rail alignment, due to temporary displacement causing pressure on other areas for habitat and forage. There could be small direct impacts due to a small loss of forage from the removal of vegetation to construct the proposed railroad. In addition, railroad operations could result in possible wildlife collisions with trains and disturbance from noise caused by passing trains. However, these impacts would not impact the viability of any game species' population.

DOE determined that federally listed species potentially present along the Caliente and Mina rail alignments could include the Mojave Desert tortoise, southwestern willow flycatcher, yellow-billed cuckoo, Lahontan cutthroat trout, and Ute ladies'-tresses orchid. There would likely be small short-term indirect impacts to some BLM and State of Nevada special status animal species because they might avoid the area of the rail alignment or be displaced during construction activities. Any potential direct impact would be due to habitat fragmentation and disturbance and possible injury or loss of individuals of a species from collision with trains. There could be indirect impacts on small mammals as a result of possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds. DOE determined that potential impacts from noise disturbance to migratory birds would be small and short term during construction and small from permanent habitat loss during the operations phase. Potential direct impacts to desert tortoise would be due to fragmentation of habitat and the possible crushing of occupied burrows during construction of common segment 6 and the Rail Equipment Maintenance Yard. Although these losses would be a minor decrease in the number if individual tortoises in the vicinity of the railroad, long-term survival of this species would not be affected. For both the Caliente rail alignment and Mina rail alignment, DOE determined that impacts to herd management areas and potential impacts to individual wild horses or burros would be small and would not significantly affect the management strategies utilized within the herd management areas.

DOE anticipates that for the Caliente rail alignment there would be short-term and long-term impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove and Upland), and the Eccles alternative segment. Impacts from constructing the Caliente alternative segment would be mostly short term and small, because the rail line would be constructed over an abandoned rail roadbed and limited to existing bridge crossings that would require modifications. The Eccles alternative segment would result in a small short-term impact to riparian habitat and limited to bridge construction over Meadow Valley Wash. Construction of the Indian Cove Staging Yard could result in a moderate impact compared to the Upland option due to topographic constraints that could require possible draining and filling of the wetland. The proposed Eccles Interchange Yard could result in mostly small direct short-term impacts due to a small loss of riparian vegetation, and small short-term indirect impacts with the potential for change in stream flow and increase in sedimentation. DOE determined there would be a moderate impact to wildlife habitat along Garden Valley alternative segments 1 and 3. Localized and minor loss of roosting and foraging habitat for the southwestern willow flycatcher and western yellow-billed cuckoo could occur from construction of the Caliente alternative segment; however, because these species do not nest along the alignment, impacts would be small and limited to transient individuals.

DOE determined that for the Mina rail alignment there would be direct short-term impacts to riparian vegetation from construction of Schurz alternative segment 1, 4, 5, or 6 due to bridge construction over the Walker River. There would be no long-term impacts on riparian vegetation along the Walker River as a result of constructing any of the Schurz alternative segments. There would be short-term moderate impacts to wildlife habitat at the potential Malpais Mesa quarry site. Construction of the Walker River Bridge for Schurz alternative segment 1, 4, 5, or 6 could result in a moderate short-term indirect impact on Lahontan cutthroat trout; however, DOE could mitigate any anticipated impact.

Under the Shared-Use Option, there would be more train traffic; therefore, DOE anticipates wildlife interactions with train traffic (collisions, change in movement patterns, altered behavior, and nest abandonment) to be slightly increased. Nevertheless, DOE anticipates that this slight increase in train traffic would result in small impacts to the wildlife communities. The existing rail alignment design can accommodate shared use with little additional construction (a few sidings) and the Department does not anticipate any other additional impacts above those discussed.

S.3.4.8 NOISE AND VIBRATION

DOE analyzed potential impacts from noise based on current ambient noise levels, noise modeling for future activities (proposed railroad construction and operations), and identification of changes in noise levels at receptors within the regions of influence. The region of influence for noise and vibration for construction and operations of the railroad along either the Caliente or the Mina rail alignment includes the construction right-of-way and extends out to variable distances along each rail alignment (depending on several factors, including the number of trains per day, ambient noise level, train speed, and number of rail cars).

For operation of trains during the construction and operations phases, DOE analyzed noise impacts under established STB impact criteria (a noise level of 65 DNL or greater, with a 3 dBA or greater increase from the baseline). For noise impacts from construction activities, DOE used U.S. Department of Transportation, Federal Transit Administration, methods and construction noise guidelines. To evaluate potential vibration impacts from construction and operation activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria.

DOE determined that railroad construction and operations along the Caliente rail alignment would lead to an unavoidable increase in ambient noise from construction activities and passing trains. Noise from trains might be noticeable as new noise in residential areas near the rail line in Caliente and Goldfield. Because there is already a substantial amount of train activity in Caliente, additional train noise would be less noticeable than in other areas where there is currently no train activity and no train noise. For construction activities, noise levels in Caliente would be higher than Federal Transit Administration construction noise guidelines and would result in a temporary unavoidable impact. Train noise during the construction and operations phases would not cause adverse noise impacts because noise levels at receptors would be lower than STB adverse impact criteria.

DOE determined that railroad construction and operations along the Mina rail alignment could lead to an unavoidable increase in ambient noise from passing trains in areas of Nevada that are mostly uninhabited. Noise from trains might be noticeable as new noise in residential areas near the rail line in Silver Springs, Silver Peak, Mina, and Goldfield. Because there is already some train activity in Silver Springs, additional train noise would be less noticeable there than in other areas where there is currently no train activity and no train noise. Construction of any of the Schurz alternative segments would eliminate future noise and vibration associated with operation of the existing Department of Defense Branchline through Schurz. However, there would be construction noise associated with removal of this existing rail line, although this noise would be temporary and no adverse impact would be expected.

For construction activities, noise levels along the Mina rail alignment would be lower than Federal Transit Administration construction noise guidelines. For train noise during the construction phase, there would be temporary adverse impacts at receptors in Silver Springs. For train noise during the operations phase, estimated noise levels at 8 receptors in Silver Springs and 1 in Wabuska would be higher than impact criteria; therefore, there would be adverse impacts from noise associated with railroad operations at those locations. However, DOE would investigate mitigation methods for these nine locations. Mitigation methods, where reasonable and feasible, could include building sound insulation or the development of a Quiet Zone, which would allow the rail operator to reduce horn noise at specific crossings.

During the construction and operations phases along either the Caliente or Mina rail alignment, vibration levels would not exceed the Federal Transit Administration damage criteria for extremely fragile historic buildings. Therefore, DOE would expect no building damage due to vibration. In addition, train-generated vibration levels would be lower than Federal Transit Administration human annoyance criterion.

Under the Shared-Use Option for either rail alignment, increased rail traffic could result in noise impacts similar to the impacts described for the Caliente and Mina rail alignments without shared-use. Increased operations would not affect vibration impacts because vibration is evaluated on a maximum-level basis only.

S.3.4.9 SOCIOECONOMICS

DOE assessed impacts to socioeconomic conditions of in relation to population, housing, employment and income, and public services over the region of influence for the Caliente rail alignment within Lincoln, Esmeralda, Nye, and Clark Counties, and over the region of influence for the Mina rail alignment within Churchill, Lyon, Mineral, Nye, Esmeralda, and Clark Counties, the combined area of Washoe County and Carson City, and the Walker River Paiute Reservation.

The social and economic activities and changes associated with railroad construction along either rail alignment would include a brief elevation in project-related employment; increases in real disposable income; increases in state and local spending; increases in gross regional product; population increases; slower rate of growth in the level of employment as railroad project activities moved from construction to operations; and possible small stresses on transportation, including small traffic-delay impacts on road traffic at grade crossings. The percentage values of such changes would be low and DOE has assessed such impacts to be generally small.

Changes associated with railroad operations along either rail alignment would include increases in project-related employment (particularly associated with railroad facilities); slight population increases; possible small stresses on transportation, including small traffic-delay impacts on road traffic at grade crossings; some pressure on housing; and possible strains on public services (schools, health care, fire-protection) in southern Nye County where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, and possibly the Nevada Railroad Control Center and the National Transportation Operations Center would be located. The percentage values of such changes would be low and DOE has assessed such impacts to be generally small to moderate.

Under the Shared-Use Option for either rail alignment, there would be little increase in impacts beyond those described for the Proposed Action without shared use. Based on the lengths of track involved under the Shared-Use Option, the incremental impacts to traffic from constructing the additional sidings would be a small fraction of the overall impacts for rail line construction under the Proposed Action without shared use. Thus, impacts to the transportation infrastructure under the Shared-Use Option would be small. Traffic-delay impacts at highway-rail grade crossings from construction trains would be consistent with the delay impacts under the Proposed Action without shared use. These impacts would be small.

S.3.4.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

S.3.4.10.1 Nonradiological Occupational Health and Safety Impacts

DOE estimated nonradiological occupational health and safety impacts in relation to worker exposures to physical hazards and nonradioactive hazardous chemicals during the construction phase. DOE based these estimates on the number of hours worked and occupational incident rates for total recordable cases, lost workday cases, and fatalities.

Construction and operations workers might be exposed to physical hazards and to nonradiological hazardous chemicals related to operation and maintenance of construction equipment, rail line equipment, and facilities equipment, including maintenance of casks and maintenance-of-way activities, including welding, metal degreasing, painting, and related activities. Occupational health and safety impacts might also result from worker exposure to fuels, lubricants, and other materials used in railroad construction, operations, and maintenance.

The recorded incident rates of these exposure hazards during construction work at the Yucca Mountain Site have been small and are anticipated to be small for railroad construction and operations. Dust and soils hazards include potential occupational exposure to hazardous inhalable dust. However, occupational impacts associated with exposure to dust would be expected to be small. DOE would implement measures, such as processing and engineering controls, to reduce exposure to dust. Impacts to construction or operations workers from unexploded ordnance would be small due to implementation of inspection procedures and mitigation measures. Workers might also be exposed to biological hazards including infectious diseases (such as Hantavirus and West Nile Virus) and other biological hazards (such as venomous animals). The recorded incidence rates of these biological hazards are small, and DOE would expect small impacts to construction or operations workers from these biological hazards.

DOE used both qualitative and quantitative components to estimate transportation accident incidents and potential fatalities resulting from vehicular and train accidents.

DOE estimated the following:

- During the construction phase, along both the Caliente rail alignment and the Mina rail alignment, there would be six vehicular-related fatalities.
- During the operations phase along the Caliente rail alignment, there would be eight vehicular-related fatalities; along the Mina rail alignment, there would be seven vehicular-related fatalities.
- During railroad construction and operations along the Caliente rail alignment and the Mina rail alignment, modeling indicates that there would be 16 rail-related accidents and approximately one rail-related fatality.

For the Shared-Use Option, DOE estimated the following:

- During the operations phase along the Caliente rail alignment, there would be eight vehicular-related fatalities; along the Mina rail alignment, there would be seven vehicular-related fatalities.
- During the operations phase along the Caliente rail alignment, there would be 26 rail-related accidents and 4 rail-related fatalities; along the Mina rail alignment, there would be 36 rail-related accidents and 7 rail-related fatalities.
- Nonradiological fatality impacts to workers from industrial hazards from railroad and facility construction and operations along the Caliente rail alignment would be approximately three, and for the Mina rail alignment would be approximately two.

S.3.4.10.2 Radiological Occupational Health and Safety Impacts

Accidents - DOE estimated radiological impacts to workers and the public for incident-free transportation, the risk of transportation accidents, and the impacts of severe transportation accidents. The region of influence for radiological impacts to members of the public during incident-free transportation includes the area 0.8 kilometer (0.5 mile) on either side of the centerline of the rail alignments. The region of influence for occupational radiological impacts during incident-free operation includes the physical boundaries of railroad operations support facilities. For radiological accidents and sabotage, the populations within the region of influence are based on the population within 80 kilometers (50 miles) on either side of the centerlines of the rail alignments.

DOE estimated the following:

- For workers, the radiological impacts were estimated to be 0.34 latent cancer fatalities for the Caliente rail alignment and 0.35 latent cancer fatalities for the Mina rail alignment.
- For workers at the Cask Maintenance Facility, the radiological impacts were estimated to be 0.43 latent cancer fatalities. For workers at the Rail Equipment Maintenance Yard, the radiological impacts were estimated to be 0.0096 latent cancer fatalities.
- For members of the public, the radiological impacts were estimated to be 1.4×10^{-4} latent cancer fatalities for the Caliente rail corridor and 8.5×10^{-4} latent cancer fatalities for the Mina rail alignment.
- For members of the public, the radiological impacts from the Cask Maintenance Facility were estimated to be 7.0×10^{-6} latent cancer fatalities.
- The risk from transportation accidents was estimated to be 1.3×10^{-6} latent cancer fatalities for the Caliente rail alignment and 7.7×10^{-6} latent cancer fatalities for the Mina rail alignment.
- The impacts of the maximum reasonably foreseeable accident were estimated to be 0.0012 latent cancer fatalities in rural areas and 0.46 latent cancer fatalities in suburban areas along the Caliente rail alignment, and 0.0089 latent cancer fatalities in rural areas and 1.2 latent cancer fatalities in suburban areas along the Mina rail alignment. The frequency of this severe accident ranged from 6×10^{-7} to 7×10^{-7} per year.

Sabotage - In response to the terrorist attacks of September 11, 2001, and to intelligence information that has been obtained since then, the United States Government has initiated nationwide measures to reduce the threat of sabotage. These measures include security enhancements intended to prevent terrorists from gaining control of commercial aircraft and additional measures imposed on foreign passenger carriers and domestic and foreign cargo carriers, as well as charter aircraft.

The Federal Government has also greatly improved the sharing of intelligence information and the coordination of response actions among federal, state, and local agencies. DOE has been an active participant in these efforts. In addition to its domestic efforts, DOE is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the impacts of sabotage events and exploring opportunities to enhance the physical protection of casks.

The Department, as required by the NWPA, would use Nuclear Regulatory Commission-certified shipping casks. Spent nuclear fuel is protected by the robust metal structure of the shipping cask, and by cladding that surrounds the fuel pellets in each fuel rod of an assembly. Further, the fuel is in a solid form, which would tend to reduce dispersion of radioactive particulates beyond the immediate vicinity of the cask, even if a sabotage event were to result in a breach of the multiple layers of protection.

In addition, the Nuclear Regulatory Commission has promulgated rules (10 CFR 73.37) and interim compensatory measures (67 *FR* 63167, October 10, 2002) specifically to protect the public from harm that could result from sabotage of spent nuclear fuel casks. The Department has committed to following these rules and measures (see 69 *FR* 18557, April 8, 2004).

For the reasons stated above, DOE believes that under general credible threat conditions the probability of a sabotage event that would result in a major radiological release would be low. Nevertheless, because of the uncertainty inherent in the assessment of the likelihood of a sabotage event, DOE has evaluated events in which a military jet or commercial airliner would crash into a spent nuclear fuel cask or a modern weapon (a high energy density device) would penetrate a spent nuclear fuel cask.

In the Yucca Mountain FEIS (Appendix J, Section J.3.3.1), DOE evaluated the ability of large aircraft parts to penetrate shipping casks and found that that neither the engines nor shafts would penetrate a cask and cause a release of radiological materials if an aircraft were to crash into a spent nuclear fuel cask. In the Yucca Mountain FEIS, DOE estimated the potential impacts of a sabotage event in which a high energy density device penetrates a rail cask. For the Rail Alignment EIS, DOE obtained more recent estimates of the fraction of spent nuclear fuel materials that would be released (release fractions) (DIRS 104918-Luna et al. 1999, all). Based on the more recent information DOE estimated that there would be 0.0028 latent cancer fatalities in rural areas and 1.1 latent cancer fatalities in suburban areas along the Caliente rail alignment, and 0.021 latent cancer fatalities in rural areas and 2.8 latent cancer fatalities in suburban areas along the Mina rail alignment.

In addition to analyzing the impacts of sabotage events, the Department would continue to modify its approach to ensuring safe and secure shipments of spent nuclear fuel and high-level radioactive waste between now and the time of shipments.

DOE also used both qualitative and quantitative components to estimate transportation accident incidents and potential fatalities resulting from vehicular and train accidents.

S.3.4.11 UTILITIES, ENERGY, AND MATERIALS

The Caliente rail alignment region of influence for public water systems and wastewater transported offsite for treatment and disposal is Lincoln, Nye, and Esmeralda Counties. The Mina rail alignment region of influence for public water systems and wastewater transported offsite for treatment and disposal is Lyon, Mineral, Esmeralda, and Nye Counties, and the Walker River Paiute Reservation, the bulk of which lies in Mineral County, with smaller portions in Churchill and Lyon Counties. The region of influence for telecommunications and electricity is limited to the companies that service the aforementioned counties. The region of influence for fossil fuels is limited to regional suppliers within the State of Nevada. The region of influence for construction materials is defined by the distribution networks and suppliers of that material to the general project area.

DOE determined that the demands placed on utilities, energy, and materials from constructing and operating the proposed rail line along either rail alignment would be met by existing supply capacities; therefore, potential impacts would be small. Utility interfaces would have the potential for short-term interruption of service, but would experience no permanent or long-term loss of service or prevention of future service-area expansions. Most water for construction along either rail alignment is planned to be supplied by new wells, although public water systems could be slightly affected by population increases attributable to construction employees. Wastewater treatment systems would not be directly affected directly by construction activities, because dedicated treatment systems would be provided at construction camps; however, there could be small impacts to wastewater treatment systems due to population increases attributable to construction employees. There would be very small impacts to telecommunications systems because during the construction phase, DOE would utilize a dedicated telecommunications system and rely little on existing telecommunications systems.

Peak electricity demand would be within capacity of regional providers. The demand for fossil fuels during construction would be approximately 6.5 percent and 6 percent of statewide use for the Caliente and Mina rail alignments, respectively, and could be met by existing regional supply systems and suppliers. During the operations phase, the demand for fossil fuels for either rail alignment would be less than 0.25 percent of statewide use. The primary materials that would be consumed during the construction phase would be steel; concrete, principally for rail ties, bridges, and drainage structures; and rock for ballast and subballast. DOE determined that construction material requirements for the Caliente rail alignment and for the Mina rail alignment would be a small fraction of current production rates within the respective regions of influence.

Under the Shared-Use Option for either rail alignment, the incremental demands on utilities, energy, and materials for construction of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option along either rail alignment would be small.

Fossil-fuel requirements for transporting general freight under the Shared-Use Option would depend on the volume and distance of shared-use traffic. DOE estimated that the incremental annual diesel consumption for commercial shared-use traffic would be 5.5 million liters (1.5 million gallons), a rate that is less than 0.3 percent of current annual diesel fuel usage in Nevada. Most, if not all, of this fuel consumption would be offset by diesel fuel that would otherwise be used if the goods or materials were shipped by truck. Therefore, the impact to the capacities of national and regional fuel producers and distributors under the Shared-Use Option would be small.

S.3.4.12 HAZARDOUS MATERIALS AND WASTES

For both the Caliente and Mina rail alignments, the region of influence for the use of hazardous materials and the generation of hazardous and nonhazardous wastes includes the nominal width of the rail line construction right-of-way, and the locations of railroad construction and operations support facilities; for the disposal of hazardous wastes, it includes the entire continental United States (commercial hazardous waste disposal vendors could utilize facilities throughout the country); and for the disposal of low-level radioactive wastes, it includes DOE low-level waste disposal sites, sites in Agreement States, and U.S. Nuclear Regulatory Commission-licensed sites. The region of influence for the disposal of nonhazardous waste for the Caliente rail alignment includes the disposal facilities in Lincoln, Nye, Esmeralda, and Clark Counties; and for the Mina rail alignment includes the disposal facilities in Mineral, Nye, Esmeralda, and Clark Counties.

During railroad construction and operations, DOE would store and use hazardous materials such as oil, gasoline, diesel fuel, and solvents, primarily for the operation, maintenance, and cleaning of equipment and cleaning of equipment and facilities, which would result in the generation of associated hazardous wastes. During the railroad construction and operations phases, the Department would implement an Environmental Management System and a Pollution Prevention/Waste Minimization Program, which would include an evaluation of methods to eliminate, reduce, or minimize the amounts of hazardous materials used and hazardous wastes generated. Ample disposal capacity is available for the disposal of hazardous waste during the construction and operations phase. DOE would implement appropriate planning measures for the storage and handling of hazardous materials and comply with applicable regulations.

The Department would dispose of nonrecyclable or nonreusable waste in permitted landfills. During construction, it is likely that, if utilized, some of the larger landfills would not see an appreciable change in the amount of waste received if they were utilized; however, some of the smaller landfills, if utilized, might see a substantial, although manageable, change in daily receipt of solid, and industrial, and special wastes.

DOE estimates that railroad construction along the Caliente rail alignment would increase the overall rate of disposal of solid waste by less than 0.01 percent and industrial and special waste in the region of influence by about 0.261 percent. DOE anticipates that impacts to local landfills from the disposal of solid and industrial and special these wastes would be small (for the relatively large Apex Landfill) to moderate (for the smaller landfills such as Goldfield Class I).

DOE estimates that railroad construction along the Mina rail alignment could generate three times the amount of industrial and special waste as would railroad construction along the Caliente rail alignment.

This is because of wastes from dismantling the Department of Defense Branchline through the town of Schurz. However, to the extent practicable, these wastes would be recycled to minimize waste volumes. DOE estimates that railroad construction along the Mina rail alignment would increase the overall rate of disposal of solid waste by 0.077 percent and, industrial and special waste in the region of influence by about 0.41 percent and 9 percent. DOE anticipates that impacts to local landfills from the disposal of these solid, industrial, and special wastes would be small (for the relatively large Apex Landfill) to moderate (for the smaller landfills such as Goldfield Class I).

During railroad operations along either the Caliente or Mina rail alignment, the generation of wastes would be substantially less than during the construction phase. DOE anticipates that railroad operations along either alignment would produce similar amounts of wastes. Therefore, impacts to landfills during operations would be small, because ample disposal capacity would be available for either rail alignment.

Activities at the Cask Maintenance Facility would generate from 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) of Class A low-level radioactive waste throughout the railroad operations phase. DOE would control and dispose of site-generated low-level radioactive waste in a DOE low-level waste disposal site, a site in an Agreement State, or in a U.S. Nuclear Regulatory Commission-licensed site, all of which currently have ample capacity to accept these wastes. Therefore, impacts to low-level radioactive waste disposal facilities would be small. No low-level radioactive waste is anticipated to be generated during construction activities; therefore, no impacts to disposal facilities would occur.

Under the Shared-Use Option for either rail alignment, waste characteristics, generation rates, and disposal requirements would increase only slightly; therefore, any additional adverse impacts associated with the Shared-Use Option would be small.

S.3.4.13 CULTURAL RESOURCES

The region of influence for cultural resources (historic and prehistoric sites) includes the construction right-of-way (the area of potential direct and indirect impacts) and a 3.2-kilometer (2-mile)-wide area centered on the rail alignment (the area of potential indirect impacts).

Because of the length of the proposed rail line along the Caliente and Mina rail alignments, DOE is using a phased cultural resource identification and evaluation approach, described in 36 CFR 800.4(b)2, to identify specific cultural resources. Under this approach, DOE would defer final intensive field surveys (known as a Class III inventory) of the actual construction right-of-way, as provided in the Programmatic Agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office. The Programmatic Agreement states that an appropriate level of field investigation—including on-the-ground intensive surveys; evaluations of all recorded resources listed on the *National Register of Historic Places*; assessments of adverse effects; and applicable mitigation of identified impacts—be completed before any ground-disturbing construction activities that could impact a specific resource could begin.

Railroad construction and operations could lead to unavoidable changes in cultural landscapes, such as changes to ethnographic, rural historic, and historic viewscapes. Cultural landscapes along the Caliente rail alignment include historic-period Western Shoshone villages and surrounding use areas in the Oasis Valley, the Goldfield area, and Stone Cabin and Reveille Valleys; early ranching operations in the Stone Cabin and Reveille Valleys; the historic Mormon settlement of Meadow Valley Wash, and the Goldfield, Clifford, and Reveille Mining Districts. Cultural landscapes along the Mina rail alignment include historic-period Northern Paiute use of the Walker River and Walker Lake areas, historic-period Western Shoshone villages and surrounding use areas in the Oasis Valley and Goldfield areas, and historic mining in the Luning, Mina, and Goldfield districts.

DOE completed literature reviews and a Class II inventory (sample field surveys within the construction right-of-way) for 20 percent of each alternative segment and common segment along the Caliente and Mina rail alignments, and has thereby identified some potential areas of specific impacts. Additionally, DOE conducted an intensive Class III inventory along a 12-kilometer (7.4-mile) corridor within the Yucca Mountain Site boundary, which resulted in the identification of seven sites and five isolates (isolated artifacts).

Based on preliminary information and the sample surveys conducted to date, the magnitude of impacts along both the Caliente and Mina rail alignments would range from small to moderate due to the extensive effort DOE would undertake to avoid or mitigate impacts to cultural resources in accordance with the regulatory framework and with the terms of the Programmatic Agreement.

Impacts to cultural resources under the Shared-Use Option for either the Caliente or Mina rail alignment would be approximately the same as those under the Proposed Action without shared use. However, construction of any additional commercial-use sidings would have the potential to impact cultural resources.

S.3.4.14 PALEONTOLOGICAL RESOURCES

Paleontology is a science that uses fossil remains to study life in past geological periods. Paleontological resources are recognized as a fragile and nonrenewable record of the history of life on earth and a critical component of America's natural heritage, and once damaged, destroyed, or improperly collected, their scientific and educational value may be greatly reduced or lost forever. The region of influence for paleontological resources along both rail alignments is the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities.

DOE used the BLM system to classify paleontological resource areas according to their potential for containing vertebrate fossils, or noteworthy occurrences of invertebrate or plant fossils. This classification system became the basis to analyze the magnitude of potential impacts from construction in the region of influence of the Caliente and Mina rail alignments.

DOE determined that there are no known paleontological resources along any of the Caliente or Mina rail alignments or at the proposed locations of railroad construction and operations support facilities. Therefore, the Department would not anticipate any impacts to paleontological resources during the construction or operations phase along either rail alignment. However, if DOE uncovered previously unknown paleontological resources during construction activities, the Department would consult with the BLM to develop appropriate conservation measures.

Under the Shared-Use Option for either rail alignment impacts to paleontological resources would be similar to the Proposed Action without shared-use.

S.3.4.15 ENVIRONMENTAL JUSTICE

The region of influence for environmental justice encompasses the regions of influence for all other resource areas because impacts in other resource areas could result in environmental justice impacts.

DOE performed the analysis of potential environmental justice impacts in accordance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*, and Council on Environmental Quality guidance. According to the Council on Environmental Quality, a minority population exists where either (a) the minority population of the affected area exceeds 50 percent; this calculation includes federally recognized American Indian lands, because American Indians are included in the definition of minority populations; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In addition to the 50-percent threshold, DOE used both the United States and the State of Nevada minority populations as bases for comparison.

The Council on Environmental Quality defines low-income by using the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is meaningfully greater than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE used both the United States and the State of Nevada low-income populations as the bases for comparison. DOE assumed a 20-percent threshold above state low-income percentages in accordance with U.S. Nuclear Regulatory Commission guidance.

DOE determined whether there would be minority or low-income populations in the Caliente or Mina rail alignment regions of influence for environmental justice, and assessed whether any high and adverse impacts could fall disproportionately on minority or low-income populations. DOE also considered whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources.

For the Caliente rail alignment, the Department determined that railroad construction and operations would not result in disproportionately high and adverse impacts to minority or low-income populations. For the Mina rail alignment, DOE determined that the Schurz population center and the Walker River Census County Division are the only locations where the minority populations exceed the threshold of 50 percent, and the Walker River Census County Division to be the only location where the low-income population exceeds the threshold of 20 percent over the state average of 10.5 percent established by the Nuclear Regulatory Commission and the Council on Environmental Quality. Because there are no large and adverse impacts in these areas, it cannot be concluded that low-income and minority populations in these areas would be disproportionately affected. Constructing and operating the proposed railroad along the Mina rail alignment would not result in high and adverse impacts to minority or low-income populations.

Similarly, the Department determined that under the Shared-Use Option for either rail alignment, there would be not high and adverse impacts to minority or low-income populations.

S.3.5 American Indian Interests

Based on information provided by the Consolidated Group of Tribes and Organizations, American Indians are concerned that substantial and high adverse effects to a number of American Indian interests could be caused within and adjacent to the Caliente rail alignment region of influence, which also encompasses the southern segments of the Mina rail alignment. The Consolidated Group of Tribes and Organizations is a forum consisting of officially appointed tribal representatives, from 17 tribes and organizations, who are responsible for presenting their respective tribal concerns and perspectives to DOE. At the time of discussions with the Consolidated Group of Tribes and Organizations, the Mina rail alignment was not under consideration as an implementing alternative and the views of the Northern Paiute peoples who traditionally occupied lands north of Goldfield and Tonopah are not represented by this group. As part of any Proposed Action, the Department would continue to consult with American Indian tribes with regard to their interests and believes.

The proposed Mina rail alignment would pass through and directly affect the Walker River Paiute Reservation. In a letter dated April 29, 2007, the Walker River Paiute Tribal Council officially informed the Department of their withdrawal from the environmental impact statement process. The Tribal Council made the decision to withdraw based on information obtained during the Tribe's involvement with the Rail Alignment EIS process and input from Tribal members. The Tribe determined that the impacts and risks associated with nuclear shipments through the Reservation were too great and they reaffirmed a past objection to the transportation by any means of nuclear or radioactive waste through the Reservation.

American Indian views on construction and operation of a railroad along the Caliente rail alignment, as primarily expressed by the Consolidated Group of Tribes and Organizations, state that construction and operation of the proposed railroad would constitute an intrusion on the traditional lands of Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone people; would disturb cultural, biological, botanical, geological, and hydrological resources, including American Indian viewscapes, songscapes, storyscapes, and traditional cultural properties; would restrict the free access of American Indian people to their resources; and could cause substantial and high adverse effects to a number of American Indian interests within and adjacent to the region of influence. Within that forum of beliefs there would be an unavoidable impact to American Indian interests.

S.3.6 Cumulative Impacts

DOE evaluated public- and private-sector past, present, and reasonably foreseeable activities that could, when combined with the Proposed Action or Shared-Use Option, result in cumulative impacts. The DOE analysis of potential cumulative effects was primarily qualitative, but the Department quantified information to the extent feasible. The cumulative impacts regions of influence for analysis encompassed the Caliente and Mina rail alignments, and areas with potential direct and indirect effects for each resource area. To assess potential cumulative impacts from other projects, DOE identified major projects within the regions of influence that could have interactions with the proposed railroad in space or time. Those major projects included a wide variety of projects including the proposed Yucca Mountain Repository, the Nevada Test and Training Range, the Nevada Test Site, groundwater development, BLM land management (including rights-of-way), and power-plant construction.

DOE determined that the cumulative impacts within most of the resource areas described in the Rail Alignment EIS would be small in the Caliente and Mina rail alignment regions of influence unless noted otherwise.

In the Caliente and Mina rail alignment regions of influence, land use and management is changing because of increased construction and development, increased urbanization, and increased conversion of undeveloped land to other purposes or to multiple purposes. Federal agencies, primarily the BLM, will continue to be the major land manager throughout the regions of influence. The BLM has a major role in determining land use in the region though administration of federal lands, including development of resource management plans for the region. The incremental change to land use from constructing and operating the proposed railroad along the Caliente or the Mina rail alignment is projected to be small to moderate.

Overall, there is, and will continue to be, a broad contrast of how visual resource impacts are managed in the regions of influence, ranging from very little management for military mission-related activities to a formal visual resource management system on BLM-administered lands. DOE determined that operation of the proposed railroad would be visible in specific locations but would not dominate the viewsheds within the regions of influence. Changes to aesthetic resources in the regions of influence have already been affected by activities such as the Nevada Test and Testing Range, the Nevada Test Site, BLM management activities, and population growth. These changes will continue in future years, but the regions will generally maintain many of the remote and rural characteristics and conditions. The incremental change to aesthetic resources from constructing and operating the proposed railroad along the Caliente or the Mina rail alignment is projected to be small.

Cumulative impacts concerns regarding surface-water resources in the Caliente and Mina rail alignment regions of influence include changes to drainage patterns, infiltration rates, flood control, and spill/contamination potential. Regional impacts would generally be localized to each specific project. Insufficient inflow from the Walker River into Walker Lake would continue to jeopardize Walker Lake's future as a viable fishery, with or without the proposed railroad in the Mina rail alignment region of influence.

The Department anticipates that cumulative impacts to groundwater resources in the Caliente and Mina rail alignments regions of influence would range from small to large, depending on location along each alignment. Overall, the groundwater needs of the Proposed Action would represent a small portion of current cumulative water usage within the Caliente or Mina rail alignment regions of influence. However, in some proposed groundwater well locations for railroad use, cumulative demand would exceed perennial yield values. Water availability will continue to be a major regional cumulative impact issue in the coming years.

The Caliente or Mina rail alignment is projected to result in small to moderate incremental impacts to cumulative biological resources in their regions of influence. A railroad and other reasonably foreseeable and continuing projects in the region of influence would require coordinated mitigation and impact avoidance among project proponents to avoid and reduce cumulative impacts to biological resources. BLM land management activities also play a major role in regional impact avoidance and mitigation.

The Proposed Action would be only one of the many reasonably foreseeable sources of socioeconomic change to portions of the regions of influence, and would be relatively less important to socioeconomic change than external economic development and population growth. The road systems in the regions of influence could experience higher traffic levels, possibly associated congestion, and increased road maintenance, but incremental impacts due to the proposed railroad would be small.

DOE anticipates that impacts to air quality in the Caliente and Mina regions of influence would be small to moderate. DOE found that impacts from construction for either the Caliente or Mina rail alignment would generate emissions of some criteria pollutants that could be higher than applicable air quality standards. While these effects would be localized in specific areas, any potential violation of air quality standards would be of concern in relation to both project-specific and cumulative impacts.

The proposed railroad would result in nonradiological and radiological health and safety impacts for workers and residents along the alignments. For members of the public situated along the Caliente and Mina rail alignments, the radiological impacts during the operations phase would be a very small contribution to the overall radiological impacts of the Yucca Mountain Repository, and incremental impacts of the proposed railroad would be small.

The Yucca Mountain FEIS evaluated the cumulative impacts of two additional inventories of spent nuclear fuel, high-level radioactive waste, and other radioactive wastes (Modules 1 and 2). These additional wastes would be above and beyond the amounts of wastes that have been analyzed for shipment in the Rail Alignment EIS, and their possible shipment could represent a cumulative impact on the resources analyzed in the Rail Alignment EIS. Although emplacement of this additional waste at Yucca Mountain would require legislative action by Congress, such shipment is a reasonably foreseeable action for purposes of NEPA analysis. Because the planned annual shipment rate of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository would be about the same as the Proposed Action in the Rail Alignment EIS, the only cumulative impacts to arise would be due to the annual increase in the number of casks. Impacts from these additional casks would be similar to the generally small impacts summarized above.

It is possible that new economic activity associated with the Shared-Use Option might lead to induced effects, but the locations, scope, and types of these effects are not known at this time.

S.3.7 DOE Preferred Alternative

The Council on Environmental Quality NEPA implementing regulations require an agency to identify its preferred alternative to fulfill its statutory mission, if one or more exists, in a Draft EIS (40 CFR 1502.14[e]). For the Rail Alignment EIS, the DOE preferred alternative would be to construct and operate a railroad along the Caliente rail alignment and to implement the Shared-Used Option. The DOE preferred alignment along the Caliente rail alignment consists of the following: the Caliente alternative segment, common segment 1, Garden Valley alternative segment 1, common segment 2, South Reveille alternative segment 3, common segment 3, Goldfield alternative segment 3, Caliente common segment 4, Bonnie Claire alternative segment 3, common segment 5, Oasis Valley alternative segment 1, and common segment 6. Table S-7 lists the preferred alternative segments and identifies the bases for the Department's preferences. The table does not list common segments 1, 2, 3, 4, 5, and 6, because those are all included in the preferred alignment.

S.3.8 Issues to be Resolved

An issue that remains unresolved is the determination of land access. The BLM would need to authorize DOE access to sufficient lands for railroad construction and operation under a right-of-way grant applied for by DOE. Under the Mina Implementing Alternative, DOE would also need to apply to the Bureau of Indian Affairs to acquire a right-of-way in which to construct segments of the rail line on the Walker River Paiute Reservation. The DOE preferred alternative is to construct and operate a railroad along the Caliente rail alignment and within that alignment DOE has identified preferred alternative segments. However, it remains unresolved whether the BLM would choose to authorize DOE land access to those preferred alternative segments or to other alternative segments, or whether under the nonpreferred alternative the Bureau of Indian Affairs would grant DOE access to land on the Walker River Paiute Reservation.

Under each implementing alternative, DOE has analyzed a Shared-Use Option, under which the Department would allow commercial shippers to use the proposed rail line for shipments of general freight. A Shared-Use Option would be subject to STB approval, and it remains unresolved whether STB would grant such approval.

S.3.9 Areas of Controversy

The Yucca Mountain Project, including the transport of spent nuclear fuel and high-level radioactive waste, has remained a controversial issue since its inception some 20 years ago, and has been strongly opposed by the State of Nevada and a variety of state, local, tribal, and citizen groups. Over the last decade the State of Nevada has filed multiple lawsuits against the Federal Government regarding the Yucca Mountain Project. In 2004, the State of Nevada petitioned the United States Court of Appeals for the District of Columbia Circuit to review the Yucca Mountain FEIS and the portion of the DOE *Record of Decision* governing the transportation of nuclear waste. The State of Nevada alleged that the FEIS was procedurally flawed, violated NEPA, and ignored STB railroad regulations. The State of Nevada also challenged the Record of Decision under the Administrative Procedure Act in determining a "mostly rail" plan to be the preferred means of shipping waste to the site, and argued that DOE exceeded its authority in selecting the Caliente corridor. On August 8, 2006, the Court denied Nevada's petition.

Table S-7. Caliente rail alignment preferred alternative segments.[a]

DOE preferred alternative	Analysis factors
Caliente alternative segment	• The Eccles alternative segment would include an Interchange Yard that requires a large amount of fill in Clover Creek to enable construction of the Staging Yard. The Caliente alternative segment Interchange Yard location would avoid this impact to Clover Creek. • The Caliente alternative segment would have greater impacts to wetlands than the Eccles alternative segment. This would create greater regulatory complexity associated with obtaining a U.S. Army Corps of Engineers permit to fill jurisdictional waters. • The Caliente alternative segment would cross more private land than the Eccles alternative segment. • The Eccles alternative segment would be more complex to construct and would cost approximately twice as much as the Caliente alternative segment. • Based on scoping comments, more stakeholders prefer the Caliente alternative segment. • The Caliente alternative segment Indian Cove Staging Yard location would require filling 47 acres (0.19 square kilometer) of wetlands. The Upland Staging Yard location would avoid the impacts to wetlands associated with the Indian Cove location.[b]
Garden Valley alternative segment 1	• Engineering factors and regulatory complexity do not offer a means to discriminate among the Garden Valley alternative segments. • Garden Valley 1 would disturb less area than Garden Valley 2, 3, or 8.
South Reveille alternative segment 3	• No major environmental discriminator. • South Reveille 3 would avoid complex road and wash crossing that would be required for South Reveille 2.
Goldfield alternative segment 3	• Engineering uncertainty of crossing mining district associated with Goldfield 1. • Goldfield 4 would include two grade-separated crossings of U.S. Highway 95. • Goldfield 4 would have greater cultural resources impacts than Goldfield 1 or Goldfield 3. Goldfield 4 would enter the Goldfield Historic District. • Goldfield 3 would have fewer land-use conflicts than Goldfield 1 or Goldfield 4.
Bonnie Claire alternative segment 3	• No major environmental discriminator. • Bonnie Claire 2 would be close to the boundary of the Nevada Test and Training Range and would be more complex to construct than Bonnie Claire 3.
Oasis Valley alternative segment 1	• No major environmental discriminator. • Oasis Valley 1 would cross one parcel of private property. Oasis Valley 3 would not cross private property. • Oasis Valley 1 would require fewer earthworks for construction than Oasis Valley 3.

a. The DOE preferred rail alignment, Caliente, includes all six common segments.
b. DOE has not identified a preference for the Staging Yard location.

The Consolidated Group of Tribes and Organizations has consistently opposed the siting of the Yucca Mountain repository and transportation of spent nuclear fuel and high-level radioactive waste to such a repository. Construction and operation of the Yucca Mountain repository and proposed railroad are viewed to constitute an intrusion on the holy lands of the Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone people, as well as a disturbance to cultural, biological, botanical, geological, and hydrological resources, and to American Indian viewscapes, songscapes, storyscapes, and traditional cultural properties. DOE accepts these viewpoints as responsible opposing viewpoints. These issues may continue to be viewed as unresolved within the forum of American Indian cultures and beliefs.

Water needs for the Caliente or Mina rail alignments would represent a small portion of current cumulative water usage within the region of influence; however, water usage in some locations would continue to exceed perennial yield values. Water usage and water development projects will continue to be a major concern in the region of influence irrespective of the water demands associated with either rail alignment. Growth in water demand in Nevada has been very rapid: water usage against the backdrop of regional water transfer plans remains an overarching controversial issue.

Possible rail line alternative segments through Garden Valley have been considered controversial in that its use has been viewed as detrimental to the remote desert setting of *City*, a large complex of abstract sculptural and architectural forms made from earth, rock, and concrete extending over 2.5 kilometers (1.5 miles) in Garden Valley.

Some issues related to land use could be viewed as potentially controversial. Although the total amount of private land along either alignment would be small (about 1 percent for Caliente and 0.5 percent for Mina) compared to the total amount of land required for the alignment, there are individual landowners who could be directly affected. No residences would be directly affected. One local business along the Caliente rail alignment, the Caliente Hot Springs Hotel, could be adversely affected because of the rail line's proximity to the hotel.

S.3.10 Major Conclusions

DOE analysis shows that construction and operation of a railroad along the Caliente rail alignment or the Mina rail alignment for shipment of spent nuclear fuel, high-level radioactive waste, and other materials from an existing rail line in Nevada to a repository at Yucca Mountain would result in broadly similar but generally small impacts to natural, human-health, social, economic, and cultural resources. The environmental justice analyses indicate that there would be no disproportionately high and adverse human health or environmental impacts to minority or low-income populations from railroad construction and operations along either the Caliente rail alignment or the Mina rail alignment.

DOE recognizes that the Mina Implementing Alternative would, on balance, be environmentally preferable to the Caliente Implementing Alternative because, in general, the Mina Implementing Alternative would have fewer private-land conflicts, less surface disturbance, smaller impacts to wetlands, and smaller impacts to air quality than the Caliente Implementing Alternative. In addition, DOE has estimated that the total cost to construct the railroad along the Mina rail alignment would be approximately 20 percent less than to construct the railroad along the Caliente rail alignment ($1.7 billion compared to $2.2 billion [2005 dollars]). However, stemming from the Walker River Paiute Tribal Council decision to withdraw from participating in the Nevada Rail Corridor SEIS and the Rail Alignment EIS process, and to renew past objections to the transportation of nuclear waste through Walker River Paiute Reservation, the DOE preferred alternative is to construct and operate a railroad along the Caliente rail alignment.

Under the No-Action Alternative, there would be no impacts to natural, human-health, social, economic, or cultural resources. In the event that DOE were not to select a rail alignment, the future course that it would pursue to meet its obligations under the NWPA would become uncertain.

S.3.11 Comparison of Environmental Impacts

Council on Environmental Quality regulations that implement the procedural requirements of NEPA state that agencies should provide a comparison of the environmental impacts of the Proposed Action and its alternatives to sharply define the issues and provide a clear basis for choice. The comparison in this section is based on the information and analyses presented in subsequent chapters of this Rail Alignment EIS.

Tables S-8 through S-10 highlight the differences in potential impacts under the Proposed Action for the Caliente and Mina Implementing Alternatives and the No-Action Alternative. Table S-8 lists the range of potential impacts under the Proposed Action for the Caliente Implementing Alternative and the Mina Implementing Alternative considering the largest and smallest potential impacts of the different alternative segments. Table S-8 allows a comparison of the Proposed Action to the No-Action Alternative.

Potential impacts under the Shared-Use Option would be generally the same as impacts under the Proposed Action without shared use, unless noted otherwise in the tables. Potential commercial sidings and facilities that could be constructed under the Shared-Use Option would likely be constructed within the operations right-of-way to the extent practicable; therefore, the impacts of their construction are included within those impacts presented for the Proposed Action.

Tables S-9 and S-10 highlight potential impacts under the Proposed Action for the Caliente rail alignment and the Mina rail alignment, respectively. The tables include the alternative segments and common segments that could form each rail alignment. To make the tables more useful to the reader in discriminating between alternative segments, they focus on the major differences in impacts. Therefore, the tables do not include entries for all resource areas. Chapter 4 includes full summaries of potential impacts for each resource area.

These tables illustrate that the Mina Implementing Alternative would be environmentally preferable when compared to the Caliente Implementing Alternative. In general, the Mina Implementing Alternative would have fewer private-land conflicts, less surface disturbance, smaller wetlands impacts, and smaller air quality impacts than the Caliente Implementing Alternative. However, the Mina Implementing Alternative remains the nonpreferred alternative due to the objection of the Walker River Paiute Tribe to the transportation of spent nuclear fuel and high-level radioactive waste through its Reservation.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 1 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Physical setting	Total surface disturbance: 55 to 61 square kilometers (14,000 to 15,000 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 1.3 to 1.8 square kilometers (320 to 440 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.	Total surface disturbance: 40 to 48 square kilometers (9,900 to 12,000 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.011 to 0.014 square kilometer (2.7 to 3.5 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	No surface disturbance or prime farmland soils impacts because the rail line and associated facilities would not be constructed.
Land use and ownership	Land-use change on public lands for operations right-of-way. Private parcels the rail line would cross: 14 to 71. Area of private land affected: 0.33 to 0.72 square kilometer (82 to 178 acres). Private land needed for facilities: 1.15 square kilometers (284 acres) Active grazing allotments the rail line would cross: 24 to 27. Animal unit months lost: 1,019 to 1,050. (An animal unit month represents enough dry forage for one mature cow for one month.) Sections with unpatented mining claims that would be crossed: 32 to 37.	Land-use change on public lands and the Walker River Paiute Reservation for operations right-of-way. Private parcels the rail line would cross: 1 to 40. Area of private land affected: 0.21 to 0.59 square kilometer (52 to 146 acres). Active grazing allotments the rail line would cross: 5 to 8. Animal unit months lost: 159 to 246. Sections with unpatented mining claims that would be crossed: 23 to 30.	DOE would relinquish public lands along the Caliente rail alignment that were withdrawn for study under Public Land Order 7653. DOE would also relinquish the public lands segregated from surface and mineral entry for 2 years along the Caliente and Mina rail alignments.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 2 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Aesthetic resources	Small to moderate impact across Caliente rail alignment from operations. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads.	Same as the Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed. Public land would remain subject to BLM administration under applicable resource management plans. BLM would continue to manage public land for multiple use.
	Small impact from train operations. No contrast to strong contrast in the short term from passing trains.	Same as the Caliente Implementing Alternative.	
	Moderate impact from Staging Yard at Indian Cove. Moderate contrast from the operation of the facility in the Class III non-BLM lands, weak contrast from the track on BLM Class II lands at the north end; in each area, consistent with applicable BLM management objectives.	Small to moderate impact from Schurz alternative segments. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives. (Moderate to strong contrast in the short term from construction of the rail-over-road grade-separated crossing of U.S. Highway 95 for Schurz 6, which would not meet BLM Class III management objectives.)	
	Potential quarry CA-8B - Moderate impact. Moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93. No long-term impact under the Proposed Action; conveyor would be removed at end of construction phase. Moderate impact under the Shared-Use Option from the use of a conveyor across U.S. Highway 93 for 6 to 8 years.	Small to moderate impact from Montezuma alternative segment 1. Weak contrast from new linear feature adjacent to State Route 265 and weak to moderate contrast in Clayton Valley; would meet BLM Class III and IV management objectives.	
		Potential Garfield Hills quarry - Moderate impact. Moderate contrast in the short term from quarrying, ballast production facilities, and conveyor close to viewers that would be compatible with BLM Class III management objectives. Small impact in long term; production facilities and conveyor would be removed and quarried areas restored after closure of quarry at end of construction phase.	

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 3 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Aesthetic resources (continued)		Potential Gabbs Range quarry - Small to moderate impact. Weak to moderate contrast in the short term from ballast production facilities close to viewers that would be compatible with BLM Class III management objectives. Small impact in long term; production facilities would be removed after closure of quarry at end of construction phase. Potential North Clayton quarry - Weak to moderate impact. Moderate contrast in the short term from production facilities close to viewers that would be compatible with BLM Class IV management objectives. Small impact in long term; production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.	
Air quality and climate – Lincoln County	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from the construction or operation of the railroad, the Caliente Interchange Yard, or potential quarry CA-8B. The closest approach to a NAAQS standard would be for 24-hour PM_{10} (38 percent of standard for rail line and potential quarry CA-8B) during the construction phase.	Not applicable. No portion of a rail line along the Mina rail corridor would be constructed in Lincoln County.	No impacts because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 4 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Air quality and climate – Esmeralda County	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from railroad construction and operations. The closest approaches to a NAAQS standard would be for 24-hour PM_{10} (87 percent of standard) and 24-hour $PM_{2.5}$ (74 percent of standard), for rail line construction near Goldfield.	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from the railroad construction and operations or the potential Malpais Mesa quarry, with most values expected to be well below the NAAQS. The closest approach to a NAAQS standard would for 24-hour PM_{10} (63 percent of standard) and 24-hour $PM_{2.5}$ (54 percent of standard) for the rail line construction near Silver Peak.	No impacts because the rail line and associated facilities would not be constructed.
Air quality and climate – Nye County	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from the railroad construction operations, with the possible exception of 24-hour PM_{10}. Modeling at the potential quarry NN-9B site in the South Reveille Valley indicates a potential exceedance (160 percent of standard, temporary and localized) of the 24-hour PM_{10} NAAQS. However, operating restrictions in the required Surface Disturbance Permit would likely reduce PM_{10} emissions, making such an exceedance unlikely.	No exceedances of the NAAQS would be expected from the railroad construction and operations, with most values expected to be far below the NAAQS.	No impacts because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 5 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Air quality and climate – Churchill County	Not applicable. No portion of the rail line along the Caliente rail alignment would be constructed in Churchill County.	No exceedances of the NAAQS would be expected from the railroad operations, with most values expected to be far below the NAAQS. There is no new rail line construction planned within Churchill County; the only construction activity would the operation of trains carrying construction material on the existing rail line.	No impacts because the rail line and associated facilities would not be constructed.
Air quality and climate – Lyon County	Not applicable. No portion of the rail line along the Caliente rail alignment would be constructed in Lyon County.	No exceedances of the NAAQS would be expected from the railroad construction and operations, with most values expected to be far below the NAAQS.	No impacts because the rail line and associated facilities would not be constructed.
Air quality and climate – Mineral County	Not applicable. No portion of the rail line along the Caliente rail alignment would be constructed in Mineral County.	Conservative modeling indicated potential exceedances of the NAAQS for PM_{10} and $PM_{2.5}$ in the following scenarios: • Rail line construction near Mina; 111 percent of the 24-hour PM_{10} NAAQS. • Rail line construction near Schurz, 186 percent of the 24-hour PM_{10} NAAQS. • Rail line construction near Schurz, 124 percent of the 24-hour $PM_{2.5}$ NAAQS. • Rail line construction near Schurz, 103 percent of the annual PM_{10} NAAQS. • Staging Yard construction near Hawthorne, 165 percent of the 24-hour PM_{10} NAAQS. • Staging Yard construction near Hawthorne, 118 percent of the 24-hour $PM_{2.5}$ NAAQS. • Staging Yard construction near Hawthorne, 102 percent of the annual PM_{10} NAAQS. • Operation of the potential Garfield Hills quarry near Hawthorne, 200 percent of the 24-hour PM_{10} NAAQS. However, operating restrictions in the required Surface Disturbance Permit would likely reduce PM_{10} and $PM_{2.5}$ emissions, making such exceedances unlikely. No exeedances for other criteria pollutants would be expected, with most values expected to be well below the NAAQS.	No impacts because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 6 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Air quality and climate – Mineral County (continued)		Modeling of emissions from construction of the Staging Yard at Hawthorne found that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be exceeded in the immediate vicinity of the Staging Yard under some conditions. Modeling of emissions from the operation of the potential quarry at Garfield Hills indicates that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be potentially exceeded. However, the required Surface Disturbance Permit is anticipated to greatly reduce PM_{10} and $PM_{2.5}$ emissions, making an exceedance of the NAAQS unlikely.	
Surface-water resources	Caliente alternative segment: Approximately 0.05 square kilometer (12 acres) of wetlands would be filled. Long-term reduced and potentially eliminated access to Caliente Hot Springs. Eccles alternative segment: Negligible amount of wetlands would be filled. Caliente alternative segment: Indian Cove Staging Yard, approximately 0.19 square kilometer (47 acres) of wetlands would be filled; Upland Staging Yard, no wetlands would be filled. Potential quarry CA-8B: Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding. Eccles alternative segment, Interchange Yard: Approximately 0.033 square kilometer (8.2 acres) of Clover Creek would be filled. Goldfield alternative segment 3: Long-term reduced and potentially eliminated access to Willow Springs.	Schurz alternative segments: Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 to 28 square meters (220 to 300 square feet) would be permanently filled to construct the bridge over the Walker River.	No impacts because the rail line and associated facilities would not be constructed. Erosion and sedimentation would continue under natural processes.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 7 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Groundwater resources	Physical impacts to existing groundwater resource features such as existing wells or springs resulting from railroad construction and operation would be small.	Physical impacts to existing groundwater resource features such as existing wells or springs resulting from railroad construction and operations would be small.	No impacts because the rail line and associated facilities would not be constructed.
	Groundwater withdrawals during construction from hydrographic areas in Panaca Valley, Sarcobatus Flat, and Oasis Valley could impact existing groundwater resources and users through localized and temporary drawdown of the water table. However, mitigation measures such as reducing the pumping rate or relocating proposed wells Pan V25/26, Pan V4, Pan V5, Pan V7/8, Pan V2, Pan V24, SaF1, OV3, OV4, and OV5/13 would minimize these impacts.	Groundwater withdrawals during construction from hydrographic areas in Clayton Valley, Sarcobatus Flat, Oasis Valley, and Columbus Salt Marsh could impact existing groundwater resources and users. However, mitigation measures such as reducing the pumping rate or relocating proposed wells CL-1a, SaF1, OV3, OV4, OV5/13, and CSM-2a would minimize these impacts.	
	The potential for groundwater withdrawals during the construction and operations phases to cause subsidence of the ground surface would be small.	Same as the Caliente Implementing Alternative.	
	The impact of proposed groundwater withdrawals on groundwater quality would be small, and the impact of withdrawals on downgradient hydrographic areas would be very small. The proposed withdrawals would not conflict with water quality standards protecting groundwater resources.	Same as the Caliente Implementing Alternative.	

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 8 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Biological resources	Short-term impact to 0.12 to 0.24 square kilometer (30 to 59 acres) wetland/riparian habitat. Long-term impact to 0.11 to 0.23 square kilometer (27 to 57 acres) wetland/riparian habitat. Short-term moderate impact on riparian and wetland vegetation along Oasis Valley alternative segment 3. Small to moderate impact on raptor nesting sites from the construction of potential quarry NN-9A. Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	Short-term impact to 0.01 to 0.05 square kilometer (2.5 to 12 acres) wetland/riparian habitat. Long-term impact to 0 to 0.01 square kilometer (0 to 2.5 acres) wetland/riparian habitat. Same as the Caliente Implementing Alternative. Small to moderate long-term impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat along Schurz alternative segment 6. Moderate long-term impact to Inter-Mountains Mixed Salt Desert Scrub along Mina common segment 1. Short-term and long-term moderate impacts to western snowy plover along Mina common segment 1. Moderate impact to winterfat communities – Montezuma alternative segments and potential Gabbs Range quarry site. Long-term moderate impacts to Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush at potential North Clayton and Malpais Mesa quarry sites. Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	No impacts because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 9 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Noise and vibration	Noise from construction activities in Caliente would exceed Federal Transit Administration guidelines. Daytime limits would be exceeded by 11 dBA from construction equipment noise and by 7 dBA from pile driving; 30-day DNL limit would be exceeded by 2 dBA from construction equipment noise and by 12 dBA from pile driving. Noise from construction equipment along the Eccles alternative segment would exceed limits by 5 dBA. No adverse noise or vibration impacts from construction trains or from operational train activity.	DOE estimates that 34 receptors would be included within the construction-train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would be considered temporary adverse impacts. Noise from operations would create adverse noise impacts at eight receptors in Silver Springs and one receptor in Wabuska. No vibration impacts from construction trains or from operational train activity.	No change to existing noise and vibration. No impacts because the rail line and associated facilities would not be constructed.
Socioeconomics – Throughout the region of influence	*Construction* Up to 1,083 animal unit months lost, valued at $57,000 (An animal unit month represents enough dry forage for one mature cow for one month.) *Operations* Continued lack of access to up to 1,083 animal unit months, valued at $57,000	*Construction* Up to 326 animal unit months lost, valued at $17,400 *Operations* Continued lack of access to up to 326 animal unit months, valued at $17,400	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics – Lincoln County	*Construction* Population: 1.7 percent increase Employment: 5.6 percent increase Real disposable income: 4.1 percent increase Gross regional product: 28 percent increase State and local government spending: 1.9 percent increase Traffic impacts to local highways: level of service on U.S. Highway 93 at Caliente would degrade from A to B	Not applicable	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 10 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Socioeconomics – Lincoln County (continued)	*Operations* Population: 2.9 percent increase Employment: 3.9 percent increase Real disposable income: 4.7 percent increase Gross regional product: 5.2 percent increase State and local government spending: 3.2 percent increase		
Socioeconomics – Esmeralda County	*Construction* Population: 1.1 percent increase Employment: 2.7 percent increase Real disposable income: 7.6 percent increase Gross regional product: 9.5 percent increase State and local government spending: 2.2 percent increase *Operations* Population: 2.0 percent increase Employment: 3.0 percent increase Real disposable income: 2.9 percent increase Gross regional product: 3.8 percent increase State and local government spending: 3.1 percent increase	*Construction* Population: 3.1 percent increase Employment: 14 percent increase Real disposable income: 27 percent increase Gross regional product: 57 percent increase State and local government spending: 4.6 percent increase *Operations* Population: 7.0 percent increase Employment: 14 percent increase Real disposable income: 10 percent increase Gross regional product: 24 percent increase State and local government spending: 9.9 percent increase	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 11 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Socioeconomics – Nye County	*Construction*	*Construction*	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
	Population: 0.2 percent increase	Population: 0.16 percent increase	
	Employment: 1.2 percent increase	Employment: 0.6 percent increase	
	Real disposable income: 0.9 percent increase	Real disposable income: 0.4 percent increase	
	Gross regional product: 3.5 percent increase	Gross regional product: 1 percent increase	
	State and local government spending: 0.4 percent increase	State and local government spending: 0.2 percent increase	
	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	
	Operations	*Operations*	
	Population: 0.3 percent increase	Population: 0.3 percent increase	
	Employment: 0.3 percent increase	Employment: 0.1 percent increase	
	Real disposable income: 0.3 percent increase	Real disposable income: 0.1 percent increase	
	Gross regional product: 0.5 percent increase	Gross regional product: 0.2 percent increase	
	State and local government spending: 0.3 percent increase	State and local government spending: 0.1 percent increase	
	Housing: county-wide population increase could place a strain on housing units in Pahrump	Housing: county-wide population increase could place a strain on housing units in Pahrump	
	Health-care services: moderate impacts due to population increases in medically underserved area	Health-care services: moderate impacts due to population increases in medically underserved area	
	Fire-protection services: moderate impacts in Pahrump due to population increases in underserved area	Fire-protection services: moderate impacts in Pahrump due to population increases in underserved area	
	Educational services: addition of 30 school-aged children to overcrowded schools	Educational services: addition of 23 school-aged children to overcrowded schools	
	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 12 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Socioeconomics - Churchill County	Not applicable	*Construction and Operations* Delay impacts on road traffic at grade crossings; less than 1 percent of vehicles traveling on U.S. Highway 50A in Hazen would incur a delay of less than 1 minute Rail impacts on existing rail traffic: moderate	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics - Lyon County	Not applicable	*Construction* Population: 0.01 percent increase Employment: 0.02 percent increase Real disposable income: 0.03 percent increase Gross regional product: 0.04 percent increase State and local government spending: 0.01 percent increase Rail impacts on existing rail traffic: moderate *Operations* Population: less than 0.01 percent increase Employment: 0.01 percent increase Real disposable income: 0.01 percent increase Gross regional product: 0.01 percent increase State and local government spending: 0.01 percent increase Rail impacts on existing rail traffic: moderate	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 13 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Socioeconomics – Walker River Paiute Reservation	Not applicable	*Construction* Assuming one of the construction camps is placed on the Walker River Paiute Reservation: Employment: up to 20 additional jobs Real disposable income: up to $386,000 Gross regional product: up to $1.4 million *Operations* Included in the Mineral County estimates because the forecasting model cannot discriminate impacts to the Reservation.	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics – Mineral County	Not applicable	*Construction* Population: 1.4 percent increase Employment: 6.1 percent increase Real disposable income: 4.5 percent increase Gross regional product: 14 percent increase State and local government spending: 1.8 percent increase Rail impacts on existing rail traffic: moderate *Operations* Population: 1.6 percent increase Employment: 2.6 percent increase Real disposable income: 2.8 percent increase Gross regional product: 1.9 percent increase State and local government spending: 1.5 percent increase Rail impacts on existing rail traffic: moderate	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 14 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Socioeconomics - Clark County	*Construction* Population: less than 0.1 percent increase Employment: 0.1 percent increase Real disposable income: 0.2 percent increase Gross regional product: 0.2 percent increase State and local government spending: small increase *Operations* Population: less than 0.1 percent increase Employment: less than 0.1 percent increase Real disposable income: less than 0.1 percent increase Gross regional product: less than 0.1 percent increase State and local government spending: less than 0.1 percent increase	*Construction* Population: 0.04 percent increase Employment: 0.1 percent increase Real disposable income: 0.1 percent increase Gross regional product: 0.1 percent increase State and local government spending: 0.04 percent increase *Operations* Population: less than 0.01 percent increase Employment: less than 0.1 percent increase Real disposable income: less than 0.1 percent increase Gross regional product: less than 0.1 percent increase State and local government spending: less than 0.1 percent increase	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics - Washoe County/Carson City	Not applicable	*Construction* Population: less than 1 percent increase Employment: less than 0.3 percent increase Real disposable income: less than 0.3 percent increase Gross regional product: less than 0.3 percent increase State and local government spending: less than 0.1 percent increase *Operations* Population: less than 0.1 percent increase Employment: less than 0.1 percent increase Real disposable income: less than 0.1 percent increase Gross regional product: less than 0.1 percent increase State and local government spending: less than 0.1 percent increase	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 15 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Occupational and public health and safety	Occupational radiological impacts: less than one latent cancer fatality Public radiological impacts: less than one latent cancer fatality Nonradiological industrial hazards during proposed railroad construction and operations: 2.22 worker fatalities Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 8 fatalities Rail-related fatalities during construction and operations: 1.3 fatalities *Shared-Use Option* Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 8 fatalities Rail-related fatalities during construction and operations: 4.6 fatalities	Occupational radiological impacts: less than one latent cancer fatality Public radiological impacts: less than one latent cancer fatality Nonradiological industrial hazards during proposed railroad construction and operations: 2 worker fatalities Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 7 fatalities Rail-related accidents during construction and operations: 1.1 fatalities *Shared-Use Option* Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 7 fatalities Rail-related fatalities during construction and operations: 7.4 fatalities	No impacts because the rail line and associated facilities would not be constructed or operated.
Utilities, energy and materials	Utility interfaces: Potential for short-term interruption of service during construction. No permanent or long-term loss of service or prevention of future service area expansions. Public water systems: Most water would be supplied by new wells; small effect on public water systems from population increase attributable to construction and operations employees.	Utility interfaces: Potential for short-term interruption of service during construction. No permanent or long-term loss of service or prevention of future service area expansions. Public water systems: Most water would be supplied by new wells; small effect on public water systems from population increase attributable to construction and operations employees.	No impacts because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 16 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Utilities, energy, and materials (continued)	Wastewater treatment systems: Dedicated treatment systems would be provided at construction camps and operations facilities; small impact on public systems from population increase attributable to construction and operations employees. Fossil fuels: Demand would be approximately 6.5 percent of statewide use during construction and less than 0.25 percent of statewide use during operations. Demand could be met by existing regional supply systems and suppliers. Materials: Requirements generally would be very small in relation to supply capacity. *Shared-Use Option* Fossil fuels: Demand would be less than 0.3 percent of statewide use during operations. Demand could be met by existing regional supply systems and suppliers.	Wastewater treatment systems: Same as Caliente Implementing Alternative. Fossil fuels: Demand would be approximately 6 percent of statewide use during construction and less than 0.25 percent of statewide use during operations. Demand could be met by existing regional supply systems and suppliers. Materials: Same as Caliente Implementing Alternative. *Shared-Use Option* Fossil fuels: Same as Caliente Implementing Alternative.	
Hazardous materials and waste	Small (Apex Landfill) to moderate (smaller landfills) impacts during the construction phase and no impact to small impact during the operations phase from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials during the construction and operations phases. Small impacts from hazardous-waste disposal during the construction and operations phases. Small impacts during the operations phase from low-level radioactive waste disposal for wastes that would be generated at the Cask Maintenance Facility.	Same as Caliente Implementing Alternative. Same as Caliente Implementing Alternative. Same as Caliente Implementing Alternative. Same as Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed.

Table S-8. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 17 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Cultural resources	Numerous archaeological sites have been identified along segments of alignments subjected to sample inventory. Potential direct and indirect impacts to National Register-eligible sites and to other sites that might be identified during the complete survey. Construction could result in impacts to the early Mormon colonization cultural landscape, Pioche-Hiko silver mining community route, 1849 Emigrant Trail campsites, and American Indian trail systems. Indirect effects to a National Register-eligible rock-art site are likely from two quarry sites. More than 50 National Register-eligible sites have been identified along segments of alignments subjected to sample inventory.	Numerous archaeological sites have been identified along segments of alignments subjected to sample inventory. Potential direct and indirect impacts to National Register-eligible sites and to other sites that might be identified during the complete survey. More than 60 National Register-eligible sites have been identified along segments of alignments subjected to sample inventory.	No impacts because the rail line and associated facilities would not be constructed.
Paleontological resources	No direct impacts to known paleontological resources.	Same as Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed.
Environmental justice	Constructing and operating the proposed rail line along the Caliente rail alignment would not result in disproportionately high and adverse impacts to minority or low-income populations.	Same as Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed.

a. BLM = Bureau of Land Management; CO = carbon monoxide; dBA = A-weighted decibels; DNL = day-night average noise level; DOE = U.S. Department of Energy; NAAQS = National Ambient Air Quality Standards; NO_x = oxides of nitrogen; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

Table S-9. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 1 of 7).

Resource Area	Alternative segments and common segments	
	Interface with the Union Pacific Railroad – Caliente	Interface with the Union Pacific Railroad – Eccles
Physical setting	Total surface disturbance: 3.1 square kilometers (770 acres). Loss of prime farmland soils: 0.16 square kilometer (40 acres). Less than 0.1 percent of prime farmland soils in Lincoln County.	Total surface disturbance: 2.1 square kilometers (520 acres). Loss of prime farmland soils: 0.10 square kilometer (24 acres). Less than 0.1 percent of prime farmland soils in Lincoln County.
Land use and ownership	Private parcels crossed: 32. Area of private land affected: 0.31 square kilometer (77 acres). Active grazing allotments crossed: 2. Animal unit months lost: 6 (0.6 percent). Indian Cove Staging Yard area of private land affected: 0.73 square kilometer (180 acres) Upland Staging Yard, area of private land affected: 0.45 square kilometer (110 acres)	Private parcels crossed: 11. Area of private land affected: 0.32 square kilometer (80 acres). Active grazing allotments crossed: 4. Animal unit months lost: 18 (1.5 percent).
Aesthetic resources	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Moderate impact from Staging Yard at Indian Cove. Moderate contrast from the operation of the facility in the Class III non-BLM lands, weak contrast from the track on BLM Class II lands at the north end; in each area, consistent with applicable BLM objectives. Potential quarry CA-8B - Moderate impact. Moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93, consistent with surrounding non-BLM lands treated as Class III. No long-term impact under the Proposed Action; conveyor would be removed at end of construction phase.	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Quarry CA-8B would not be developed for the Eccles alternative segment.
Surface-water resources	Caliente alternative segment: Approximately 0.05 square kilometer (12 acres) of wetlands would be filled. Long-term reduced and potentially eliminated access to Caliente Hot Springs. Indian Cove Staging Yard: Approximately 0.19 square kilometer (47 acres) of wetlands would be filled. Potential quarry CA-8B: Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.	Eccles alternative segment: Negligible amount of wetlands would be filled. Eccles Interchange Yard: Approximately 0.033 square kilometer (8.2 acres) of Clover Creek would be filled.

Table S-9. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments [a] (page 2 of 7).

Resource Area	Alternative segments and common segments	
	Interface with the Union Pacific Railroad – Caliente	Interface with the Union Pacific Railroad – Eccles
Groundwater resources	Groundwater withdrawals from the hydrographic area in Panaca Valley could impact existing groundwater users. However, mitigation measures such as reducing the pumping rate at or relocating proposed wells Pan V25/26, Pan V4, Pan V5, and Pan V3/6 would minimize these impacts.	Groundwater withdrawals from the hydrographic area in Panaca Valley could impact existing groundwater users. However, mitigation measures such as reducing the pumping rate at or relocating proposed wells Pan V3/6 and Pan V25/26 would minimize these impacts.
Biological resources	Caliente alternative segment and Interchange Yard: Short-term impact to 0.09 square kilometer (22 acres) wetland/riparian habitat. Long-term impact to 0.11 square kilometer (27 acres) wetland/riparian habitat. Upland Staging Yard: Short-term impact to 0.01 square kilometer (2.5 acres) wetland/riparian habitat. Long-term impact to less than 0.01 square kilometer (2 acres) wetland/riparian habitat. Indian Cove Staging Yard: Short-term impact to 0.09 square kilometer (22 acres) wetland/riparian habitat. Long-term impact to 0.04 square kilometer (9.9 acres) wetland/riparian habitat. Long-term moderate impact on riparian and wetland vegetation from the construction of a siding for potential quarry CA-8B.	Eccles alternative segment and Interchange Yard: Short-term impact to 0.10 square kilometer (24 acres) wetland/riparian habitat. Long-term impact to 0.10 square kilometer (24 acres) wetland/riparian habitat. Eccles-North Staging Yard: Short-term impact to 0.01 square kilometer (2.6 acres) wetland/riparian habitat. Long-term impact to 0.01 square kilometer (2.6 acres) wetland/riparian habitat.
Noise and vibration	Noise from construction activities would exceed Federal Transportation Administration guidelines. Daytime limits would be exceeded by 11 dBA from construction equipment noise and by 7 dBA from pile driving; 30-day DNL limit would be exceeded by 2 dBA from construction equipment noise and by 12 dBA from pile driving. There would be no adverse impacts from the operation of construction trains. There would be no receptors within the 65 DNL contour. There would be no adverse impacts from noise for the operation of trains along the rail alignment. No receptors would fall within the 3 dBA increase contour or the 65 DNL contour. There would be no adverse impacts from vibrations, which would fall below Federal Transportation Administration criteria.	Noise from construction activities would exceed Federal Transportation Administration guidelines. Construction equipment noise would cause daytime limits to be exceeded by 5 dBA. There would be no adverse impacts from the operation of construction trains. No receptors would fall within the 65 DNL contour. There would be no adverse impacts from noise for the operation of trains along the rail alignment. No receptors would be within the 65 DNL contour. There would be no adverse impacts from vibrations, which would fall below Federal Transportation Administration criteria.
Cultural resources	Potential direct and indirect impacts at three known National Register-eligible sites and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at two known potentially eligible sites and at other sites that might be identified during the complete survey.

Table S-9. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 3 of 7).

Resource Area	Alternative segments and common segments			
	Caliente common segment 1			
Physical setting	Total surface disturbance: 12 square kilometers (3,000 acres). Loss of prime farmland soils: 1.2 square kilometers (300 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.			
Land use and ownership	Private parcels crossed: 1. Area of private land affected: 0.0007 square kilometer (0.2 acre). Active grazing allotments crossed: 10. Animal unit months lost: 453 (0.7 percent).			
Cultural resources	Construction activities could result in impacts to the early Mormon colonization cultural landscape, the Pioche-Hiko silver mining community route, 1849 emigrant campsites, a National Register-eligible prehistoric site in the vicinity of Black Rock Springs, and to other sites that might be identified during the complete survey.			
	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Physical setting	Total surface disturbance: 3.4 square kilometers (840 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.29 square kilometer (72 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.	Total surface disturbance: 3.6 square kilometers (890 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.4 square kilometer (99 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.	Total surface disturbance: 3.7 square kilometers (910 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0 square kilometer (0 acre).	Total surface disturbance: 3.7 square kilometers (910 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.36 square kilometer (89 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.
Land use and ownership	Active grazing allotments crossed: 5. Animal unit months lost: 120 (1.34 percent).	Active grazing allotments crossed: 4. Animal unit months lost: 131 (1.1 percent).	Active grazing allotments crossed: 5. Animal unit months lost: 126 (1.4 percent).	Active grazing allotments crossed: 4. Animal unit months lost: 131 (1.1 percent).

Table S-9. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 4 of 7).

Resource Area	Alternative segments and common segments			
	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Aesthetic resources	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.
Cultural Resources	Construction could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.	Construction could result in direct and indirect impacts to American Indian trail systems, two National Register-eligible sites, and to other sites that might be identified during the complete survey.	Construction could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.	Construction could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.
	Caliente common segment 2			
Physical setting	Total surface disturbance: 4.1 square kilometers (1,000 acres). Would result in topsoil loss and increased potential for erosion.			
Land use and ownership	Active grazing allotments crossed: 3. Animal unit months lost: 128 (0.4 percent).			
Cultural resources	Potential indirect impacts include visual impacts to the Black Top archaeological locality; potential direct and indirect impacts to American Indian trail systems and a potential historic ranching cultural landscape, and to other sites that might be identified during the complete survey.			
	South Reveille 2		South Reveille 3	
Physical setting	Total surface disturbance: 4.8 square kilometers (1,200 acres). Would result in topsoil loss and increased potential for erosion.		Total surface disturbance: 5 square kilometers (1,240 acres). Would result in topsoil loss and increased potential for erosion.	
Land use and ownership	Active grazing allotments crossed: 1. Animal unit months lost: 54 (0.2 percent). Sections with unpatented mining claims the alignment would cross: 2 sections with 72 claims.		Active grazing allotments crossed: 1. Animal unit months lost: 58 (0.2 percent). Sections with unpatented mining claims the alignment would cross: 2 sections with 72 claims.	

Table S-9. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 5 of 7).

Resource Area	Alternative segments and common segments	
	South Reveille 2	South Reveille 3
Biological resources	Small to moderate impact on raptor nesting sites from the construction of potential quarry NN-9A.	Small to moderate impact on raptor nesting sites from the construction of potential quarry NN-9A.
Cultural resources	Rail line construction could represent a long-term indirect impact on a National Register-eligible rock-art site, and potential direct and indirect impacts at other sites that might be identified during the complete survey.	Rail line construction could represent a long-term indirect impact on a National Register-eligible rock-art site, and potential direct and indirect impacts at other sites that might be identified during the complete survey.

Resource Area	Caliente common segment 3
Physical setting	Total surface disturbance: 10 square kilometers (2,500 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Active grazing allotments crossed: 3. Animal unit months lost: 250 (0.6 percent). Sections with unpatented mining claims the alignment would cross: 10 sections with 166 claims.
Cultural resources	Potential direct and indirect impacts at one known National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.

Resource Area	Goldfield 1	Goldfield 3	Goldfield 4
Physical setting	Total surface disturbance: 9.8 square kilometers (2,400 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 10.2 square kilometers (2,500 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 6.5 square kilometers (1,600 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 6. Area of private land affected: 0.37 square kilometer (91 acres). Unpatented mining claims the alignment would cross: 14 sections with 474 claims.	Private parcels crossed: 2. Area of private land affected: 0.01 square kilometer (2 acres). Unpatented mining claims the alignment would cross: 14 sections with 359 claims.	Private parcels crossed: 37. Area of private land affected: 0.23 square kilometer (56 acres). Unpatented mining claims the alignment would cross: 19 sections with 538 claims.
Cultural resources	Potential direct and indirect impacts at possible Western Shoshone camps, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at one possible Western Shoshone camp, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at multiple National Register-eligible sites and in and around the town of Goldfield, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
Surface-water resources	No impact to Willow Springs.	Long-term reduced and potentially eliminated access to Willow Springs.	No impact to Willow Springs.

Table S-9. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments [a] (page 6 of 7).

Resource Area	Alternative segments and common segments	
	Caliente common segment 4	
Physical setting	Total surface disturbance: 1.1 square kilometers (270 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	
	Bonnie Claire 2	Bonnie Claire 3
Physical setting	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.
Cultural resources	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.
	Common segment 5	
Physical setting	Total surface disturbance: 3.1 square kilometers (770 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at two National Register-eligible archaeological sites, 20 additional resources that have been recorded within the region of influence, and at other sites that might be identified during the complete survey.	
	Oasis Valley 1	Oasis Valley 3
Physical setting	Total surface disturbance: 1 square kilometer (250 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.3 square kilometers (320 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 1. Area of private land affected: 0.04 square kilometer (9.9 acres). Active grazing allotments crossed: 1. Animal unit months lost: 8 (0.8 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.	Private parcels crossed: 0. Area of private land affected: 0. Active grazing allotments crossed: 1. Animal unit months lost: 13 (1.4 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.
Groundwater resources	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed wells OV3, OV4, and OV5 or drawing water from alternative wells nearby would minimize these impacts.	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed well OV13 or drawing water from alternative wells nearby would minimize these impacts.

Table S-9. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 7 of 7).

Resource Area	Alternative segments and common segments	
	Oasis Valley 1	Oasis Valley 3
Biological resources	No impact on riparian and wetland vegetation.	Short-term moderate impact on riparian and wetland vegetation.
Cultural resources	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Common segment 6	
Physical setting	Total surface disturbance: 5.5 square kilometers (1,400 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at archaeological sites recorded in region of influence, including three National Register-eligible resources, and at other sites that might be identified during the complete survey.	
Land use and ownership	Sections with unpatented mining claims the alignment would cross: 4 sections with 34 claims.	
Biological resources	Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	

a. BLM = Bureau of Land Management; dBA = A-weighted decibels; DOE = U.S. Department of Energy.

Table S-10. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 1 of 7).

Resource area	Existing rail line/alternative segments/common segments
	Union Pacific Railroad Hazen Branchline
Noise and vibration	DOE estimates that 34 receptors would be included within the construction train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would be considered temporary adverse impacts. Noise from operations would create adverse noise impacts at eight receptors in Silver Springs and one receptor in Wabuska. There would be no adverse impact from vibrations, which would fall below Federal Transportation Administration criteria.
	Department of Defense Branchline North
Physical setting	Total surface disturbance: 0.16 square kilometer (40 acres). Would result in topsoil loss and increased potential for erosion.

Table S-10. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 2 of 7).

Resource area	Existing rail lines/alternative segments/common segments			
	Schurz alternative segment 1	Schurz alternative segment 4	Schurz alternative segment 5	Schurz alternative segment 6
Physical setting	Total surface disturbance: 4.6 square kilometers (1,100 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.011 square kilometer (2.7 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	Total surface disturbance: 6.1 square kilometers (1,500 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.012 square kilometer (3 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	Total surface disturbance: 6.9 square kilometers (1,700 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.014 square kilometer (3.5 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	Total surface disturbance: 6.5 square kilometers (1,600 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.014 square kilometer (3.5 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.
Aesthetic resources	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives. Moderate to strong contrast in the short term from construction of the rail-over-road crossing of U.S. Highway 95 for Schurz 6, which would not meet BLM Class III management objectives.

Table S-10. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 3 of 7).

Resource area	Existing rail line/alternative segments/common segments			
	Schurz alternative segment 1	Schurz alternative segment 4	Schurz alternative segment 5	Schurz alternative segment 6
Biological resources	No impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.03 square kilometer (6.4 acres) wetland/riparian habitat. Long-term impact to 0.01 square kilometer (3.1 acres) wetland/riparian habitat.	No impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.03 square kilometer (6.4 acres) wetland/riparian habitat. Long-term impact to 0.01 square kilometer (3.1 acres) wetland/riparian habitat.	No impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.02 square kilometer (4.9 acres) wetland/riparian habitat. No long-term impact to wetland/riparian habitat.	Small to moderate long-term impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.01 square kilometer (3.1 acres) wetland/riparian habitat. No long-term impact to wetland/riparian habitat.
Surface-water resources	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 square meters (220 square feet) would be permanently filled to construct the bridge over the Walker River.	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 square meters (220 square feet) would be permanently filled to construct the bridge over the Walker River.	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 28 square meters (300 square feet) would be permanently filled to construct the bridge over the Walker River.	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 28 square meters (300 square feet) would be permanently filled to construct the bridge over the Walker River.
Cultural resources	Potential direct and indirect impacts at two potential National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at three potential National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at two potential National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Department of Defense Branchline South			
Physical setting	Total surface disturbance: 0.26 square kilometer (64 acres). Would result in topsoil loss and increased potential for erosion.			
	Mina common segment 1			
Physical setting	Total surface disturbance: 12 square kilometers (3,000 acres). Would result in topsoil loss and increased potential for erosion.			

Table S-10. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 4 of 7).

Resource area	Existing rail line/alternative segments/common segments		
	Mina common segment 1		
Land use and ownership	Private parcels the rail line would cross: 1. Area of private land affected: 0.21 square kilometer (53 acres). Active grazing allotments the rail line would cross: 3. Animal unit months lost: 104 (0.6 percent).		
Aesthetic resources	Potential Garfield Hills quarry - Moderate impact. Moderate contrast in the short term from quarrying, ballast production facilities, and conveyor close to viewers that would be compatible with BLM Class III management objectives. Small impact to no impact in long term; production facilities and conveyor would be removed and quarried areas restored after closure of quarry at end of construction phase. Potential Gabbs Range quarry - Small to moderate impact. Weak to moderate contrast in the short term from ballast production facilities close to viewers that would be compatible with BLM Class III management objectives. Small impact to no impact in long term; production facilities would be removed after closure of quarry at end of construction phase.		
Biological resources	Moderate long-term impact to Inter-Mountains Mixed Salt Desert Scrub. Moderate impact to winterfat communities – Potential Gabbs Range quarry.		
Cultural resources	Potential direct and indirect impacts at multiple National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.		
	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Physical setting	Total surface disturbance: 16 square kilometers (4,000 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 11 square kilometers (2,700 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 17 square kilometers (4,200 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 0. Area of private land affected: 0 square kilometer (0 acre). Active grazing allotments crossed: 4. Animal unit months lost: 117 (1.2 percent). Unpatented mining claims the alignment would cross: 17 sections containing 202 claims.	Private parcels crossed: 38. Area of private land affected: 0.34 square kilometer (84 acres). Active grazing allotments crossed: 1. Animal unit months lost: 47 (0.5 percent). Unpatented mining claims the alignment would cross: 24 sections containing 655 claims.	Private parcels crossed: 1. Area of private land affected: 0.1 square kilometer (24 acres). Active grazing allotments crossed: 2. Animal unit months lost: 129 (0.8 percent). Unpatented mining claims the alignment would cross: 19 sections containing 249 claims.

Table S-10. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 5 of 7).

Resource area	Existing rail line/alternative segments/common segments		
	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Aesthetic resources	Small to moderate impact. No to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, access roads. Weak contrast from new linear feature adjacent to State Route 265 and weak to moderate contrast in Clayton Valley; would meet BLM Class III and IV management objectives. Potential North Clayton quarry - Small to moderate impact. Moderate contrast in the short term from production facilities close to viewers that would be compatible with BLM Class IV management objectives. Small impact to no impact in long term; production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, access roads.	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, access roads. Potential North Clayton quarry - Weak to moderate impact. Moderate contrast in the short term from production facilities close to viewers that would be compatible with BLM Class IV management objectives. Small impact to no impact in long term; production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.
Groundwater resources	Groundwater withdrawals from hydrographic area 143 (Clayton Valley) would impact existing users of groundwater in the vicinity of Silver Peak. However, mitigation measures such as reducing the pumping rate at proposed well CL-1a would minimize these impacts.	Groundwater withdrawals would not result in impacts on existing groundwater users or groundwater resources.	Groundwater withdrawals would not result in impacts on existing groundwater users or groundwater resources.

Table S-10. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 6 of 7).

Resource area	Existing rail line/alternative segments/common segments		
	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Biological resources	Moderate impact to winterfat communities. Long-term moderate impacts to Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush at potential North Clayton and Malpais Mesa quarry sites.	Moderate impact to winterfat communities.	Moderate impact to winterfat communities. Long-term moderate impacts to Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush at potential Malpais Mesa quarry site.
Cultural resources	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Mina common segment 2		
Physical setting	Total surface disturbance: 0.28 square kilometer (69 acres). Would result in topsoil loss and increased potential for erosion.		
Cultural resources	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that may be identified during the complete survey.		
	Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3	
Physical setting	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	
	Common segment 5		
Physical setting	Total surface disturbance: 3.1 square kilometers (770 acres). Would result in topsoil loss and increased potential for erosion.		
Cultural resources	Potential direct and indirect impacts at two National Register-eligible archaeological sites, 20 additional resources that have been recorded within the region of influence, and at other sites that might be identified during the complete survey.		

Table S-10. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 7 of 7).

Resource area	Existing rail line/alternative segments/common segments	
	Oasis Valley alternative segment 1	Oasis Valley alternative segment 3
Physical setting	Total surface disturbance: 1 square kilometer (250 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.3 square kilometers (320 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 1 Area of private land affected: 0.04 square kilometer (9.9 acres). Active grazing allotments crossed: 1 Animal unit months lost: 8 (0.8 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.	Private parcels crossed: 0 Area of private land affected: 0 Active grazing allotments crossed: 1 Animal unit months lost: 13 (1.4 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.
Groundwater resources	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed wells OV3, OV4, and OV5 or drawing water from nearby alternative wells would minimize these impacts.	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed well OV13 or drawing water from nearby alternative wells would minimize these impacts.
Biological resources	No impact on riparian and wetland vegetation.	Short-term moderate impact on riparian and wetland vegetation.
Cultural resources	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Common segment 6	
Physical setting	Total surface disturbance: 5.5 square kilometers (1,400 acres). Would result in topsoil loss and increased potential for erosion.	
Biological resources	Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	
Land use and ownership	Sections with unpatented mining claims the alignment would cross: 4 sections with 34 claims.	
Cultural resources	Potential direct and indirect impacts at archaeological sites recorded in region of influence, including three National Register-eligible resources, and at other sites that might be identified during the complete survey.	

a. BLM = Bureau of Land Management; dBA = A-weighted decibels; DNL = day-night average noise level; DOE = U.S. Department of Energy.

CONVERSIONS

METRIC TO ENGLISH			ENGLISH TO METRIC		
Multiply	**by**	**To get**	**Multiply**	**by**	**To get**
Area					
Square meters	10.764	Square feet	Square feet	0.092903	Square meters
Square kilometers	247.1	Acres	Acres	0.0040469	Square kilometers
Square kilometers	0.3861	Square miles	Square miles	2.59	Square kilometers
Concentration					
Kilograms/sq. meter	0.16667	Tons/acre	Tons/acre	0.5999	Kilograms/sq. meter
Milligrams/liter	1[a]	Parts/million	Parts/million	1[a]	Milligrams/liter
Micrograms/liter	1[a]	Parts/billion	Parts/billion	1[a]	Micrograms/liter
Micrograms/cu. Meter	1[a]	Parts/trillion	Parts/trillion	1[a]	Micrograms/cu. meter
Density					
Grams/cu. cm	62.428	Pounds/cu. ft.	Pounds/cu. ft.	0.016018	Grams/cu. cm
Grams/cu. meter	0.0000624	Pounds/cu. ft.	Pounds/cu. ft.	16,025.6	Grams/cu. meter
Length					
Centimeters	0.3937	Inches	Inches	2.54	Centimeters
Meters	3.2808	Feet	Feet	0.3048	Meters
Kilometers	0.62137	Miles	Miles	1.6093	Kilometers
Temperature					
Absolute					
Degrees C + 17.78	1.8	Degrees F	Degrees F – 32	0.55556	Degrees C
Relative					
Degrees C	1.8	Degrees F	Degrees F	0.55556	Degrees C
Velocity/Rate					
Cu. meters/second	2118.9	Cu. feet/minute	Cu. feet/minute	0.00047195	Cu. meters/second
Grams/second	7.9366	Pounds/hour	Pounds/hour	0.126	Grams/second
Meters/second	2.237	Miles/hour	Miles/hour	0.44704	Meters/second
Volume					
Liters	0.26418	Gallons	Gallons	3.78533	Liters
Liters	0.035316	Cubic feet	Cubic feet	28.316	Liters
Liters	0.001308	Cubic yards	Cubic yards	764.54	Liters
Cubic meters	264.17	Gallons	Gallons	0.0037854	Cubic meters
Cubic meters	35.314	Cubic feet	Cubic feet	0.028317	Cubic meters
Cubic meters	1.3079	Cubic yards	Cubic yards	0.76456	Cubic meters
Cubic meters	0.0008107	Acre-feet	Acre-feet	1233.49	Cubic meters
Weight/Mass					
Grams	0.035274	Ounces	Ounces	28.35	Grams
Kilograms	2.2046	Pounds	Pounds	0.45359	Kilograms
Kilograms	0.0011023	Tons (short)	Tons (short)	907.18	Kilograms
Metric tons	1.1023	Tons (short)	Tons (short)	0.90718	Metric tons
ENGLISH TO ENGLISH					
Acre-feet	325,850.7	Gallons	Gallons	0.000003046	Acre-feet
Acres	43,560	Square feet	Square feet	0.000022957	Acres
Square miles	640	Acres	Acres	0.0015625	Square miles

a. This conversion is only valid for concentrations of contaminants (or other materials) in water.

METRIC PREFIXES

Prefix	Symbol	Multiplication factor	
exa-	E	1,000,000,000,000,000,000	$= 10^{18}$
peta-	P	1,000,000,000,000,000	$= 10^{15}$
tera-	T	1,000,000,000,000	$= 10^{12}$
giga-	G	1,000,000,000	$= 10^{9}$
mega-	M	1,000,000	$= 10^{6}$
kilo-	k	1,000	$= 10^{3}$
deca-	D	10	$= 10^{1}$
deci-	d	0.1	$= 10^{-1}$
centi-	c	0.01	$= 10^{-2}$
milli-	m	0.001	$= 10^{-3}$
micro-	µ	0.000 001	$= 10^{-6}$
nano-	n	0.000 000 001	$= 10^{-9}$
pico-	p	0.000 000 000 001	$= 10^{-12}$

Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor
DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada
DOE/EIS-0369D

Volume I

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy (DOE)

TITLE: *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (DOE/EIS-0250F-S2D; the Nevada Rail Corridor SEIS), and *Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0369D; the Rail Alignment EIS)

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U.S. Department of Energy
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Washington, DC 20585
Telephone: (202) 586-4600
Or leave a message: (800) 472-2756

Information about this document is available on the Internet at the Yucca Mountain Project web site at *http://www.ocrwm.doe.gov* and on the DOE National Environmental Policy Act (NEPA) web site at *http://eh.doe.gov/nepa/*.

ABSTRACT: The Nevada Rail Corridor SEIS (DOE/EIS-0250F-S2D) analyzes the potential impacts of constructing and operating a railroad to connect the Yucca Mountain repository site to an existing rail line near Wabuska, Nevada (in the Mina rail corridor). The Nevada Rail Corridor SEIS analyzes the Mina rail corridor at a level of detail commensurate with that of the rail corridors analyzed in the Final *Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F). The Nevada Rail Corridor SEIS also updates relevant information regarding other rail corridors previously analyzed in the Yucca Mountain FEIS (Carlin, Jean, and Valley Modified) to identify any significant new circumstances or information relevant to environmental concerns.

The Rail Alignment EIS (DOE/EIS-0369D) analyzes the potential impacts of railroad construction and operation along common segments and alternative segments within the Caliente (selected in a previous Record of Decision, 69 *Federal Register* 18557) and Mina rail corridors for the purpose of determining an alignment for the construction and operation of a railroad for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from an existing rail line in Nevada to a geologic repository at Yucca Mountain. The Rail Alignment EIS also analyzes the potential impacts of constructing and operating support facilities.

COOPERATING AGENCIES: The U.S. Bureau of Land Management, the Surface Transportation Board, and the U.S. Air Force are cooperating agencies in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS.

PUBLIC COMMENTS: A 90-day comment period on this document begins with the publication of the Environmental Protection Agency Notice of Availability in the *Federal Register*. DOE will consider comments received after the 90-day period to the extent practicable. The Department will hold public hearings to receive comments on the document at the times and locations announced in local media and the DOE Notice of Availability. Written comments may also be submitted by U.S. mail to the U.S. Department of Energy at the above address in Las Vegas, via the Internet at *http://www.ymp.gov,* or by facsimile at 1-800-967-0739. This public comment period and the public hearings coincide with those of the *Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1D).

READERS GUIDE

READERS GUIDE TO

Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor
DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada
DOE/EIS-0369D

This NEPA document contains two separate analyses—

- The Nevada Rail Corridor SEIS supplements and updates the information on Nevada rail corridors reported in the Yucca Mountain EIS (DOE/EIS-0250F), which DOE completed in 2002.
- The Rail Alignment EIS provides detailed analyses of two rail corridors (Caliente and Mina) at the alignment level.

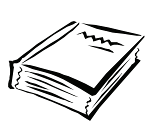
The Repository SEIS (DOE/EIS-0250F-S1D), published simultaneously with the Nevada Rail Corridor SEIS and the Rail Alignment EIS, is a separate, but related, analysis.

The Foreword, which immediately follows this Readers Guide, explains and graphically shows the relationship between the Nevada Rail Corridor SEIS, the Rail Alignment EIS, and the Repository SEIS. The Foreword also explains the relationship between those NEPA documents and the Repository SEIS, a separate, but related, environmental analysis.

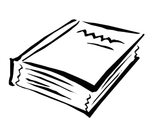
Readers might want to know…

How is the document structured?

This document has a summary and four volumes, as follows:

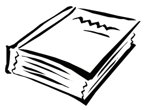


The Summary provides an overview of the information and analyses provided in Volumes I, II, III, and IV. From the Summary, readers will gain a general understanding of the proposed project, the environmental analyses, and potential environmental impacts. By its very nature, the Summary does not provide the engineering and scientific detail of the full document.

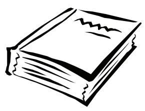


Volume I contains the Nevada Rail Corridor SEIS in its entirety, and Chapters 1 and 2 of the Rail Alignment EIS.

Volume II contains Chapter 3 of the Rail Alignment EIS, which describes the existing environmental setting and conditions for 15 environmental resource areas along the Caliente rail alignment and the Mina rail alignment.



Volume III contains Chapter 4 of the Rail Alignment EIS, which describes potential impacts to the existing environmental setting and conditions for 15 environmental resource areas along the Caliente rail alignment and the Mina rail alignment.



Volume IV contains Chapters 5, 6, 7, and 8 of the Rail Alignment EIS; a list of preparers, contributors, and reviewers; a glossary of terms, a reference list, Appendixes A through N, and an index.

In addition, DOE has developed a Map Atlas, which contains aerial photographs with digital overlays of the proposed railroad along the Caliente rail alignment and the Mina rail alignment. The Map Atlas is available on the Office of Radioactive Waste Management website at *www.ocrwm.doe.gov*.

The graphic on the next page shows the document structure and lists the contents of each volume.

Is this document difficult to understand?

This NEPA document is large and the subject of the proposed railroad project is complex. The analyses cover many environmental resource areas over long linear distances. DOE has endeavored to present this information in a logical format, and has included much of the information in tables and figures.

The Caliente and Mina rail alignments are treated fully and individually in the Rail Alignment EIS, Chapters 3 and 4. Although this approach results in repetition of some information, it allows readers interested in only one of the rail alignments easy access to information about that alignment.

The Department has provided tools and applied conventions to make the document as understandable and reader friendly as possible. For example:

- **Acronyms and Abbreviations** This document uses relatively few acronyms and abbreviations. Those used in text are spelled out at first use in each chapter; those used in tables and figures because of space limitations are defined in table and figure footnotes. The inside front cover of each volume of the document lists acronyms and abbreviations used in text. Each appendix has its own list of acronyms and abbreviations, as appropriate.

- **Definitions** Volume IV contains a glossary of terms. The glossary defines terms unique to this document and focuses on terms used in the environmental analyses and terms related to railroads. Glossary terms are shown in ***bold italics*** at first use in each chapter. Some glossary terms are also given in text boxes at appropriate places in the document.

- **Document Navigation** The Summary and each volume of this document contain detailed tables of contents, including lists of tables and figures. There is also a detailed index at the back of Volume IV.

Summary

High-level overview of the Nevada Rail Corridor SEIS and the Rail Alignment EIS.

Volume I

Nevada Rail Corridor SEIS

Chapter 1, Purpose and Need for Agency Action
Chapter 2, Proposed Action and Alternatives
Chapter 3, Affected Environment and Evaluation of Impacts - Mina rail Corridor
Chapter 4, Cumulative Impacts - Mina Rail Corridor
Chapter 5, New Information Regarding Other Rail Corridors
Chapter 6, Conclusion

Rail Alignment EIS:

Chapter 1, Purpose and Need for Agency Action
Chapter 2, Proposed Action and Alternatives

Volume II

Rail Alignment EIS

Chapter 3, Affected Environment
Section 3.2, Caliente Rail Alignment
Section 3.3, Mina Rail Alignment

Volume III

Rail Alignment EIS

Chapter 4, Environmental Impacts
Section 4.2, Caliente Rail Alignment
Section 4.3, Mina Rail Alignment

Volume IV

Rail Alignment EIS

Chapter 5, Cumulative Impacts
Chapter 6, Statutory, Regulatory, and Other Applicable Requirements
Chapter 7, Best Management Practices and Mitigation
Chapter 8, Unavoidable Adverse Impacts; Short-Term Uses and Long-Term Productivity; Irreversible and Irretrievable Commitment of Resources

List of Preparers, Contributors, and Reviewers
Glossary
References

Appendix A, Federal Register Notices
Appendix B, Interagency and Intergovernmental Interactions
Appendix C, Evolution of Alternative Segments and Common Segments
Appendix D, Aesthetic Resources
Appendix E, Air Quality Assessment Methodology
Appendix F, Floodplains and Wetlands Assessment
Appendix G, Methodology for Assessing Impacts to Groundwater
Appendix H, Biological Resources
Appendix I, Noise and Vibration Assessment Methodology
Appendix J, Socioeconomics
Appendix K, Radiological Health and Safety
Appendix L, Supplemental Transportation Information
Appendix M, Cultural Resources Programmatic Agreement
Appendix N, Distribution List

Index

- **Units of Measure** DOE has used standard units of measure, both metric and English. The Metric Conversion Act of 1975 (Public Law 94-168) and Executive Order 12770, *Metric Usage in Federal Government Programs*, require federal agencies to "seek out ways to increase understanding of the metric system of measurement through educational information and guidance and in Government publications."

  DOE believes that providing measures in both metric and English units ensures understanding by a wider audience of readers who speak English, including those more familiar with the metric system of measurement.

  Generally, measurements given in text are provided in the metric unit followed by the English conversion in parentheses, and tables provide measures in metric units and include a footnote with the English conversion factor. The inside back cover of each volume of this document provides a conversion table (metric to English and English to metric).

- **Rounding** DOE has endeavored to provide numerical data at a level to permit a meaningful comparison of quantities. Some numbers in this document are rounded, others are not. Generally, DOE has not rounded numbers taken from source documents and used as inputs to analyses. Numbers resulting from analyses are rounded if the inclusion of more digits would not be meaningful for comparative purposes. Extremely large numbers or extremely small numbers might be given using what is known as scientific notation. The inside front cover of each volume of this document provides a brief explanation of scientific notation.

What is DIRS?

The acronym DIRS precedes technical references cited in this document. DIRS stands for Document Input Reference System, a Yucca Mountain Project database used to catalog and track the use of references in project documents. Documents in this system have been checked and verified suitable for use, including those requiring copyright permissions. Every reference cited in this EIS is traceable via its unique DIRS number. To the extent possible, each reference citation provides a pointer to the location of the cited information within the reference. If the citation is general and applies to the entire document, or if it is not possible to provide a specific pointer (for example, in large data sets), the citation is indicated as "all."

What does DTN mean?

Data sets referenced in this document are preceded by the abbreviation DTN, which stands for Data Tracking Number. The Yucca Mountain Project uses a controlled system for cataloging and tracking all data used in project technical documents. Data in this system have been checked and verified suitable for use. All project data cited in this EIS are traceable to the unique DTN.

If I have comments on this EIS, where do I send them?

The Cover Sheet preceding this Readers Guide provides information on the public comment period and how to submit comments.

FOREWORD

The U.S. Department of Energy (DOE or Department) has prepared two draft National Environmental Policy Act (NEPA) documents associated with the proposed disposal of spent nuclear fuel and high-level radioactive waste in a geologic repository at the Yucca Mountain Site in Nye County, Nevada:

- *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1; the Repository SEIS).
- *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (Part 1) (DOE/EIS-0250F-S2D; the Nevada Rail Corridor SEIS), and *Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (Part 2) (DOE/EIS-0369D; the Rail Alignment EIS).

The Repository SEIS evaluates the potential environmental impacts of constructing and operating the Yucca Mountain repository under the current repository design and operational plans, the purpose of which is to assist the U.S. Nuclear Regulatory Commission (NRC) in adopting, to the extent practicable, any EIS prepared pursuant to Section 114(f)(4) of the Nuclear Waste Policy Act, as amended (NWPA; 42 United States Code 10101 *et seq.*).

The Nevada Rail Corridor SEIS and the Rail Alignment EIS evaluate the potential environmental impacts of constructing and operating a railroad for shipments of spent nuclear fuel and high-level radioactive waste from an existing rail line in Nevada to the repository at Yucca Mountain, the purpose of which is to help the Department decide whether to construct and operate a railroad, and if so, within which corridor and along which alignment.

Background and Context

The NWPA directs the Secretary of Energy, if the Secretary decides to recommend approval of the Yucca Mountain site for development of a repository, to submit a final EIS with any recommendation to the President. To fulfill that requirement, the Department prepared the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F, February 2002) (Yucca Mountain FEIS).

On February 14, 2002, the Secretary transmitted to the President his recommendation (including the Yucca Mountain FEIS) for approval of the Yucca Mountain site for development of a geologic repository. The President considered the site qualified for application to the NRC for construction authorization and recommended the site to the U.S. Congress. Subsequently, Congress passed a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. On July 23, 2002, the President signed the joint resolution into law (Public Law 107-200). The Department is now in the process of preparing an application for submittal to the NRC seeking authorization to construct the repository, as required by the NWPA (Section 114(b)).

Since completion of the Yucca Mountain FEIS in 2002, DOE has continued to develop the repository design and associated construction and operational plans. As now proposed, the newly designed surface and subsurface facilities would allow DOE to operate the repository following a primarily canistered approach in which most commercial spent nuclear fuel would be packaged at the reactor sites in transportation, aging, and disposal (TAD) canisters. Any commercial spent nuclear fuel arriving at the repository in packages other than TAD canisters would be repackaged by DOE at the repository into TAD canisters. DOE would construct the surface and subsurface facilities over a period of several years (referred to as phased construction) to accommodate an increase in spent nuclear fuel and high-level radioactive waste receipt rates as repository operational capability reaches its design capacity. To address the current repository design and operational plans, the Department announced its intent to prepare a Supplement to the Yucca Mountain FEIS (DOE/EIS-0250F-S1), consistent with NEPA and the NWPA. (*Supplement to the Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV*; 71 *Federal Register* [*FR*] 60490, October 13, 2006). The Repository SEIS supplements the Yucca Mountain FEIS by considering the potential environmental impacts of the construction, operation and closure of the repository under the current repository design and operational plans, and by updating the analysis and potential environmental impacts of transporting spent nuclear fuel and high-level radioactive waste to the repository, consistent with transportation-related decisions the Department made following completion of the Yucca Mountain FEIS.

On April 8, 2004, the Department issued a Record of Decision announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain FEIS as the primary means of transporting spent nuclear fuel and high-level radioactive waste to the repository (*Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV*; 69 *FR* 18557, April 8, 2004). Implementation of the mostly rail scenario ultimately would require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. To that end, in the same Record of Decision, the Department also selected the Caliente rail corridor from several corridors considered in the Yucca Mountain FEIS as the corridor in which to study possible alignments for a rail line. On the same day DOE selected the Caliente corridor, it issued a Notice of Intent to prepare an EIS under NEPA to study alternative alignments within the Caliente corridor (the Rail Alignment EIS; DOE/EIS-0369) (*Notice of Intent to Prepare an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV*; 69 *FR* 18565, April 8, 2004).

During the subsequent public scoping process, DOE received comments suggesting that other rail corridors be considered, in particular, the Mina route. In the Yucca Mountain FEIS, DOE had considered but eliminated the Mina route from detailed study because a rail line within the Mina route could only connect to an existing rail line in Nevada by crossing the Walker River Paiute Reservation, and the Tribe had informed DOE that it would not allow nuclear waste to be transported across the Reservation.

Following review of the scoping comments, DOE held discussions with the Walker River Paiute Tribe and, in May 2006, the Tribal Council informed DOE that it would allow the Department to consider the potential impacts of constructing and operating a railroad to transport spent nuclear fuel and high-level radioactive waste across its reservation. On October 13, 2006, after a preliminary evaluation of the feasibility of the Mina rail corridor, DOE announced its intent to expand the scope of the Rail Alignment EIS to include the Mina corridor (*Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV*; 71 *FR* 60484). Although the expanded NEPA analyses, referred to as the Nevada Rail Corridor SEIS and the Rail Alignment EIS, evaluate the potential environmental impacts associated with the Mina rail corridor, DOE has identified the Mina alternative as nonpreferred because the Tribe has withdrawn its support for the EIS process.

Relationships Among the EISs

The Yucca Mountain FEIS, the Repository SEIS, and the Nevada Rail Corridor SEIS and the Rail Alignment EIS are related in several respects. The Nevada Rail Corridor SEIS supplements the rail corridor analysis of the Yucca Mountain FEIS by analyzing the potential environmental impacts associated with constructing and operating a railroad within the Mina corridor. The Nevada Rail Corridor SEIS analyzes the Mina corridor at a level of detail commensurate with that of the rail corridor analysis in the Yucca Mountain FEIS, and concludes that the Mina corridor warrants further study in the Rail Alignment EIS to identify an alignment for the construction and operation of a railroad.

The Nevada Rail Corridor SEIS also updates relevant information regarding three other rail corridors previously analyzed in the Yucca Mountain FEIS (Carlin, Jean, and Valley Modified). The update demonstrates that there are no significant new circumstances or information relevant to environmental concerns associated with these three rail corridors, and that they do not warrant further consideration in the Rail Alignment EIS. The Caliente-Chalk Mountain rail corridor, which also was included in the Yucca Mountain FEIS, would intersect the Nevada Test and Training Range, and was eliminated from further consideration because of U.S. Air Force concerns that a rail line within the Caliente-Chalk Mountain corridor would interfere with military readiness testing and training activities.

The Rail Alignment EIS tiers from the broader corridor analysis in both the Yucca Mountain FEIS and the Nevada Rail Corridor SEIS, consistent with the Council on Environmental Quality regulations (see 40 Code of Federal Regulations 1508.28). Under the Proposed Action considered in the Rail Alignment EIS, DOE analyzes specific potential impacts of constructing and operating a railroad along common segments and alternative segments within the Caliente and Mina corridors for the purpose of determining an alignment in which to construct and operate a railroad for shipments of spent nuclear fuel and high-level radioactive waste from an existing rail line in Nevada to a geologic repository at Yucca Mountain.

The Repository SEIS includes the potential environmental impacts of national transportation, and the potential impacts from the construction and operation of a rail line along specific alignments in either the Caliente or the Mina corridor, as described in the Rail Alignment EIS, to ensure that the Repository SEIS considers the full scope of potential environmental impacts associated with the proposed construction and operation of the repository. Conversely, the Rail Alignment EIS includes the potential impacts of constructing and operating the repository as a reasonably foreseeable future action in its cumulative impacts analysis. To ensure consistency, the Repository SEIS, the Nevada Rail Corridor SEIS, and the Rail Alignment EIS use the same inventory of spent nuclear fuel and high-level radioactive waste and the same number of rail shipments for analysis. Thus, the associated occupational and public health and safety impacts within the Nevada rail corridors under consideration are the same in both documents. Furthermore, to promote conformity, where appropriate, consistent analytical approaches were used in both documents to evaluate the various resource areas.

The figure that follows summarizes the relationship among the EISs.

Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS-0250F)

Proposed Action:

- DOE would construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain.
- Repository operations would include transporting spent nuclear fuel and high-level radioactive waste to Yucca Mountain nationally and in Nevada by either mostly rail or mostly truck

Record of Decision

- Mostly rail nationally and in Nevada
- Caliente rail corridor to determine a rail alignment

Repository SEIS
(DOE/EIS-0250F-S1)

1. Supplements the Yucca Mountain FEIS in its entirety, as modified by:
   - Record of Decision (mostly rail, Caliente rail corridor) (69 *FR* 18557)
   - Outcome of the Nevada Rail Corridor SEIS (Mina rail corridor)
2. Otherwise the Proposed Action remains unchanged:
   - DOE would construct, operate and monitor, and eventually close a repository
   - During repository operations, shipments would occur by mostly rail
   - In Nevada, rail shipments would occur on a railroad to be constructed along an alignment within either the Caliente or the Mina rail corridor
   - Shipments also would arrive at repository by truck
3. To supplement Nevada transportation analysis, Repository SEIS incorporates by reference relevant information from the Rail Alignment EIS:
   - Affected environments for Caliente and Mina rail alignments
   - Environmental impacts from constructing and operating a railroad along Caliente or Mina rail alignment
   - Cumulative impacts associated with Caliente and Mina rail alignments

Nevada Rail Corridor SEIS (Part 1)
(DOE/EIS-0250F-S2)

1. Supplements the Nevada transportation analysis of the Yucca Mountain FEIS, as modified by:
   - Record of Decision (mostly rail) (69 *FR* 18557)
   - Proposed consideration of Mina rail corridor
2. Under the Proposed Action, DOE would construct and operate a railroad to connect the Yucca Mountain repository to an existing rail line near Wabuska, Nevada (the Mina rail corridor)
   - Mina corridor information and analyses at a level of detail commensurate with that of the other corridors in the Yucca Mountain FEIS
3. Considers other corridors in the Yucca Mountain FEIS for significant new circumstances or information relevant to environmental concerns
   - Review environmental information available since the Yucca Mountain FEIS
4. Conclusion:
   - Whether the Mina rail corridor warrants further detailed study to determine an alignment based on impact analysis
   - Whether there are significant changes or new information relevant to environmental concerns for the other corridors that would warrant further detailed study to determine an alignment

Rail Alignment EIS (Part 2)
(DOE/EIS-0369)

1. Tiers from the Yucca Mountain FEIS and the Nevada Rail Corridor SEIS
2. Proposed Action based on Record of Decision (69 *FR* 18557)
   - Under the Proposed Action, DOE would determine an alignment for the construction and operation of a railroad
     - ⇒ Caliente Implementing Alternative (preferred)
     - ⇒ Mina Implementing Alternative (nonpreferred)

Relationship between the Repository SEIS, the Nevada Rail Corridor SEIS, and the Rail Alignment EIS.

Part 1

Draft Supplemental Environmental Impact Statement
for a Geologic Repository for the Disposal of
Spent Nuclear Fuel and High-Level Radioactive Waste
at Yucca Mountain, Nye County, Nevada –
Nevada Rail Transportation Corridor
DOE/EIS-0250F-S2D

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

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1. PURPOSE AND NEED FOR AGENCY ACTION

This chapter explains why DOE needs to construct and operate a railroad in Nevada, summarizes the process leading to the addition of a rail corridor for further study, and describes the interests and roles of cooperating agencies. It also describes the Rail Alignment EIS and Nevada Rail Corridor scoping processes; summarizes public scoping comments and how DOE acted on those comments; describes interactions with American Indian Tribes and tribal organizations; and the relationship of this Nevada Rail Corridor SEIS to other environmental documents.

Glossary terms are shown in ***bold italics***.

1.1 Purpose and Need

The United States has focused a national effort on siting and developing a ***geologic repository*** for ***disposal*** of ***spent nuclear fuel*** and ***high-level radioactive waste***, and on developing systems in preparation for transporting these materials from their locations throughout the country to a repository. On July 23, 2002, the President signed into law (Public Law 107-200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain Site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste.

Spent nuclear fuel is fuel that has been withdrawn from a reactor following irradiation.

- **Commercial spent nuclear fuel** comes from civilian nuclear power plants that generate electricity.
- **DOE spent nuclear fuel** comes from DOE production reactors, naval reactors, and university- and government-owned test and experimental reactors.

High-level radioactive waste is the highly radioactive material that results from the reprocessing of spent nuclear fuel and other highly radioactive material, which the U.S. Nuclear Regulatory Commission determines by rule requires permanent isolation.

After the Yucca Mountain Site was designated, the U.S. Department of Energy (DOE or the Department) initiated preparation of a license application to be submitted to the U.S. Nuclear Regulatory Commission seeking authorization to construct the repository. In addition, to be in a position to transport spent nuclear fuel and high-level radioactive waste to the repository should the Commission approve construction of the repository and receipt of these materials, DOE proceeded with certain decisions related to the transportation of these materials. On April 8, 2004, the Department announced that it would ship most spent nuclear fuel and high-level radioactive waste to the repository by rail (train) (*Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV*; 69 *Federal Register* [*FR*] 18557). Because rail access to Yucca Mountain is not currently available, DOE would have to build a rail line to connect to an existing rail line in Nevada.

1.2 Yucca Mountain Site-Selection and Recommendation Process

The Nuclear Waste Policy Act of 1982 (Public Law 97-425) acknowledged the Federal Government's responsibility to provide for the disposal of the Nation's spent nuclear fuel and high-level radioactive waste. This Act, as amended (42 United States Code [U.S.C.] 10101 *et seq.*), which the Nevada Rail

Corridor SEIS and the Rail Alignment EIS refer to as the NWPA, identifies the Yucca Mountain Site in Nye County, Nevada, as the site to be studied as a potential location for a geologic repository.

After completion of site characterization studies at Yucca Mountain, the Secretary of Energy, finding the site to be scientifically and technically suitable for development of a repository, submitted his recommendation, along with a comprehensive statement of the basis for the recommendation, to the President of the United States, George W. Bush, for approval of the Yucca Mountain Site for the development of a nuclear waste repository. As required by the NWPA, the Department prepared the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F, February 2002; DIRS 155970-DOE 2002, all) (Yucca Mountain FEIS), to accompany the Secretary's recommendation. The President considered the site qualified for application to the Nuclear Regulatory Commission for a construction authorization and recommended the site to the U.S. Congress. On July 23, 2002, the President signed into law (Public Law 107-200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain Site for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste.

1.3 Rail Corridors Considered in the Yucca Mountain FEIS and this Nevada Rail Corridor SEIS

In the Yucca Mountain FEIS, DOE analyzed a proposed action to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain. As part of that action, DOE evaluated various modes of transporting spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Site from 72 commercial and 5 DOE sites (now 4 DOE sites because the Department is moving spent nuclear fuel from the Fort St. Vrain site in Colorado to the Idaho National Laboratory in Idaho). Figure 1-1 shows these sites.

DOE evaluated two national transportation scenarios, the "mostly legal-weight truck scenario" and the "mostly rail scenario," and three Nevada transportation scenarios, referred to as the "Nevada mostly legal-weight truck scenario," the "Nevada mostly rail scenario," and the "Nevada mostly heavy-haul truck scenario."

Under the Nevada mostly rail scenario, DOE considered in detail five potential ***rail corridors*** (Caliente, Carlin, Caliente-Chalk Mountain, Jean, and Valley Modified) within the State of Nevada in which the Department could construct a ***railroad*** to link an existing rail line to a repository at Yucca Mountain. Figure 1-2 shows these five corridors.

> **Rail corridor:** A strip of land 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at Yucca Mountain.
>
> **Rail route:** A path that a rail line would follow within a rail corridor.
>
> **Rail line:** An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.
>
> **Railroad:** A transportation system incorporating the rail line, operations support facilities, railcars, locomotives, and other related property and infrastructure.
>
> **Option:** A strip of land from one point along a corridor to another point on the same corridor that provides a different route.

On April 8, 2004 (69 *FR* 18557), the Department issued a ***Record of Decision*** announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain FEIS as the primary means of transporting spent nuclear fuel and high-level radioactive waste to the

Legend

- ▲ Yucca Mountain
- ★ Commercial Sites

  Note: The Yucca Mountain FEIS analysis considered three commercial site pairs—Salem and Hope Creek, Nine Mile Point and FitzPatrick, and Dresden and Morris—to be single sites because of their proximity to each other.

- ◉ DOE Sites

  Notes:

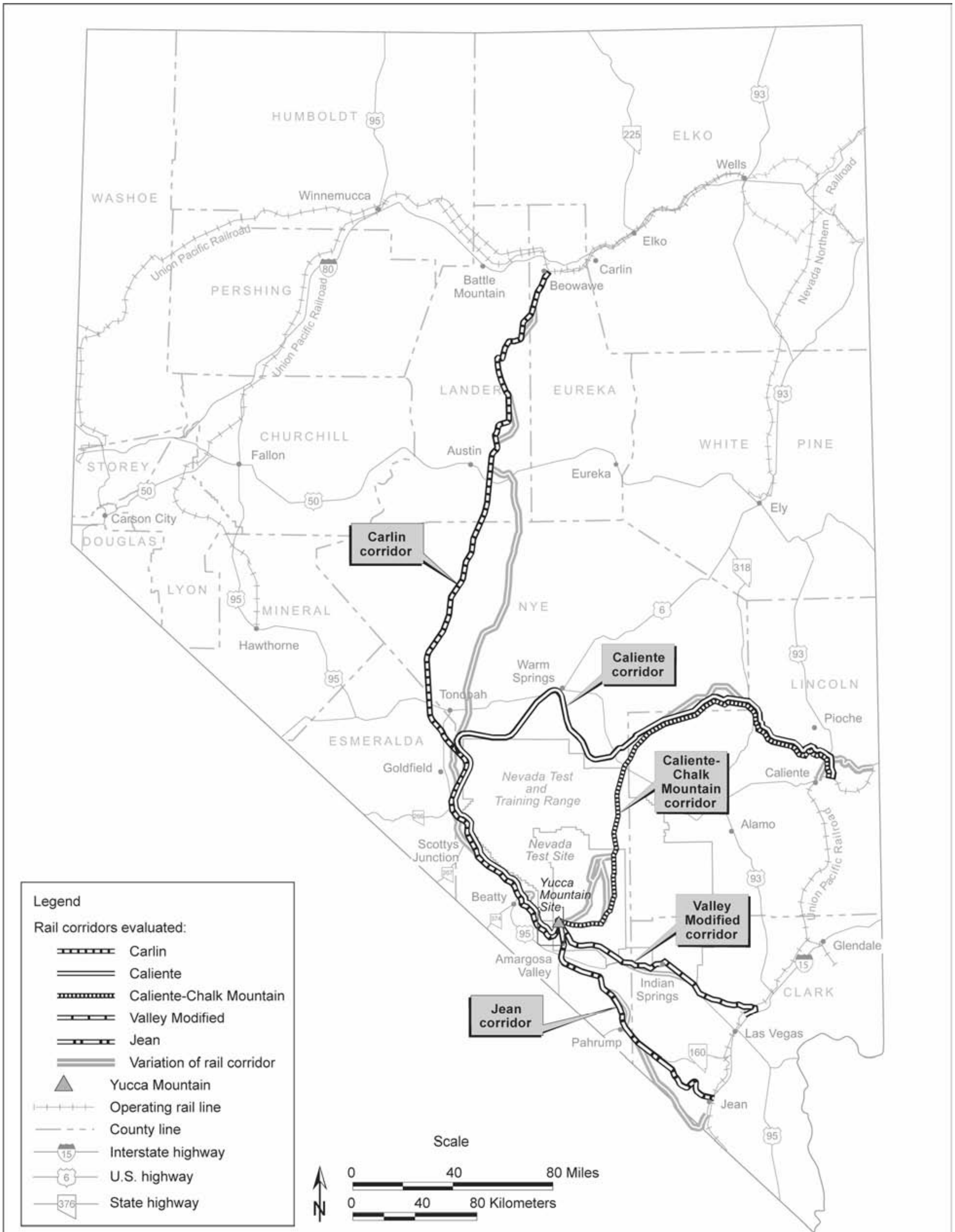
  The Yucca Mountain FEIS analysis included the high-level radioactive waste at West Valley. The State of New York owns the high-level radioactive waste and the site. Under the West Valley Demonstration Project Act, DOE is responsible for solidifying and transporting the high-level radioactive waste to a repository.

  The Yucca Mountain FEIS analysis included DOE spent nuclear fuel at a fifth DOE location, Fort St. Vrain in Colorado. DOE will move that waste to the Idaho National Laboratory for processing and it will be included in the laboratory inventory. Therefore, this map does not show Fort St. Vrain as a DOE source of spent nuclear fuel.

Notes: DOE = U.S. Department of Energy; FEIS = Final Environmental Impact Statement. Symbols do not reflect precise locations.

Source: Modified from DIRS 155970-DOE 2002, Figure 1-1.

Figure 1-1. Locations of commercial and DOE sites that would ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain.



Source: Modified from DIRS 155970-DOE 2002, Figure 2-26.

Figure 1-2. Five rail corridors evaluated in detail in the Yucca Mountain FEIS.

repository. Implementation of the mostly rail scenario ultimately would require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. To that end, in the same Record of Decision, the Department also selected the Caliente rail corridor from several corridors considered in the Yucca Mountain FEIS as the corridor in which to study possible alignments for a rail line. On the same day DOE selected the Caliente corridor, it issued a Notice of Intent to prepare an EIS under the National Environmental Policy Act (NEPA) to study alternative alignments (now referred to as alternative segments) within the Caliente corridor (the Rail Alignment EIS; DOE/EIS-0369) (*Notice of Intent to Prepare an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV*; 69 *FR* 18565).

During subsequent public scoping, DOE received comments suggesting that DOE consider other rail corridors that DOE had not previously considered in detail, in particular, the Mina route. In the Yucca Mountain FEIS, DOE had considered but eliminated the Mina route from detailed study because a rail line within the Mina route could only connect to an existing rail line in Nevada by crossing the Walker River Paiute Reservation, and the Tribe had informed DOE that it would not allow nuclear waste to be transported across the Reservation (DIRS 182776-Collins 1991, all).

Following review of the scoping comments, DOE held discussions with the Walker River Paiute Tribe and, in May 2006, the Tribal Council informed DOE that it would allow the Department to consider the potential impacts of transporting spent nuclear fuel and high-level radioactive waste across its reservation (DIRS 182775-Williams 2006, all). DOE then prepared a preliminary feasibility study of the Mina rail corridor (DIRS 180222-BSC 2006, all).

On October 13, 2006, after a preliminary evaluation of the feasibility of the Mina rail corridor, DOE announced its intent to expand the scope of the Rail Alignment EIS to include the Mina corridor (*Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV*; 71 *FR* 60484). DOE also announced that it would update, as appropriate, the information and analysis for other rail corridors analyzed in the Yucca Mountain FEIS.

This expanded NEPA analysis includes the Nevada Rail Corridor SEIS (DOE/EIS-0250F-S2D), which updates the Nevada rail corridor analysis in the Yucca Mountain FEIS by analyzing the potential environmental impacts associated with constructing and operating a railroad within the Mina rail corridor (corridor-level analysis) and the Rail Alignment EIS (DOE/EIS-0369D), which analyzes the potential environmental impacts associated with constructing and operating a railroad along specific alignments within the Caliente rail corridor and the Mina rail corridor (alignment-level analysis). Figure 1-3 shows the location of the Mina rail corridor evaluated in this Nevada Rail Corridor SEIS, and the Caliente rail corridor evaluated in the Rail Alignment EIS.

This Nevada Rail Corridor SEIS supplements the Nevada transportation-related element of the Yucca Mountain FEIS, but only the element that remains a part of the Yucca Mountain FEIS Proposed Action–the Nevada mostly rail scenario. Under the Proposed Action considered in this Nevada Rail Corridor SEIS (described in more detail in Chapter 2), DOE would construct and operate a railroad to connect the Yucca Mountain Repository to an existing rail line near Wabuska, Nevada (the Mina rail corridor). Accordingly, this Nevada Rail Corridor SEIS analyzes the Mina rail corridor at a level of detail commensurate with that of the rail corridors analyzed in the Yucca Mountain FEIS (see Chapters 3 and 4 of this Nevada Rail Corridor SEIS).

The analysis of the Mina rail corridor is intended to support Departmental conclusions about whether the potential attributes, characteristics, and environmental impacts of constructing and operating a railroad within the Mina rail corridor are such that DOE should proceed with analyzing specific alignments within the Mina rail corridor in the Rail Alignment EIS. In Chapter 6 of this Nevada Rail Corridor SEIS, DOE concludes that the Mina rail corridor warrants further study to determine an alignment for the construction and operation of a railroad.

On April 17, 2007, the Tribal Council for the Walker River Paiute Tribe passed a resolution withdrawing support for the Tribe's participation in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS. The Tribal Council based its decision on a review of information gathered to that time and input from Tribal members. The Tribal Council's resolution also renewed the Tribe's past objection to the transportation of nuclear waste through their Reservation (DIRS 181604-Williams 2007, all). Thus, although Mina is analyzed in detail in the Rail Alignment EIS, DOE has identified the Mina Implementing Alternative as nonpreferred.

This Nevada Rail Corridor SEIS also updates relevant information regarding other rail corridors previously analyzed in the Yucca Mountain FEIS (Carlin, Jean, and Valley Modified) to identify any significant new circumstances or information that would cause DOE to further consider these corridors. The Caliente-Chalk Mountain rail corridor, also previously analyzed in the Yucca Mountain FEIS, would conflict with the mission of the U.S. Air Force. Therefore, DOE has eliminated this corridor from further consideration and has not updated information concerning the Caliente-Chalk Mountain rail corridor in this Nevada Rail Corridor SEIS.

Chapter 5 of this Nevada Rail Corridor SEIS provides updated information and analyses for the Carlin, Jean, and Valley Modified rail corridors; Figure 1-3 shows the locations of these three rail corridors.

The updated information and analysis are intended to support Departmental conclusions about whether there are significant new circumstances or information relevant to environmental concerns for the Carlin, Jean, and Valley Modified corridors. Factors important to reaching a conclusion include the nature of the updated environmental information and associated changes to potential environmental impacts, including irreversible and irretrievable commitments of resources and cumulative impacts, since DOE completed the Yucca Mountain FEIS. Other factors include, as appropriate, changes to potential land-use conflicts and their potential to adversely affect construction of a rail line, and the potential delays that could affect the availability of a rail line in these corridors. In Chapter 6 of this Nevada Rail Corridor SEIS, DOE concludes that there are no significant new circumstances or information relevant to environmental concerns regarding these corridors. Therefore, the Rail Alignment EIS considers implementing alignment alternatives only in the Caliente and Mina corridors.

As Chapter 6 discusses, although the amount of private land within the Carlin rail corridor appears to have decreased since DOE completed the Yucca Mountain FEIS, the complex land-ownership pattern resulting from the mix of private and public lands the corridor would cross remains unchanged. Such land-use complexity increases the potential to adversely affect construction of a railroad, and increases the potential for delays that could affect the availability of a rail line in the Carlin rail corridor. In contrast, the Mina rail corridor would cross less private land, and the corresponding land-ownership pattern would be less complex. Therefore, although DOE announced its preference for the Carlin rail corridor in the *Federal Register* (69 *FR* 74951, December 29, 2003) the Department has concluded that the Carlin rail corridor does not warrant further consideration at the alignment level in the Rail Alignment EIS.

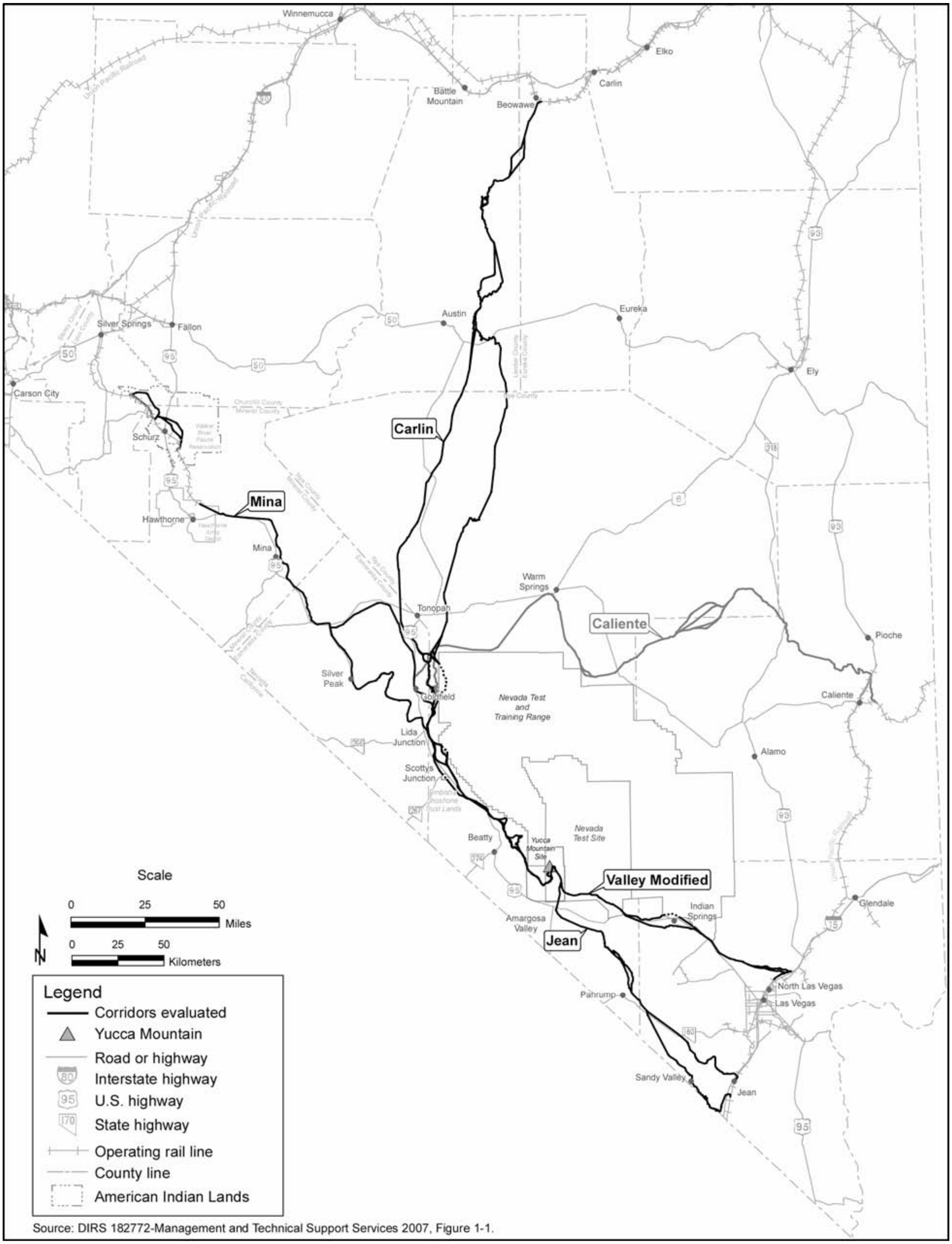


Figure 1-3. Four rail corridors and the Caliente corridor (pre-scoping, October 2006).

1.3.1 CALIENTE RAIL CORRIDOR

In its Record of Decision (69 *FR* 18557, April 8, 2004), DOE selected the Caliente rail corridor in which to evaluate possible ***rail alignments*** for construction and operation of a railroad within Nevada. The Department decided to evaluate alignments within the Caliente corridor based, in part, on the analyses of the Yucca Mountain FEIS. The Department, however, also considered other factors such as potential for construction delays, direct and indirect costs of each alignment, and comments received from the public.

DOE also considered potential land-use conflicts and their potential to adversely affect construction of a rail line. Compared to the other four corridors, the Caliente rail corridor appeared to have the fewest land-use or other conflicts that could lead to substantial delays in acquiring the necessary land and rights-of-way, or beginning construction. The Department concluded that the Valley Modified rail corridor could conflict with the Desert National Wildlife Range and local community plans for development in the greater Las Vegas metropolitan area. The Caliente-Chalk Mountain rail corridor would conflict with the U.S. Air Force mission on the Nevada Test and Training Range. The Jean rail corridor would require crossing relatively greater amounts of private land, and would pose greater potential land-use conflicts because of its proximity to the Las Vegas metropolitan area. The Carlin rail corridor also would require crossing relatively greater amounts of private land, and little infrastructure, such as roads and electric power, is available over long segments of the corridor, which would tend to make logistics and emergency response during construction more challenging.

The Department also considered concerns expressed by members of the public in Nevada. In these comments, the public stated that DOE should avoid rail corridors in the Las Vegas Valley.

DOE also considered the direct costs of constructing and operating a railroad, and the indirect costs resulting from potential delays in the availability of the railroad. The Jean and Valley Modified rail corridors would be the shortest among the five corridors and would have the lowest estimated construction costs. The Carlin and Caliente rail corridors would be the longest and, on the basis of construction costs alone, would be more expensive to develop. However, delays in rail line construction because of land-use or other conflicts and the resulting inability to accept spent nuclear fuel and high-level radioactive waste transported by rail to the repository in a timely manner would add to both the liability costs for delayed acceptance of commercial spent nuclear fuel and the costs of continued storage of high-level radioactive waste.

The Department considered irreversible and irretrievable commitments of resources in making its decision, recognizing that resources such as electric power, fossil fuels, construction materials, and water would be consumed during rail line construction within any of the five rail corridors considered in the Yucca Mountain FEIS. On balance, DOE concluded that these commitments would not significantly diminish the resources in question.

DOE concluded that the Caliente rail corridor would be preferable to the other corridors, and therefore decided to evaluate possible alignments for the rail line connecting the repository to an existing rail line in Nevada. This evaluation is included in the Rail Alignment EIS.

1.3.2 MINA RAIL CORRIDOR

DOE had previously considered, but eliminated the Mina rail corridor from detailed study because a rail line in that corridor could only connect to an existing rail line by crossing the Walker River Paiute Reservation, and the Tribe had informed DOE that it would not allow nuclear waste to be transported across its Reservation (DIRS 182776-Collins 1991, all).

Following review of the scoping comments, DOE held discussions with the Walker River Paiute Tribe and, in May 2006, the Tribal Council informed DOE that it would allow DOE to consider the potential impacts of constructing and operating a rail line to transport spent nuclear fuel and high-level radioactive waste across its Reservation (DIRS 182775-Williams 2006, all). On October 13, 2006, after a preliminary evaluation of the feasibility of the Mina rail corridor, DOE announced its intent to expand the scope of the Rail Alignment EIS to include the Mina rail corridor (71 *FR* 60484).

The analysis of the Mina rail corridor is intended to support DOE conclusions about whether the potential attributes, characteristics, and environmental impacts of constructing and operating a railroad in that corridor are such that DOE should proceed with analyzing specific alignments within the corridor in the Rail Alignment EIS.

However, in May 2007, the Walker River Paiute Tribal Council informed DOE that it was withdrawing its support for the Tribe's participation in the preparation of the Supplemental Rail Corridor EIS and Rail Alignment EIS. The Tribal Council based its decision on a review of information gathered to that time and input from Tribal members. The Tribal Council's resolution also renewed the Tribe's past objection to the transportation of nuclear waste through its Reservation (DIRS 181604-Williams 2007, all). Accordingly, in the Rail Alignment EIS DOE has identified the Mina Implementing Alternative as nonpreferred.

1.3.3 CARLIN, JEAN, AND VALLEY MODIFIED RAIL CORRIDORS

In the Amended Notice of Intent (71 *FR* 60484, October 13, 2006), DOE also announced that it would update, as appropriate, the information and analyses for other rail corridors analyzed in the Yucca Mountain FEIS (Carlin, Jean, and Valley Modified) to identify any significant new circumstances or information relevant to environmental concerns. DOE eliminated the Caliente-Chalk Mountain rail corridor, which would intersect the Nevada Test and Training Range, from detailed study because of U.S. Air Force concerns that a rail line within the Range would interfere with the military's mission; therefore, DOE did not include the Caliente-Chalk Mountain rail corridor in this Nevada Rail Corridor SEIS.

Chapter 5 of this Nevada Rail Corridor SEIS provides updated information and analyses for the Carlin, Jean, and Valley Modified rail corridors.

The updated information and analyses for the Carlin, Jean, and Valley Modified rail corridors are intended to support Departmental conclusions about the status of those corridors and whether, based on environmental considerations, any of those corridors should be further analyzed at the alignment level. In Chapter 6 of this Nevada Rail Corridor SEIS, DOE concludes that there are no significant new circumstances or information relevant to environmental concerns that would warrant further consideration of the Carlin, Jean, or Valley Modified rail corridors at the alignment level. DOE also concludes that the Mina rail corridor warrants further study to determine an alignment for the construction and operation of a railroad.

1.4 Cooperating Agencies

Pursuant to the NWPA, DOE is responsible for the disposal of spent nuclear fuel and high-level radioactive waste to protect public health, safety, and the environment, and for developing and implementing a plan for transporting spent nuclear fuel and high-level radioactive waste to a repository at Yucca Mountain. The Council on Environmental Quality regulations at 40 Code of Federal Regulations (CFR) 1501.6 emphasize agency cooperation early in the NEPA process and allow a lead agency (in this case, DOE) to request the assistance of other agencies that either have jurisdiction by law or have special expertise regarding issues considered in an EIS. The Bureau of Land Management (BLM), the Surface

Transportation Board (STB), and the U.S. Air Force are cooperating agencies in the development of this Nevada Rail Corridor SEIS and the Rail Alignment EIS, pursuant to Council on Environmental Quality Regulations, and have participated in its preparation. Cooperating agencies that could issue decisions concerning the Proposed Action and alternatives to the Proposed Action could adopt this Nevada Rail Corridor SEIS or the Rail Alignment EIS, in whole or in part, and use them as a basis for their decisions. These agencies have management and regulatory authority over lands and resources that would be crossed by or be close to the proposed railroad or they have special expertise related to the Proposed Action.

The Walker River Paiute Tribe, the Bureau of Indian Affairs, and the U.S. Army were cooperating agencies until the Walker River Paiute Tribe withdrew from participating in the EIS process. The Bureau of Indian Affairs and the U.S. Army withdrew as cooperating agencies after the Tribe withdrew.

1.4.1 BUREAU OF LAND MANAGEMENT

The BLM is an agency within the U.S. Department of the Interior and is responsible for administering more than 1 million square kilometers (250 million acres) of public lands, mostly in 12 western states, including Alaska. Congress enacted the Federal Land Policy and Management Act (43 U.S.C. 1701 *et seq*.) "to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development, and enhancement of the public lands; and for other purposes." It is the primary legislation guiding the BLM in its responsibility to manage the public lands and resources in a combination of ways that best serve the present and future needs of the American people.

To construct that portion of the proposed rail line that would cross public land, DOE would obtain a right-of-way from the BLM. BLM regulations at 43 CFR Part 2800 establish the procedures for processing right-of-way applications from federal agencies. The right-of-way application would include public land facilities that would be part of the proposed railroad. The BLM may adopt this Nevada Rail Corridor SEIS and the Rail Alignment EIS, as authorized by the Council on Environmental Quality regulations (40 CFR 1506.3) to satisfy its NEPA requirements for the right-of-way application. ***Right-of-way grants*** on public lands must be consistent with the applicable BLM ***resource management plan***(s). The BLM is a cooperating agency in the preparation of this Nevada Rail Corridor SEIS and the Rail Alignment EIS and could adopt and use the document to process a DOE right-of-way application for access to the public lands that would be required for construction and operation of the proposed railroad. The procedures for BLM adoption of another agency's EIS (*National Environmental Policy Act Handbook*, BLM Handbook H-1790-1; DIRS 182299-BLM 1988, all) specify that the BLM conduct an independent review of the EIS and issue its own Record of Decision. Cooperating agency status provides the BLM the opportunity to work closely with DOE during development of this Nevada Rail Corridor SEIS and the Rail Alignment EIS to encourage a product that meets the NEPA requirements for processing a right-of-way application.

> **Resource management plan:** A land-use plan for public lands as described by the Federal Land Management and Policy Act. Among other things, it establishes land areas for limited, restricted, or exclusive use; allowable resource uses; resource condition goals and objectives; general management practices to achieve the goals; the need for more specific management plans for certain areas; general implementation sequences; and monitoring intervals and standards (43 CFR Part 1610).

1.4.2 SURFACE TRANSPORTATION BOARD

The STB is a regulatory agency that Congress charged with the fundamental missions of resolving railroad rate and service disputes and reviewing proposed railroad construction, acquisitions, mergers, and abandonments. The STB is decisionally independent, although it is administratively affiliated with the U.S. Department of Transportation. The ICC [Interstate Commerce Commission] Termination Act of 1995 (Public Law No. 104-88) created the STB, which is the successor agency to the Interstate Commerce Commission.

The STB has jurisdiction over railroad rate and service issues, and rail structuring transactions such as new line construction, line sales, line abandonments, and railroad mergers. The STB also has jurisdiction over common-carrier rail lines that are part of the interstate rail network. A common-carrier rail line is one that holds itself out to the public for service and has an obligation to provide rail service to any and all shippers that request service along that line.

If the proposed railroad is to be operated as a common-carrier rail line, the Department would have to apply to the STB for a license to construct and operate (certificate of public convenience and necessity). As part of the licensing process, the STB must consider the environmental effects of rail line construction and operation. The STB Section of Environmental Analysis is responsible for preparing the appropriate NEPA documentation for rail line construction and operation cases that come before the STB. Because the STB is a cooperating agency in the preparation of this Nevada Rail Corridor SEIS and the Rail Alignment EIS, these NEPA documents are intended to satisfy the STB Section of Environmental Analysis NEPA obligations.

1.4.3 U.S. AIR FORCE

The mission of the U.S. Air Force, in conjunction with the other armed services, is to preserve the peace and security and provide for the defense of the United States, its Territories, Commonwealths, and possessions, and any U.S.-occupied areas. The U.S. Air Force agreed to become a cooperating agency as a consequence of its jurisdiction over airspace and land associated with the Nevada Test and Training Range that would have been affected by one or more of the potential rail line options (segments) analyzed in this Nevada Rail Corridor SEIS and the Rail Alignment EIS. DOE coordinates with and, at times, obtains approval from the responsible armed service when DOE actions might encroach on U.S. Department of Defense land and potentially affect military operations. Although DOE has decided not to pursue potential rail line options that would have entered the Nevada Test and Training Range, DOE is coordinating with the U.S. Air Force (for example, on the nature, extent, and location of U.S. Air Force overflights) to minimize impacts of the proposed rail line to the U.S. Air Force mission. In addition, the U.S. Air Force offers special expertise associated with portions of the rail corridors near the Nevada Test and Training Range.

1.5 Environmental Impact Statement Process

Council on Environmental Quality regulations (40 CFR Parts 1500 through 1508) that implement the procedural requirements of NEPA, and DOE NEPA regulations (10 CFR Part 1021) provide procedures to use when preparing an EIS. A major emphasis of the EIS process is to promote public awareness of the Proposed Action and its alternatives and to provide opportunities for public involvement. An agency prepares an EIS in a series of steps: (1) by publishing a Notice of Intent to prepare an EIS and implementing a process known as “public scoping,” as further discussed in Section 1.5.1, whereby comments are solicited from federal, state, and local agencies, American Indian tribes and organizations, other organizations, and the general public to assist in defining the proposed action, alternatives, and issues requiring analysis; (2) by preparing a Draft EIS for public review and comment; (3) by preparing a Final EIS that incorporates and responds to all substantive comments received on the Draft EIS; and (4) by preparing a Record of Decision to announce the agency’s decision on a project and explain the reasons for the decision.

1.5.1 DEPARTMENT OF ENERGY NOTICES OF INTENT AND SCOPING MEETINGS

On April 8, 2004, DOE published a Notice of Intent (69 *FR* 18565) announcing that it would prepare an EIS for the alignment, construction, and operation of a railroad (called the rail line in the Notice of Intent) for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. The Notice also announced the schedule for public scoping meetings, and invited and encouraged comments on the scope of the Rail Alignment EIS to ensure that all relevant environmental issues and reasonable alternatives would be addressed. To facilitate the scoping process, in the Notice of Intent DOE identified a preliminary list of issues and environmental resources that might be considered in the Rail Alignment EIS, and specifically invited comments on the following six questions to help define the scope of the EIS:

1. Should additional alternatives be considered that might minimize, avoid, or mitigate adverse environmental impacts (for example, looking beyond the corridor, avoiding Wilderness Study Areas, American Indian Trust Lands, or encroachment on the Nevada Test and Training Range)?
2. Should any of the preliminary alternatives be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. Should DOE allow private entities to ship commercial commodities on its rail line?
5. What mitigation measures should be considered?
6. Are there national security issues that should be addressed?

The scoping comment period began with publication of the Notice of Intent in the *Federal Register* and was originally scheduled to close on May 24, 2004. In response to a request from the State of Nevada, DOE extended the comment period by 7 days, to June 1, 2004 (69 *FR* 22496, April 26, 2004), bringing the total length of the scoping comment period to 55 days. DOE held five public scoping meetings on the Rail Alignment EIS at the following locations on the following dates in Nevada:

- Amargosa Valley – Longstreet Hotel Casino, Nevada State Highway 373, May 3, 2004
- Goldfield – Goldfield Community Center, 301 Crook Street, May 4, 2004
- Caliente – Caliente Youth Center, U.S. Highway 93, May 5, 2004
- Reno – University of Nevada, Reno, Fifteenth and North Virginia, May 12, 2004
- Las Vegas – Cashman Center, 850 North Las Vegas Boulevard, May 17, 2004

In addition to the *Federal Register* notices announcing the meetings, DOE advertised the meetings in five local newspapers that have a total circulation of approximately 250,000; sent four separate press releases to media outlets, industry, and stakeholders; mailed several thousand letters to stakeholders, members of the public, and other interested parties; and distributed over 1,000 handbills in Esmeralda, Lincoln, and Nye Counties.

DOE conducted the public scoping meetings in an open-house format. Members of the public were invited to attend the meetings at their convenience, any time during meeting hours, and submit their comments in writing at the meeting, or in person to a court reporter who was available throughout the meeting. The open-house format provided for one-on-one discussions with DOE representatives responsible for the preparation of the Rail Alignment EIS. Approximately 440 people (number is approximate because some attendees did not sign in) attended the meetings and 86 submitted oral comments (that the court reporters transcribed) on the scope of the EIS.

DOE considered comments received during the scoping comment period on the scope of the Rail Alignment EIS, along with information BLM received, including results of interviews with grazing allotment permittees and other interested parties documented in *Proposed Yucca Mountain Corridor Affected Grazing Permittees* (DIRS 173845-Resource Concepts 2005, all). DOE sponsored an American Indian perspectives document in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document; DIRS 174205-Kane et al. 2005, all) (see section 1.5.3). DOE also considered information obtained through sources such as interviews with officials from Lincoln and Nye Counties.

On October 13, 2006, after a preliminary evaluation of the feasibility of the Mina rail corridor (DIRS 180222-BSC 2006, all), DOE announced its intent to expand the scope of the Rail Alignment EIS to include the Mina rail corridor as an alternative (*Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV;* 71 *FR* 60484). DOE specifically invited comments on the following four questions relative to the Mina rail corridor to help define the scope of the analysis:

1. Should additional alternative alignments (now called alternative segments) be considered that might minimize, avoid, or mitigate adverse environmental impacts (for example, looking beyond the Mina rail corridor, avoiding environmentally sensitive areas)?
2. Should any of the preliminary alternatives be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. What mitigation measures should be considered?

In addition, DOE indicated interest in identifying any significant changes to, or significant new information relevant to, the rail corridors analyzed in the Yucca Mountain FEIS.

The second scoping comment period began with publication of the Amended Notice of Intent in the *Federal Register* and was originally scheduled to close on November 27, 2006. In response to requests from the public, DOE extended the comment period by 15 days, to December 12, 2006 (71 *FR* 65785, November 9, 2006), bringing the total length of the scoping comment period to 61 days. DOE held eight public scoping meetings during the second public scoping period at the following locations on the following dates in Nevada and Washington, D.C.:

- Washington, D.C. – L'Enfant Plaza Hotel, 480 L'Enfant Plaza, SW, October 30, 2006
- Amargosa Valley – Longstreet Hotel Casino, Nevada State Highway 373, November 1, 2006
- Las Vegas – Cashman Center, 850 North Las Vegas Boulevard, November 2, 2006
- Caliente – Caliente Youth Center, U.S. Highway 93, November 8, 2006
- Goldfield – Goldfield School Gymnasium, Hall and Euclid, November 13, 2006
- Hawthorne – Hawthorne Convention Center, 932 E. Street, November 14, 2006
- Fallon – Fallon Convention Center, 100 Campus Way, November 15, 2006
- Reno – University of Nevada, Reno, Lawlor Event Center, 1500 N. Virginia Street, November 27, 2006

In addition to the *Federal Register* notices announcing the meetings, DOE advertised the meetings in eight local newspapers, including the *Washington Post*. Total circulation of the newspapers is approximately 280,000 plus an additional 750,000 for the *Washington Post*. DOE sent four separate press releases to media outlets, industry, and stakeholders; mailed several thousand letters to stakeholders, members of the public, and other interested parties; and distributed over 1,300 handbills in Washoe, Churchill, Lyon, Mineral, Esmeralda, Lincoln, and Nye Counties.

DOE conducted the public scoping meetings in an open-house format. Members of the public were invited to attend the meetings at their convenience, any time during meeting hours, and submit their comments in writing at the meeting, or in person to a court reporter who was available throughout the meeting. The open-house format provided for one-on-one discussions with DOE representatives responsible for the preparation of this Nevada Rail Corridor SEIS and the Rail Alignment EIS. Approximately 330 people (number is approximate because some attendees did not sign in) attended the meetings, and 63 submitted oral comments (that the court reporters transcribed) on the scope of the expanded NEPA analysis.

1.5.2 PUBLIC SCOPING COMMENTS

DOE received more than 4,100 comments during the first public scoping period for the Rail Alignment EIS, and some after the close of the scoping period. DOE summarized all comments received in *Summary of Public Scoping Comments, Related to the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV* (DIRS 176463-Craig, Lechel, and Morton 2004, all) and considered the content of all substantive comments in determining the scope of the Rail Alignment EIS. During this scoping period, DOE also received comments suggesting that other rail corridors be considered in the Rail Alignment EIS, in particular the Mina corridor. Compelling arguments were presented in comments that the Mina rail corridor should be given a full evaluation.

The scoping period for this expanded NEPA document (this Nevada Rail Corridor SEIS and the Rail Alignment EIS) began on October 13, 2006, and ended on December 12, 2006. DOE received approximately 790 comments during this second public scoping period, and some comments after the close of the scoping period. DOE summarized all comments received (including those submitted after the close of the scoping period) in *Summary of Public Scoping Comments on the Expanded Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV* (DIRS 181379-DOE 2007, all) and considered the content of all comments in determining the scope of this expanded NEPA analysis.

Many of the comments received were applicable to this expanded EIS, including the Mina rail corridor, and the review of the Carlin, Jean, and Valley Modified rail corridors (Nevada Rail Corridor SEIS). Other comments related to the Repository SEIS (DOE/EIS-0250F-S1).

Table 1-1 summarizes the public scoping comments DOE received during both scoping periods held in 2004 and 2006, as they relate to corridor identification and evaluation.

1.5.3 TRIBAL INTERACTIONS MEETINGS

In 1987, DOE initiated the Native American Interaction Program to solicit input from and interact with tribes and organizations on the characterization of the Yucca Mountain Site and the possible construction and operation of a repository. These tribes and organizations—Southern Paiute; Western Shoshone; and Owens Valley Paiute and Shoshone people from Arizona, California, Nevada, and Utah—have cultural and historic ties to both the Yucca Mountain area and to the larger region that includes portions of the Mina rail corridor as well as the Carlin, Jean, and Valley Modified rail corridors.

Table 1-1. Public comments specific to this Nevada Rail Corridor SEIS resulting from the 2004 and 2006 scoping periods (page 1 of 3).

Comment Issue	Scoping comment summary	DOE comment summary response
Basis of corridor selection	Commenters sought clarification for, or questioned the basis of, the DOE decision to select the Caliente corridor. Commenters also questioned the basis for not selecting the other corridors such as Valley Modified or Caliente Chalk-Mountain.	On December 29, 2003, DOE announced it preference for the Caliente corridor (68 *FR* 74951). In that announcement, the Department also announced the Carlin corridor as its secondary preference. On April 8, 2004, the Department issued a *Federal Register* Notice that documented the detailed bases for the rail corridor decision. In large part the decision was based on the preference to avoid and minimize crossing of private lands.
Scope of Rail Alignment EIS	Two commenters suggested that before completing the comparative analysis of impacts of the Caliente, Mina, and No-Action Alternatives, DOE should update and distribute in draft form its comparative analysis of all previously considered rail routes (Carlin, Jean, and Valley Modified). This report should be the basis for development of the EIS and be a justification for inclusion or elimination of a particular route.	In its October 13, 2006, *Federal Register* Notice (71 *FR* 60484), DOE announced its intent to expand the scope of the Environmental Impact Statement for the Alignment Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV. Part of the intended expanded scope of the EIS was to proceed with the review of the environmental analyses presented in the Yucca Mountain FEIS for the Carlin, Jean, and Valley Modified corridors along with changes in the affected environment. As appropriate the environmental information and analyses were updated. This information is presented in Chapter 5 of this Nevada Rail Corridor SEIS.
Carlin corridor	A few commenters preferred the Carlin rail corridor to either the Mina or Caliente rail corridor because Carlin would be more protected and have less chance of sabotage. The EIS should address the concerns raised by Eureka County in its 2001 report on the Carlin rail corridor (see www.yuccamountain.org/impact_report/impact01.htm). Activities at Barrick Gold Mines' property in Crescent Valley have increased substantially since the Yucca Mountain FEIS was released. Other mining activities are occurring near Beowawe and it's possible that this part of Eureka County could one day rival the famous Carlin trend farther east near Elko.	The environmental information and analyses for the Carlin corridor have been reviewed and updated as appropriate. Based on these reviews and updates, the Department had found that for the most part, the environmental conditions and associated environmental impacts for each of the original corridors, including Carlin, remain unchanged from, or are substantially similar to, those reported in the Yucca Mountain FEIS. A DOE alignment-level evaluation of potential impacts from possible sabotage indicated that such impacts would not be a discriminator in the selection of a rail alignment; and therefore, would not be a discriminator in the selection of a rail corridor. Potential impacts from possible sabotage would be the same for any corridor. DOE acquired the cited Eureka County report and factored the information provided into its review of the Carlin corridor. Changes as appropriate can be found in Section 5.2 of this Nevada Rail Corridor SEIS. DOE noted that potential land use conflicts in the Carlin corridor have increased since publication of the Yucca Mountain FEIS.
Jean corridor	One commenter preferred the Jean Corridor because it would be the least expensive to construct.	DOE reviewed and updated the environmental information and impact analyses reported in the Yucca Mountain FEIS, as appropriate. DOE found that potential land-use conflicts and air quality concerns have increased since the Department completed the Yucca Mountain FEIS conflicts.

Table 1-1. Public comments specific to this Nevada Rail Corridor SEIS resulting from the 2004 and 2006 scoping periods (page 2 of 3).

Comment Issue	Scoping comment summary	DOE comment summary response
Valley Modified corridor	The EIS should consider substantial changes that have occurred elsewhere in Clark County relative to the Department's continued consideration of routes other than Mina and Caliente. Annexation of land by both the City of North Las Vegas and the City of Henderson, as well as privatization of BLM lands in the valley, have resulted in substantial real and planned changes since issuance of the Yucca Mountain FEIS. The development of the Ivanpah Airport in the southwestern part of Clark County should also be taken into consideration when evaluating both rail and truck routes.	DOE reviewed land-use changes for the Carlin, Jean, and Valley Modified rail corridors and updated that information. Section 5.4.1 of this Nevada Rail Corridor SEIS reports updated land-use information for the Valley Modified rail corridor; the Ivanpah Airport is addressed under several resource categories.
Changes in land use in Las Vegas and Clark county since 2002	The EIS should consider the many land-use changes that have occurred in the Las Vegas Metropolitan area since the Yucca Mountain FEIS was released. For example, as of June 2006, there were 105 projects planned or being built within 1 mile of the existing Union Pacific Railroad, I-15, State Route 160, and the beltway. Within this area are 132,951 housing units and 33,368,223 square feet of commercial property.	DOE reviewed land-use changes for the Carlin, Jean, and Valley Modified rail corridors and updated that information. Section 5.4.1 of this Nevada Rail Corridor SEIS reports updated land-use information for the Valley Modified rail corridor; the Ivanpah Airport is addressed under several resource categories.
Chalk Mountain corridor	Several commenters suggested that national security concerns by themselves should not have eliminated the Caliente Chalk-Mountain corridor.	In a letter to the U.S. Air Force (dated December 1, 2004), DOE eliminated from detailed study alignments within the Caliente rail corridor that would intersect the Nevada Test and Training Range because of concerns regarding military readiness testing and training activities. This letter was in response to a May 28, 2004, letter from the U.S. Air Force. DOE based its decision not to provide updates for the Caliente-Chalk Mountain rail corridor on the same rationale.

Table 1-1. Public comments specific to this Nevada Rail Corridor SEIS resulting from the 2004 and 2006 scoping periods (page 3 of 3).

Comment Issue	Scoping comment summary	DOE comment summary response
Suggested new routes and routes eliminated in 2002	Several commenters suggested new rail line routes to Yucca Mountain and alternatives to rail transport. One person suggested a new rail corridor originating from Baker, California, and extending through Death Valley Junction to Yucca Mountain. According to the commenter, this corridor would be shorter than the Mina rail corridor and easier to construct. Another commenter said that a rail route through the Tonopah Test Range would be reasonable considering that the Range will be closing in 2010. Another person suggested a rail route from Fallon southward through Gabbs Valley. Another person said that a route through the Nevada Test Site should be used, along with part of the Caliente corridor. One person questioned why the shortest distance to Yucca Mountain, via a 100-mile-long rail line through the Las Vegas Valley, was not being considered. One person suggested that all possible corridors to Yucca Mountain be considered in the EIS (such as one from Barstow, California, and Apex, Nevada), including those previously examined in the Yucca Mountain FEIS. One commenter requested that DOE study the Feather River rail line as an alternative to the Donner Pass rail line that passes through Reno. One commenter said that DOE should eliminate those routes that had already been eliminated in the Yucca Mountain FEIS, and focus only on the Mina and Caliente rail corridors. According to this commenter, there is no reason for DOE to reconsider in this EIS its decision that the Caliente corridor is preferred to the other four corridors previously evaluated; to do so would add unnecessary cost and complexity to preparation of the ongoing EIS and delay its issuance.	Most of the routes suggested in these scoping comments were eliminated from consideration for reasons similar to those for eliminating routes considered in the 1990 *Preliminary Rail Access Study* (DIRS 104792-1990, all). Over the years, DOE has evaluated numerous rail corridor modes for transporting spent nuclear fuel and high-level radioactive was to Yucca Mountain. Before DOE prepared the Yucca Mountain FEIS, the Department identified 10 potential rail line routes to Yucca Mountain (Valley, Arden, Crucero, Ludlow, Mina, Caliente, Carlin, Cherry Creek and Dike) in the 1990 *Preliminary Rail Access Study* (DIRS 104792-1990, all). Options within each route were developed wherever possible. The routes were chosen to maximize the use of federal lands, provide access to regional rail carriers, avoid obvious land-use conflicts, and meet current rail line engineering practices. After the development of these rail routes, Lincoln County and the City of Caliente identified three additional routes (identified as Lincoln County Routes A, B, and C). DOE evaluated the 10 rail line routes plus Lincoln County A, B, and C, for a total of 13 routes. In 1995 DOE reevaluated the routes in the *Nevada Potential Repository Preliminary Transportation Strategy, Study* 1 (DIRS 104795-CRWMS M&O 1995, all) and in the second part of the study in 1996 (DIRS 101214-CRWMS M&O 1996, all). One new route, Valley Modified, was added in the 1995 study based on updated information from the Bureau of Land Management. Three additional alignments – Caliente-Chalk Mountain, Elgin/Rox, and Hancock Summit-were evaluated in the *Nevada Potential Repository Preliminary Assessment of the Caliente-Chalk Mountain Rail Corridor* (DIRS 132219- CRWMS M&O 1997, all). The evaluation reviewed each potential rail corridor to identify land-use issues and access to regional carriers. The evaluations compared other factors for the routes, including favorable topography and avoidance of lands withdrawn from public use by federal action. DOE eliminated the Valley, Arden, Crucero, Ludlow, Mina, Cherry Creek, Dike, Elgin/Rox, Hancock Summit, and Lincoln County A, B, and C rail routes from further study. In 1995 (DIRS 104795-CRWMS M&O 1995, all) and 1996 (DIRS 101214-CRWMS M&O 1996, all) studies DOE determined that the Mina and Cherry Creek rail corridors should be assigned a status of "Eliminated from Detailed Evaluation – Monitor." For the most part, the environmental conditions and associated potential environmental impacts for each rail corridor remain unchanged from, or are substantially similar to, those considered in the Yucca Mountain FEIS. For these reasons, DOE concludes there are no significant new circumstances or information relevant to environmental concerns that would warrant further consideration of these three rail corridors at the alignment level. DOE did not update the information and analysis for the Caliente-Chalk Mountain rail corridor.

The Native American Interaction Program concentrates on the protection of cultural resources at Yucca Mountain and contributes to a government-to-government relationship with the tribes and organizations. Its purpose is to help DOE comply with various federal laws and regulations, including the American Indian Religious Freedom Act (42 U.S.C. 1996); the Archaeological Resources Protection Act (16 U.S.C. 470aa et seq.); the National Historic Preservation Act (16 U.S.C. 470 et seq.); the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001); the American Indian and Alaska Native Tribal Government Policy; DOE Order 1230.2, American Indian and Tribal Government Policy; Executive Order 13007, Indian Sacred Sites, and Executive Order 13084, Consultation and Coordination with Indian Tribal Governments. These regulations and Executive Orders mandate the protection of archaeological sites and cultural items and require agencies to include American Indians and federally recognized tribes in discussions and interactions on major federal actions.

Initial ethnographic studies identified three tribal groups – the Southern Paiute, the Western Shoshone, and the Owens Valley Paiute and Shoshone – whose cultural heritage includes the Yucca Mountain region. Additional ethnographic efforts eventually led to the involvement of 17 tribes and organizations in the Yucca Mountain Project American Indian and cultural resource studies.

The 17 tribes and organizations have formed the Consolidated Group of Tribes and Organizations, which consists of tribal representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. A major priority of the Group has been the protection of cultural resources and environmental restoration at Yucca Mountain. Members of the Consolidated Group of Tribes and Organizations have participated in many ethnographic interviews and have provided DOE valuable insights into American Indian cultural and religious values and beliefs. These interactions have produced several reports that record the regional history of American Indian people and the interpretation of American Indian cultural resources in the Yucca Mountain region. On June 2, 2004, DOE met with the Consolidate Group of Tribes and Organizations to introduce the rail alignment project and learn of its members' concerns.

In October 2004, a group of designated tribal representatives participated with DOE representatives in a field reconnaissance trip along the proposed rail alignment, followed by a meeting with the consolidated group in late November 2004. Based on these efforts, these tribal representatives known as the American Indian Writers Subgroup, a subgroup of the Consolidated Group of Tribes and Organizations, prepared the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all). This document provides insight into American Indian viewpoints and concerns regarding cultural resources along the Caliente rail alignment and long-term impacts of the DOE selection of a rail system to transport spent nuclear fuel and high-level radioactive waste to a geologic repository at Yucca Mountain, Nevada. This document is a supplement to the American Indian Writers Subgroup document produced in 1998 titled *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement* (DIRS 102043-AIWS 1998, all).

In July 2005, DOE held a tribal update meeting with the Consolidated Group of Tribes and Organizations. The rail alignment project and the document prepared by the American Indian Writers Subgroup were topics of discussion. In September 2005, DOE held a special meeting with the Group for discussions on the Environmental Assessment associated with a DOE request for the Public Land Order and associated regulatory actions. In April 2006, DOE again met with the American Indian Writers Subgroup for continued discussions and updates on the Caliente rail alignment. After each meeting the tribal representatives prepared a series of recommendations for DOE consideration. DOE received recommendations, categorized them, and assigned personnel to respond to the recommendations. On November 29, 2006, DOE met with the Group to present the proposed inclusion of the Mina rail corridor for analysis in this Nevada Rail Corridor SEIS and in the Rail Alignment EIS and to provide an update on the ongoing analysis of the Caliente rail alignment.

DOE met with Walker River Paiute tribal representatives on several occasions in 2006 and 2007 to discuss their interest in allowing DOE to evaluate a potential rail corridor, the Mina rail corridor, which would cross the Walker River Paiute Reservation. Tribal members toured the Yucca Mountain Site and attended scoping meetings.

1.6 Relationship to Other Environmental Documents

On October 13, 2006, the Department announced its intent to prepare a Supplement to the Yucca Mountain FEIS (DOE/EIS-0250F-S1), consistent with the NEPA and the NWPA, to evaluate the potential environmental impacts of the current repository design and operational plans (71 *FR* 60490). The primary purpose of the Repository SEIS is to assist the U.S. Nuclear Regulatory Commission in adopting, to the extent practicable, any EIS prepared pursuant to Section 114(f)(4) of the NWPA. As stated in the Foreword to this Nevada Rail Corridor SEIS and the Rail Alignment EIS, the Repository SEIS supplements the Yucca Mountain FEIS in its entirety, except for those transportation-related elements that were eliminated from the Department's Proposed Action (such as the mostly legal-weight truck scenario) by the 2004 Record of Decision. Therefore, under the Repository SEIS Proposed Action, DOE would construct, operate and monitor, and eventually close a repository at Yucca Mountain.

During repository operations, most shipments of spent nuclear fuel and high-level radioactive waste would arrive at the repository by rail, and in Nevada such shipments would be via a rail line constructed within either the Caliente or the Mina rail corridors. Accordingly, the Repository SEIS analyzes the potential environmental impacts from the construction, operation, and closure of the repository, and updates the analysis of the impacts of shipping most spent nuclear fuel and high-level radioactive waste by rail.

This Nevada Rail Corridor SEIS supplements the Yucca Mountain FEIS, to the extent that it analyzes the potential impacts of constructing and operating a rail line to connect the Yucca Mountain repository site to an existing rail line near Wabuska, Nevada (in the Mina rail corridor). This Nevada Rail Corridor SEIS analyzes the Mina rail corridor at a level of detail commensurate with that of the rail corridors analyzed in the Yucca Mountain FEIS. It also updates relevant information regarding the other rail corridors analyzed in the Yucca Mountain FEIS (Carlin, Jean, and Valley Modified) to identify any significant new circumstances or information relevant to environmental concerns.

The Rail Alignment EIS tiers from the broader corridor analysis in the Yucca Mountain FEIS and in this Nevada Rail Corridor SEIS. Under the Rail Alignment EIS Proposed Action, DOE analyzes the potential impacts of specific common segments and alternative segments within the Caliente and Mina rail corridors for the purpose of determining an alignment in which to construct and operate a railroad for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from an existing rail line in Nevada to a geologic repository at Yucca Mountain.

The Repository SEIS, this Nevada Rail Corridor SEIS, and the Rail Alignment EIS are related to the extent that the potential transportation impacts associated with shipments to the repository are part of the total impacts associated with the Repository SEIS Proposed Action. Thus, the Repository SEIS incorporates by reference the rail alignment impact evaluations of the Rail Alignment EIS to ensure that the Repository SEIS considers the full scope of potential environmental impacts associated with its Proposed Action. Moreover, because the potential transportation impacts associated with shipments to the repository are part of the total impacts associated with the Repository SEIS Proposed Action, the Rail Alignment EIS considers potential impacts from constructing the repository as a reasonably foreseeable future action in its cumulative impacts analysis. To ensure consistency, the Repository SEIS, this Nevada Rail Corridor SEIS, and the Rail Alignment EIS use the same inventory of spent nuclear fuel and high-level radioactive waste and the same number of rail shipments for analysis. Thus, the associated occupational and public health and safety impacts within the Nevada rail corridors under consideration are the same in all three NEPA analyses. Furthermore, to promote conformity, in both EISs DOE used consistent analytical approaches to evaluate the various resource areas where appropriate.

A number of completed, in-preparation, or proposed DOE NEPA-related documents relate to this Nevada Rail Corridor SEIS. In addition, other federal agencies have prepared related documents. Consistent with Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR Parts 1500 through 1508), DOE has used information from these documents in its analysis and has incorporated this material by reference as appropriate throughout this Nevada Rail Corridor SEIS. Table 1-2 lists these documents.

Table 1-2. NEPA documentation related to the proposed rail corridor (page 1 of 3).

Document	Relationship to this Nevada Rail Corridor SEIS
DOE documents	
Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada. Las Vegas, Nevada: U.S. Department of Energy, Nevada Field Office. 1996 (DOE/EIS-0243).	Examines the impacts from the continued operations of the Nevada Test Site.
Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-site Locations in the State of Nevada: U.S. Department of Energy, Nevada Field Office (DOE/EIS-0243-SA-01)	Documents the affected environment in 2002 and discusses any changes from the 1996 site-wide EIS (DOE/EIS-0243. Provides the status of new programs as of 2002.
Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, U.S. Department of Energy (DOE/EIS-0250F).	Examines the impacts of construction, operation, monitoring, and eventual closure of a geologic repository at Yucca Mountain. Examines the potential impacts of transporting spent nuclear fuel and high-level radioactive waste nationally and in the State of Nevada.
Notice of Preferred Nevada Rail Corridor (68 *FR* 74951, December 29, 2003).	Announces the Caliente rail corridor, from the five rail corridors studied in the Yucca Mountain FEIS, as the DOE preferred rail corridor in which to construct a rail line.
Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (69 *FR* 18557, April 8, 2004).	Selects the mostly rail scenario analyzed in the Yucca Mountain FEIS as the mode of transportation on a national basis and within the State of Nevada. Selects the Caliente rail corridor for alignment, construction, and operation of a proposed railroad to Yucca Mountain.
Notice of Intent to Prepare an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV (68 *FR* 18565, April 8, 2004).	Announces DOE intent to prepare an EIS for the alignment, construction, and operation of a railroad for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada to a geologic repository at Yucca Mountain, Nye County, Nevada.
Environmental Assessment for the Proposed Withdrawal of Public Lands within and Surrounding the Caliente Corridor, U.S. Department of Energy, (DOE/EA-1545).	Examines the environmental impacts of withdrawing public lands from surface and mineral entry for up to 20 years to allow evaluation of the land for the proposed rail corridor.
Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV (71 *FR* 60484, October 13, 2006).	Announced DOE intent to expand the scope of the Rail Alignment EIS to include the Mina rail alignment.

Table 1-2. NEPA documentation related to the proposed rail corridor (page 2 of 3).

Document	Relationship to this Yucca Mountain Nevada Rail Corridor SEIS
DOE documents (continued)	
Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS-0250F-S1).	Updates the Yucca Mountain FEIS and examines the impacts of construction, operation, monitoring, and eventual closure of a geologic repository at Yucca Mountain. Examines the potential impacts of transporting spent nuclear fuel and high-level radioactive waste nationally.
Notice of Availability of the Draft Environmental Assessment for the Proposed Infrastructure Improvements for the Yucca Mountain Project, Nevada, U.S. Department of Energy (71 *FR* 38391, July 6, 2006).	DOE released a Draft Environmental Assessment (EA) in 2006 that evaluated several proposed improvements to infrastructure at the Yucca Mountain Repository Site and adjacent portions of the Nevada Test Site. Proposed infrastructure improvements that were analyzed in the Draft EA are being analyzed in the Yucca Mountain Repository Supplemental EIS. Hence, a Final Infrastructure EA will not be published.
Notice of Intent to Prepare a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement-Complex 2030 (71 *FR* 61731, October 19, 2006).	Announced DOE intent to prepare a supplement to the Stockpile Stewardship and Management Programmatic EIS to analyze the environmental impacts from continued transformation of the United States' nuclear weapons complex.
Notice of Intent to Prepare an Environmental Impact Statement for the Disposal of Greater-Than-Class-C Low-Level Radioactive Waste (72 *FR* 40135, July 23, 2007).	Announced DOE intent to prepare an EIS to evaluate disposal options for Greater-Than-Class-C low-level radioactive waste.
Notice of Intent to Prepare a Programmatic Environmental Impact Statement-Designation of Energy Corridors on Federal Land in 11 Western States, (70 *FR* 56647, September 28, 2005).	DOE is preparing an EIS as a co-lead agency with the BLM and other cooperating agencies to evaluate the impacts of designating corridors in the Western U.S. for use as electric transmission, communications, and natural gas transmission corridors. Potential corridors cross Nevada.
Other agency documents	
Proposed Tonopah Resource Management Plan and Final Environmental Impact Statement (DIRS 101523-BLM 1994, all).	Examines implementation of BLM management goals and actions in the Tonopah area.
Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement. (DIRS 176043-BLM 1998, all).	Examines implementation of BLM management goals and actions in the Las Vegas area.
Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada (68 *FR* 74965, December 29, 2003).	Announced the BLM receipt of a request from DOE to withdraw public land in the Caliente corridor from surface and mineral entry for a period of 20 years to evaluate the land for the potential construction, operation, and maintenance of a rail corridor for the transportation of spent nuclear fuel and high-level radioactive waste in Nevada. Segregates the land from surface and mineral entry for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.
Draft - Resource Management Plan/Environmental Impact Statement for the Ely District (DIRS 174518-BLM 2005, all).	Examines implementation of BLM resource management plans, actions, and goals in the Ely area.
Final Environmental Impact Statement: Weber Dam Repair and Modification Project, (DIRS 182302-Bureau of Indian Affairs 2005, all).	Examines potential environmental impacts to the Walker River from repair and modification of the Weber Dam.

Table 1-2. NEPA documentation related to the proposed rail corridor (page 3 of 3).

Document	Relationship to this Yucca Mountain Nevada Rail Corridor SEIS
Public Land Order No. 7653; Withdrawal of Public Lands for the Department of Energy to Protect the Caliente Rail Corridor, Nevada (70 *FR* 76854, December 28, 2005).	Withdraws public lands within the Caliente rail corridor from surface and mineral entry, subject to valid existing rights, for 10 years to allow DOE to evaluate the lands for the potential construction, operation, and maintenance of a rail corridor.
Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada (72 *FR* 1235, January 10, 2007).	Announced BLM receipt of an application from DOE to withdraw public lands from surface and mineral entry through December 27, 2015, to evaluate the lands for the potential construction, operation, and maintenance of a rail line. This covers the Mina rail alignment and segments of the Caliente rail alignment not covered in Public Land Order No. 7653. Segregates the land from surface and mineral entry for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.
Notice of Intent to "Prepare a Comprehensive Conservation Plan and Associated Environmental Impact Statement for the Desert National Wildlife Refuge Complex" (67 *FR* 54229, August 21, 2002).	The U.S. Fish and Wildlife Service manages the Desert National Wildlife Refuge in Southern Nevada. Part of the Valley Modified rail corridor would pass near the refuge.

a. BLM = Bureau of Land Management; DOE = U.S. Department of Energy; EA = environmental assessment; EIS = environmental impact statement; FEIS = final environmental impact statement; *FR* = *Federal Register*.

2. PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action and the No-Action Alternative analyzed in this Nevada Rail Corridor SEIS. Section 2.2 describes the Proposed Action. Section 2.3 describes the No-Action Alternative. Section 2.4 summarizes the potential environmental impacts under the Proposed Action for the Mina rail corridor.

Glossary terms are shown in ***bold italics***.

2.1 Introduction

This Nevada Rail Corridor SEIS analyzes a ***Proposed Action*** and a ***No-Action Alternative***. It supplements the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS; DOE/EIS-0250F; DIRS 155970-DOE 2002, all), to the extent that it analyzes the potential impacts of constructing and operating a railroad to connect the Yucca Mountain Site to an existing rail line near Wabuska, Nevada, within the Mina rail corridor. Under the Proposed Action, the U.S. Department of Energy (DOE or the Department) has analyzed in this Nevada Rail Corridor SEIS the Mina rail corridor at a level of detail commensurate with that of the rail corridors (Caliente, Caliente-Chalk Mountain, Carlin, Jean, and Valley Modified) analyzed in the Yucca Mountain FEIS. This Nevada Rail Corridor SEIS further provides updated information on the Carlin, Jean, and Valley Modified rail corridors (see Chapter 5 of this Nevada Rail Corridor SEIS). DOE eliminated the Caliente-Chalk Mountain rail corridor, which would cross part of the Nevada Test and Training Range, from further consideration because of U.S. Air Force concerns that a rail line would interfere with military mission activities (see Section 1.3 of this Nevada Rail Corridor SEIS).

Council on Environmental Quality and DOE regulations that implement the provisions of the National Environmental Policy Act (NEPA) require consideration of the alternative of no action. Under the No-Action Alternative in this Nevada Rail Corridor SEIS, DOE would not select a rail alignment within the Mina rail corridor for the construction and operation of a railroad. As such, the No-Action Alternative provides a basis for comparison to the Proposed Action.

This Nevada Rail Corridor SEIS also analyzes a Shared-Use Option for the Mina rail corridor under which DOE would allow commercial shippers to use the railroad for shipments of general freight.

2.2 Proposed Action

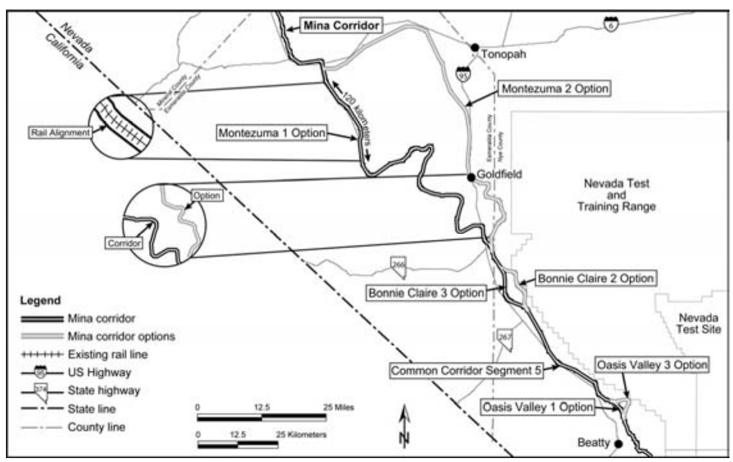
The Proposed Action in this Nevada Rail Corridor SEIS is to construct and operate a railroad within the Mina rail corridor to connect the Yucca Mountain repository to an existing rail line near Wabuska, Nevada. The purpose of this railroad would be to transport, in Nevada, spent nuclear fuel and high-level radioactive waste and other materials for repository constructions and operations to the Yucca Mountain Site.

The Proposed Action includes construction and operation of a railroad and the infrastructure necessary to support the construction and operation of a railroad within the Mina rail corridor. Construction would occur primarily within the rail corridor right-of-way and would require obtaining water, ballast, subballast, steel for bridges, concrete ties, and rail. DOE would first construct a rail roadbed and then track construction would occur. The rail roadbed would form the base upon which the ballast, concrete ties, and rail would be laid. Track construction would include the placement of concrete ties, rail, and ballast on top of the rail roadbed and establishing power and communication systems. DOE would also need to construct bridges, place ***culverts***, and create ***at-grade*** and ***grade-separated crossings*** along the rail line.

In this Nevada Rail Corridor SEIS, DOE analyzes construction of a rail line in the Mina rail corridor. During the construction and operations phases, certain support facilities and access features (for example, a staging yard and access roads) would be needed, and those are addressed insofar as information is available for this corridor-level analysis. However, DOE does not consider impacts from construction and operations support facilities a discriminator at the corridor level. A detailed analysis of construction and operations support facilities, including their locations, is provided in the Rail Alignment EIS.

On April 8, 2004 (69 *FR* 18557), the Department issued a ***Record of Decision*** announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain FEIS as the primary means of transporting spent nuclear fuel and high-level radioactive waste to the repository. In the same Record of Decision, the Department also selected the Caliente rail corridor from several corridors considered in the Yucca Mountain FEIS as the corridor in which to study possible alignments for a rail line. The Proposed Action in this Nevada Rail Corridor SEIS does not change the Department's decision to select the mostly rail scenario nor the selection of the Caliente rail corridor in which to study possible alignments for a rail line.

TERMS RELATED TO THE PROPOSED ACTION IN THIS NEVADA RAIL CORRIDOR SEIS



Rail corridor – A strip of land 400 meters (0.25 mile) wide through which DOE would identify an alignment for the construction of a railroad in Nevada to a geologic repository at Yucca Mountain.

Rail alignment – A strip of land less than 400 meters (0.25 mile) wide through which the location of a rail line would be identified. In the Rail Alignment EIS, the location of a rail line within a rail corridor.

Option – In the Yucca Mountain FEIS the terms for describing separate routes within a corridor were alternates, variations and options. For this Nevada Rail Corridor SEIS, only option is used and is applied more generally; option refers to a strip of land from one point along a corridor to another point on the same corridor that provides a different route.

Common corridor segment - Geographic region for which a single route has been identified.

2.2.1 MINA RAIL CORRIDOR

The Mina rail corridor is about 450 kilometers (280 miles) in length; however, construction of new rail line would range between about 386 kilometers (240 miles) and 409 kilometers (254 miles) because the corridor includes existing Department of Defense rail line between Wabuska and the Hawthorne Army Depot in Hawthorne, Nevada (DIRS 180222-BSC 2006, p. 5). Figure 2-1 shows the Mina rail corridor and its options.

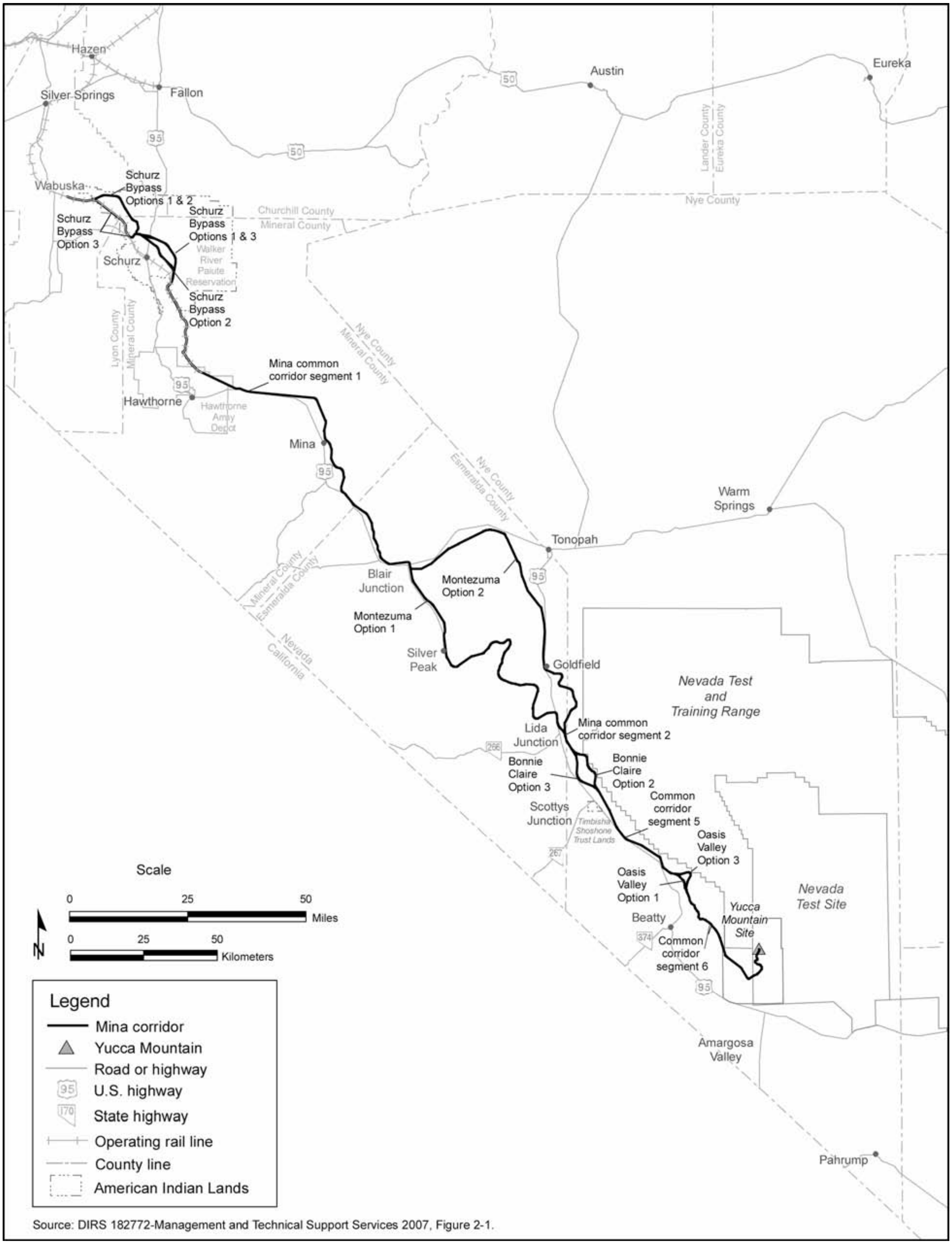


Figure 2-1. Mina rail corridor and options (pre-scoping, October 2006).

In the summer of 2006, DOE initiated a study to consider the feasibility of the Mina rail corridor and to identify specific common corridor segments and associated preliminary options (DIRS 180222-BSC 2006, all). In this feasibility study the Department identified rail line options on the Walker River Paiute Reservation to bypass Schurz, around the Montezuma Range, north of Scottys Junction (referred to as Bonnie Claire), and in Oasis Valley.

The Mina rail corridor originates at an existing rail line near Wabuska, Nevada, where it proceeds southeasterly through Hawthorne, to Blair Junction, and then on to Lida Junction. The construction of the new rail line from Hawthorne south would follow an abandoned rail line nearly to Yucca Mountain. At Lida Junction, the rail corridor trends southeasterly through Oasis Valley before turning north-northeast to Yucca Mountain. Sections 2.2.1.1 through 2.2.1.9 describe the Mina rail corridor common corridor segments and options.

2.2.1.1 Department of Defense Branchline

The Mina rail corridor would begin near Wabuska, Nevada, east of the Fort Churchill Siding on the Department of Defense rail line. The rail corridor proceeds southeast to a point about 29 kilometers (18 miles) northwest of the Town of Schurz. The Department of Defense Branchline is about 8 kilometers (5 miles) long (DIRS 180222-BSC 2006, p. 9). The rail corridor then crosses the Walker River Paiute Reservation, along one of three options that would bypass the town of Schurz.

2.2.1.2 Schurz Bypass Options

A May 2006 letter from the Tribal Council for the Walker River Paiute Tribe (DIRS 182775-Williams 2006, all) indicated that if DOE were to build a new rail line through the Reservation, the Tribe would prefer that the rail line avoid the town of Schurz. At present, an existing rail line travels through the middle of town. In response to the Tribe’s letter, DOE identified three options to bypass Schurz, as shown in Figure 2-2. All the Schurz bypass options would cross the Walker River and the Walker River Paiute Reservation.

Schurz bypass option 1 would begin at the existing Department of Defense Branchline about 29 kilometers (18 miles) northwest of Schurz and pass along the eastern side of Sunshine Flat. From there, it would pass east of Weber Reservoir and cross U.S. Highway 95 about 8 kilometers (5 miles) north of the intersection of U.S. Highway 95 and Alternate U.S. Highway 95. Schurz bypass 1 would be about 51 kilometers (32 miles) long and would reconnect with the Department of Defense Branchline about 13 kilometers (8 miles) south of Schurz (DIRS 180222-BSC 2006, pp. 9 and 27).

Schurz bypass option 2 would begin at the existing Department of Defense Branchline at the same point as Schurz bypass option 1. From there, it would pass east of Weber Reservoir and cross U.S. Highway 95 about 6.4 kilometers (4 miles) north of the intersection of Highway 95 and Alternate U.S. Highway 95. From there, it would trend to the southeast but stay to the east of Schurz and west of the location of Schurz bypass option 1 until it rejoined the existing Department of Defense Branchline about 13 kilometers (8 miles) south of Schurz. Schurz bypass option 2 would be about 50 kilometers (31 miles) long (DIRS 180222-BSC 2006, pp. 9 and 27).

Schurz bypass option 3 would begin at the Department of Defense Branchline about 9.7 kilometers (6 miles) northwest of Schurz. It would cross U.S. Highway 95 about 8 kilometers (5 miles) north of the intersection of U.S. Highway 95 and Alternate U.S. Highway 95, at which point it would continue southeast to a point where it would rejoin the existing Department of Defense Branchline about 13 kilometers (8 miles) south of Schurz. Schurz bypass option 3 would be about 50 kilometers (31 miles) long (DIRS 180222-BSC 2006, pp. 9 and 27).

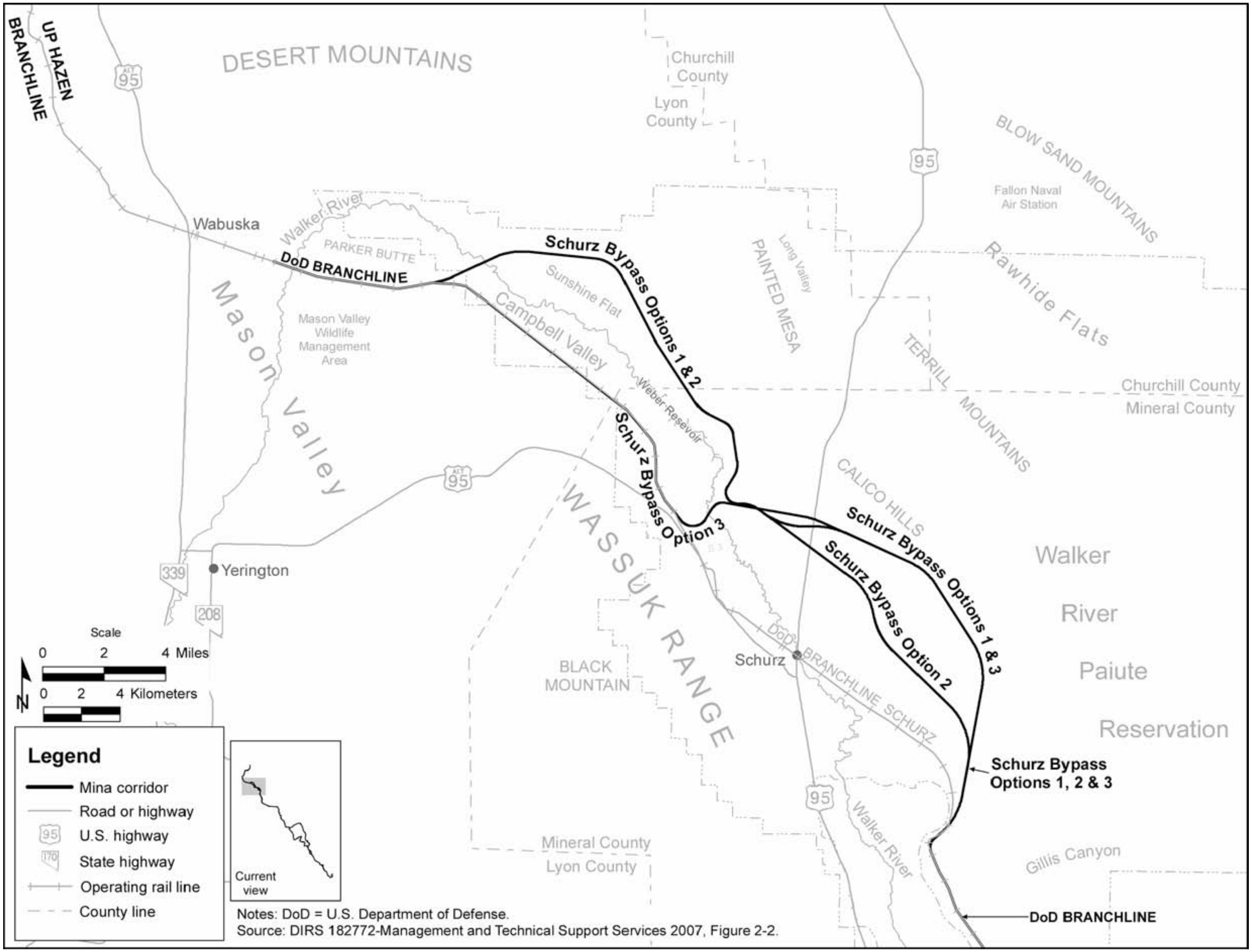


Figure 2-2. Schurz bypass options (pre-scoping, October 2006).

2.2.1.3 Common Corridor Segment 1

Common corridor segment 1 would begin north of Hawthorne and would trend southeast before turning east at U.S. Highway 95. It would trend east along U.S. Highway 95 through Soda Springs Valley for approximately 40 kilometers (25 miles). Continuing to parallel U.S. Highway 95, the rail line would cross State Route 361 and turn south for approximately 64 kilometers (40 miles). It would pass Luning and Mina along U.S. Highway 95. The rail line would then turn east before crossing U.S. Highway 95 in the area of Blair Junction and continuing for about 1.6 kilometers (1 mile) before joining the selected Montezuma options. Common corridor segment 1 would be approximately 160 kilometers (92 miles) long; which includes 21 miles of existing Department of Defense rail line (DIRS 180222-BSC 2006, pp. 9 and 27).

2.2.1.4 Montezuma Options

Montezuma option 1 would depart Common corridor segment 1 just southeast of Blair Junction. It would trend roughly southeast along State Route 265 passing to the east of Silver Peak in Clayton Valley. It would then turn to the northwest through Clayton Valley. It would then trend south between Clayton Ridge on the west and Montezuma Peak on the east before turning east, passing to the south of Montezuma Peak. The rail alignment would again turn roughly south, traveling to the west of the Goldfield Hills. It would then travel northwest, cross U.S. Highway 95, and turn south before joining Common corridor segment 2 near Lida Junction. Montezuma option 1 would be approximately 120 kilometers (73 miles) long (DIRS 180222-Nevada Rail Partners 2006, pp. 10 and 27).

Montezuma option 2 would depart Common corridor segment 1 just southeast of Blair Junction. It would trend northeast just south of U.S. Highway where it would follow an abandoned rail ***roadbed*** of the former Tonopah and Goldfield Railroad to north of Lone Mountain. Northeast of Lone Mountain, it would turn south into Montezuma Valley and run south before turning east and crossing U.S. Highway 95 south of Goldfield. It would then trend south before joining Common corridor segment 2 near Lida Junction. Montezuma option 2 would be approximately 120 kilometers (74 miles) long (DIRS 180222-Nevada Rail Partners 2006, pp. 10 and 27).

2.2.1.5 Common Corridor Segment 2

Common corridor segment 2 would begin at the end of the selected Montezuma option and run roughly southeast as a single route for about 3 kilometers (2 miles) before reaching the Bonnie Claire area. Common corridor segment 2 would be approximately 3 kilometers long (DIRS 180222-Nevada Rail Partners 2006, pp. 10 and 27).

2.2.1.6 Bonnie Claire Options

DOE is considering two options in the Bonnie Claire area, Bonnie Claire 2 and 3. The Department did not evaluate Bonnie Claire option 1 because it would cross Timbisha Shoshone Trust Lands (see Appendix C). Bonnie Claire option 2 would begin about 8 kilometers (5 miles) north of Stonewall Pass and trend east toward the Nevada Test and Training Range for about 5 kilometers (3 miles) before turning south for an additional 18 kilometers (11 miles). Bonnie Claire option 2 would generally follow the Nevada Test and Training Range boundary and end in Sarcobatus Flats north of Scottys Junction near the intersection of State Route 267 and U.S. Highway 95. Bonnie Claire option 2 would be approximately 19 kilometers (12 miles) long (DIRS 180222-BSC 2006, pp. 10 and 27).

Bonnie Claire option 3 would begin about 8 kilometers (5 miles) north of Stonewall Pass. It would trend generally south, parallel to U.S. Highway 95 to the east. Bonnie Claire option 3 would end in Sarcobatus Flats north of Scottys Junction near the intersection of State Route 267 and U.S. Highway 95. Bonnie

Claire option 3 would be approximately 19 kilometers (12 miles) long (DIRS 180222-BSC 2006, pp. 11 and 27).

2.2.1.7 Common Corridor Segment 5

Common corridor segment 5 would begin approximately 4 kilometers (2 miles) north of Scottys Junction and trend generally southeast through the Sarcobatus Flat area. Common corridor segment 5 would end approximately 6 kilometers (4 miles) north of Springdale, where it would connect to one of the selected Oasis Valley options. Common corridor segment 5 would be approximately 40 kilometers (25 miles) long (DIRS 180222-BSC 2006, p. 11).

2.2.1.8 Oasis Valley Options

DOE is considering two options in the Oasis Valley area, Oasis Valley 1 and 3. The Department did not evaluate Oasis Valley option 2 because the option's engineering factors and environmental and land-use features are similar to those for Oasis Valley option 1 (see Appendix C). Oasis Valley option 1 would begin about 3.2 kilometers (2 miles) north of Oasis Mountain, and run southeast. It would be approximately 9.7 kilometers (6 miles) long (DIRS 180222-BSC 2006, p 11).

Oasis Valley option 3 would begin about 3.2 kilometers (2 miles) north of Oasis Mountain, and run generally east and then south before it crossed Oasis Valley farther to the east than Oasis Valley option 1. Oasis Valley option 3 would be about 14 kilometers (9 miles) long (DIRS 180222-BSC 2006, p 11).

2.2.1.9 Common Corridor Segment 6

Common corridor segment 6 would begin about 3 kilometers (2 miles) east of U.S. Highway 95. Common corridor segment 6 would trend generally southeast for 40 kilometers (25 miles) from Oasis Valley to Beatty Wash. It would then turn north near the southern end of Busted Butte and then trend generally north, terminating at the Yucca Mountain Site. Common corridor segment 6 would be approximately 51 kilometers (32 miles) long (DIRS 180222-Nevada Rail Partners 2006, p. 11).

2.2.2 SHARED-USE OPTION

In the Yucca Mountain FEIS, the Department considered a Shared-Use Option as reasonably foreseeable and evaluated that option under cumulative impacts. For this Nevada Rail Corridor SEIS, the Department considers the Shared-Use option under the Proposed Action.

Construction and operation of a rail line in the Mina rail corridor could provide an option for shared use and operation of commercial rail service to serve communities along the corridor. The presence of a rail line could influence further development and land use in the corridor. The Shared-Use Option would not require any changes in design to that described for the Proposed Action in this Nevada rail corridor SEIS. However, shared use would require design and construction of additional commercial sidings and facilities to provide access and operational capabilities for commercial shippers. Trains carrying commercial shipments would be separate from trains carrying spent nuclear fuel and high-level radioactive waste.

2.2.3 OVERVIEW OF DESIGN EVOLUTION

In the Yucca Mountain FEIS and in this Nevada Rail Corridor SEIS and Rail Alignment EIS, DOE based its rail corridor design and associated construction and operations plans on standard railroad industry practices and in consideration of applicable regulations. Since issuing the Yucca Mountain FEIS, DOE has advanced its proposed design and associated plans to determine an alignment for the construction and operation of a railroad within the Caliente rail corridor (DIRS 180877-Nevada Rail Partners 2007, all). These current design and construction and operations plans, which meet standard industry practices and objectives, have advanced from those of the Yucca Mountain FEIS. The following engineering design details and associated operations plans for the Caliente rail alignment have been used in developing the Mina rail corridor for purposes of evaluating the potential environmental impacts from constructing and operating a railroad from Wabuska, Nevada, to Yucca Mountain.

- More detailed aerial mapping and contour analysis of the Caliente rail corridor and its options
- Corridor options to further avoid areas of environmental concern
- Use of material excavated from one area within the corridor to provide subballast for other areas; the use of any excess for widening the rail roadbed or development of a service road, thereby reducing the need for spoils areas
- Final grading requirements of slopes, installation of rock-fall protection devices, replacement of topsoil, revegetation and installation of other permanent erosion control systems, and an adjacent maintenance road within the corridor
- Changes to design criteria to now include a maximum horizontal curvature of 6 degrees with 2 percent compensated curves, use of 62-kilogram (136 lbs) rail and 30 centimeters (12 inches) of ballast, and a 9.4-meter (31-foot) top of cross section
- Use of a centralized train control signal system (monitoring equipment, signals, communications equipment) for train operations
- An increase in the total number of trains of up to 17 trains per week during the operations phase
- An operations period of up to 50 years
- More detailed design of certain facilities that would interface with the Union Pacific Railroad near Caliente, Nevada
- The average width land disturbed is 100 meters (325 feet) within the corridor based on conceptual rail alignment engineering and construction design (DIRS 180877-Nevada Rail Partners 2007, all)

DOE analyzed the construction and operations of a rail line within the Mina rail corridor. Where details regarding supporting facilities within the Mina rail corridor are known (staging yards, maintenance roads), they were analyzed in the appropriate resource area. Regardless of where in the document they are analyzed or considered, supporting facilities are not considered a discriminator at the corridor level. A detailed analysis of supporting facilities, including locations, is done at the alignment level in the Rail Alignment EIS.

2.2.4 RAIL LINE CONSTRUCTION IN THE MINA RAIL CORRIDOR

Unless otherwise indicated, all construction activities would occur inside the rail line ***construction right-of-way*** (nominally 150 meters [500 feet] on either side of the centerline of the rail alignment, for a ***nominal*** width of 300 meters [1,000 feet]). The total construction ***footprint*** would be approximately 140 square kilometers (35,000 acres), but would vary depending on the corridor options selected. However, based on land disturbance computations from the Air Quality Emission Factors and Socio-Economic Input Caliente Rail Corridor (DIRS 180921-Nevada Rail Partners 2007, all), DOE used an average width of the Caliente rail alignment of 100 meters (325 feet) to estimate land disturbance for the Mina rail corridor at 41 square kilometers (10,000 acres) (DIRS 180877-Nevada Rail Partners 2007, p. 2-10).

DOE would implement ***best management practices*** during the entire construction process, such as dust suppression and the use of silt fencing to control soil erosion during construction activities.

DOE anticipates that it would take a minimum of 4 years, and possibly up to 10 years, to construct the railroad in the Mina rail corridor. Construction would begin with the procurement of concrete ties and rail for track construction and steel for bridge construction. DOE would start constructing major bridges, culverts, and grade-separated crossings before other infrastructure because they would take longer to construct (DIRS 180922-Nevada Rail Partners 2007, Section 7.0).

Ballast is the coarse rock that is placed under the railroad tracks to support the railroad ties and improve drainage along the rail line.

Subballast is a layer of crushed gravel that is used to separate the ballast and roadbed for the purpose of load distribution and drainage.

Water, ***subballast, ballast***, steel for bridges, concrete ties, and rail would be required for rail line construction.

Approximately 90 percent of the water that would be used during construction would be used for earthwork compaction and control of excavation dust (DIRS 180922-Nevada Rail Partners 2007, pp. 9 and 10).

Approximately 4.5 metric tons of subballast per meter (1.5 tons of subballast per foot) of track construction would be required. The Department would obtain subballast from materials excavated during rail roadbed construction, or from existing ***borrow sites*** in the rail corridor (DIRS 180877-Nevada Rail Partners 2007, p. 2-3).

Approximately 5.1 metric tons of ballast per meter (1.7 tons of ballast per foot) of track construction would be needed along the rail line. Approximately one concrete tie for every 0.61 meter (2 feet) of track construction would be needed along the entire length of the rail line. DOE would obtain rail from commercial sources and weld it into 440-meter (1,440-foot) strings at a portable welding plant located within the construction right-of-way (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 to 3-10).

DOE would install grade crossings where the rail line would cross a roadway. In places where the rail line would cross a highway (for example, U.S. Highway 95), the routes would be grade-separated. Where the rail line would cross paved public roadways, the routes would cross at-grade and active warning devices, such as flashing lights and gates, would be installed. Where the rail line would cross unpaved roads, DOE would install passive warning devices such as crossbucks and stop signs (DIRS 180923-Nevada Rail Partners 2007, p. 6-9).

The rail roadbed would be constructed along the centerline of the rail line. Construction of the rail roadbed would require clearing, excavating earth and rock on previously undisturbed land and removing and stockpiling topsoil where needed. Construction would require both cuts and fills (DIRS 180922-Nevada Rail Partners 2007, Section 2.0).

During rail line construction, DOE would install an unpaved road parallel to the rail line inside the construction right-of-way. The Department could leave this access road in place to provide additional access to the rail line for maintenance. Because maintenance would be performed using on-rail vehicles or trains, no bridges would need to be constructed for access roads (DIRS 180922-Nevada Rail Partners 2007, Section 4.5).

DOE would construct ***sidings*** approximately every 40 kilometers (25 miles) so that trains running in opposite directions could pass one another. This spacing would result in approximately 10 to 12 sidings for the rail line. Sidings would be placed inside the ***operations right-of-way*** (nominally 61 meters [200 feet] on either side of the rail line centerline) (DIRS 180922-Nevada Rail Partners 2007, p. 2-3).

The Department would build a distribution line for electric power along the entire length of the corridor. Power to the distribution system would be fed from locations where existing high-voltage transmission lines intersected the corridor (DIRS 180922-Nevada Rail Partners 2007, p. 4-6).

DOE would install a communications system utilizing a fiber-optic communications cable, very-high-frequency (commonly called VHF) radio, satellite radios, and possibly satellite or cellular telephones. The Department would position communications towers at the beginning, end, and approximately every 16 to 32 kilometers (10 to 20 miles) along the rail line. These towers would be approximately 23 to 30 meters (75 to 100 feet) tall and would enable very-high-frequency radio communication between rail line personnel working in remote locations along the rail line. DOE would install 4.6-meter (15-foot)-tall ***wayside signals*** along the rail line to control train movements (DIRS 180922-Nevada Rail Partners 2007, pp. 2-2 and 2-3).

The final step in the construction of the railroad would be the commissioning of train operations. Each time a section of the track was completed and the signals and communications systems installed and tested, integrated testing would commence, utilizing train equipment to validate that all components were operating as designed. Successful testing would result in final jurisdictional inspection and commissioning, by the appropriate regulatory authority, of the rail line for normal operations (DIRS 180922-Nevada Rail Partners 2007, p. 7-4).

2.2.5 RAILROAD OPERATIONS AND MAINTENANCE

The rail line would be expected to operate for up to 50 years for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials to the repository at Yucca Mountain. DOE would operate and maintain the rail line in accordance with applicable regulations, guidelines, and standards of the Federal Railroad Administration, the Union Pacific Railroad, and the Association of American Railroads.

2.2.5.1 Railroad Operations

Railroad operations would begin immediately after construction was completed. The railroad would operate dedicated trains carrying spent nuclear fuel and high-level radioactive waste and trains carrying other materials, which could include construction materials, diesel fuel, and repository equipment. During the operations phase, DOE would use the rail line to transport approximately 9,500 railcars, each with a cask of spent nuclear fuel or high-level radioactive waste, and approximately 29,000 railcars of construction materials, diesel fuel, and supplies for the repository and facilities. The frequency of trains going to the repository would vary slightly, but would average 17 one-way trains or 8.5 round trips per week (derived from DIRS 175036-BSC 2005, Table 4.2).

Union Pacific Railroad trains carrying casks of spent nuclear fuel and high-level radioactive waste would arrive in Nevada via the Union Pacific Railroad Mainline, travel to Wabuska via the Union Pacific branchline, and then proceed to a staging yard.

The dedicated cask trains on the rail line would be assembled at the staging yard and would consist of two or three 4,000-horsepower diesel-electric locomotives followed by a ***buffer car***; one to five ***cask cars*** followed by another buffer car; and one ***escort car*** carrying security personnel. ***Naval spent nuclear fuel*** trains would typically include two or three locomotives, 1 to 12 cask cars, a buffer car in front of the first cask car and after the last cask car, and one to two escort cars. Trains would depart a staging yard and proceed along the rail line to the Yucca Mountain Site. Trains would require

A **buffer car** is a railcar that would be placed at the front of a cask train between the locomotive and the first cask car and at the back of the train between the last cask car and the escort car.

A **cask car** is a railcar that would be used to transport a cask of spent nuclear fuel or high-level radioactive waste.

An **escort car** is a passenger car that would carry security personnel.

fewer than 10 hours for the trip between a staging yard and the Yucca Mountain Repository (DIRS 180923-Nevada Rail Partners 2007, p. 5-1). After casks were unloaded at the site, the empty casks would be returned to service.

Freight trains carrying construction and other materials would arrive in Nevada via the Union Pacific Railroad Mainline, travel to Wabuska via the Union Pacific branchline, and then proceed to a nearby staging yard. From a staging yard, locomotives would transport the materials along the rail line to the repository.

A railroad control center, in coordination with a national transportation operations center, would control the operations along the rail line. DOE would use a satellite-based transportation tracking and communication system to track rail shipments of spent nuclear fuel and high-level radioactive waste to the repository (DIRS 180923-Nevada Rail Partners 2007, p. 6-6).

2.2.5.2 Railroad Maintenance

Maintenance of the rail line would be an ongoing process that would be concurrent with the operations phase of the railroad. The primary maintenance and inspection functions would include track inspection; signal testing and inspection; minor rail, tie, and turnout replacement; and routine ballasting and surfacing tasks. Maintenance activities would be scheduled to minimize the impact on planned train movements (DIRS 180923-Nevada Rail Partners 2007, Section 10.0).

Maintenance crews would access the work area using ***hi-rail trucks*** (vehicles capable of traveling on roads or on railroad tracks**)**, rail mounted machinery (tamper, track liner, etc), or maintenance trains. During rail line construction, DOE would construct unpaved roads parallel to the rail line inside the construction right-of-way. The Department could leave these access roads in place to provide additional access to the rail line for maintenance.

Following the final shipment of spent nuclear fuel, high-level radioactive waste, and other materials to the repository, DOE could abandon the rail line or could make it available to local communities or the private sector for other uses (DIRS 180923-Nevada Rail Partners 2007, Section 10.0).

2.3 No-Action Alternative

Council on Environmental Quality and DOE regulations that implement the procedural requirements of NEPA require consideration of the alternative of no action. Under the No-Action Alternative in this Nevada Rail Corridor SEIS, DOE would not construct and operate a railroad within the Mina rail corridor from Wabuska to Yucca Mountain. Therefore, the No-Action Alternative provides a basis for comparison to the Proposed Action.

2.4 Summary of Potential Environmental Impacts for the Mina Rail Corridor

Sections 2.4.1 through 2.4.12 summarize the potential environmental impacts associated with construction and operation of a railroad in the Mina rail corridor. Table 2-1 provides an overview of these potential impacts for the Mina rail corridor.

Table 2-1. Potentially affected resources – Mina rail corridor (page 1 of 2).

Resource	Impact/indicator
Land use	
Disturbed land[a]	9,000 to 10,000 acres (37 to 41 square kilometers), depending on rail corridor option
Land ownership/management authority	
Private land	400 to 670 acres (1.6 to 2.7 square kilometers) (1 to 2 percent of total ownership/authority)
Tribal trust lands and reservations	3,100 to 5,100 acres (12.5 to 20.5 square kilometers) (5 to 12 percent of total ownership/authority)
BLM-administered land	32,600 to 33,100 acres (132.1 to 133.9 square kilometers) (80 to 85 percent of total ownership/authority)
Department of Defense land (Hawthorne Army Depot)	1,200 acres (4.7 square kilometers) (3 percent of total ownership/ authority)
DOE land (Nevada Test Site)	1,300 acres (5.3 square kilometers) (3 percent of total ownership/ authority)
Air quality	
National Ambient Air Quality Standards attainment status	Areas in attainment or unclassifiable for air quality standards; small impacts from construction and operations
Hydrology	
Surface water	Small impacts associated with the alteration of drainage patterns or changes to erosion and sedimentation rates
Groundwater use	5,950 acre feet (7.32 million cubic meters)
Biological resources and soils	Small impacts to habitat, wildlife, vegetation, and soils
Cultural resources (records search)	Five percent of area surveyed with 132 recorded sites; eligible affected sites would require mitigation during construction; indirect impacts would be small during operations.
Occupational and public health and safety	
Construction and operations	
Industrial hazards	
Total recordable cases	379
Lost workday cases	215
Fatalities	0.92 (combined involved and noninvolved workers)
Transportation (construction phase only)	
Traffic fatalities	4.0
Cancer fatalities	0.54
Operations only	
Incident-free radiological impacts (latent cancer fatalities)	
Public	0.00082
Workers	0.33
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	0.0000074
Cancer fatalities from vehicle emissions	0.40

Table 2-1. Potentially affected resources – Mina rail corridor (page 2 of 2).

Resource	Impact/indicator
Occupational and public health and safety (continued)	
Operations phase only	
Transportation accident fatalities	
Worker commuting and material delivery	3.3
Radiological waste transportation	0.31
Socioeconomics	Construction employment: 6,500 worker-years over a minimum 5-year construction phase, primarily from Clark County and the Carson City/Washoe County area Construction economic measures: Less than a 2-percent increase in gross regional product, real disposable personal income, and spending by state and local governments Construction public services: Small increase in local populations Operations employment: 42 workers Operations economic measures: less than a 2-percent increase in gross regional product, real disposable personal income, and spending by state and local governments Operations public services: Small to moderate increase to local populations in Lyon, Mineral, Nye, and Esmeralda Counties
Noise and vibration	Construction noise levels would be below the Federal Transit Administration noise guidelines. Construction- and operations-train noise would be audible to receptors in Silver Peak and Goldfield. No adverse impacts from vibration.
Aesthetics	Small; construction and operation of a railroad primarily in BLM visual resource management Class III and IV would be consistent with BLM management objectives for those areas
Utilities, energy, and materials	
Diesel fuel	33 million gallons (125 million liters)
Gasoline	660,000 gallons (2.5 million liters)
Steel	74,000 tons (67,000 metric tons)
Concrete	287,000 tons (260,000 metric tons)
Wastes	
Construction-related municipal waste; limited quantities of other waste types	1.7 tons (1.5 metric tons) per day
Environmental justice (disproportionately high and adverse impacts)	None identified

a. Land disturbance is based on an average construction right-of-way of 100 meters (325 feet) (DIRS 180877-BSC 2007, p. 2-10).

Where practical, DOE has ***quantified*** potential impacts and other characteristics of the Proposed Action. In other instances, it is not practical to quantify impacts and DOE provides a ***qualitative*** assessment of potential impacts. In this Nevada Rail Corridor SEIS, the Department has used the following descriptors to qualitatively characterize impacts only where quantification of impacts was not practical:

- **Small** - For the issue, environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- **Moderate** - For the issue, environmental effects would be sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- **Large** - For the issue, environmental effects would be clearly noticeable and would be sufficient to destabilize important attributes of the resource.

Unless otherwise noted, potential impacts described in Table 2-1 would be adverse and are for both the construction and operations phases.

2.4.1 LAND USE AND OWNERSHIP

Construction of a railroad in the Mina rail corridor would disturb approximately 37 to 41 square kilometers (9,000 to 10,000 acres) of land, depending on the option selected (DIRS 180877-BSC 2007, p. 2-10). The Mina rail corridor would cross up to 15 separate grazing allotments. The approximate disturbance area associated with the Mina rail corridor would constitute less than 1 percent of the land within those 15 grazing allotments. Within this regional perspective of nearby existing and reasonably foreseeable land uses and land ownership, the commitment of land for the Mina rail corridor would constitute a minor proportion of overall land commitment. Impacts to private land could be approximately 1.6 to 2.7 square kilometers (400 to 670 acres), depending upon the option selected, which consists of primarily agricultural and mineral uses and contain no private residences.

The Mina rail corridor would not cross or affect any Wilderness Areas, Wilderness Study Areas, or areas of Critical Environmental Concern. The Mina rail corridor would be consistent with the goals and policies of the resource management plans in the BLM-administered areas through which it passes. A rail line in the Mina rail corridor could cross private lands. If, in locating the final alignment, DOE could not avoid private lands, the Department would need to acquire access to them to construct and operate the railroad. If private property was divided by the rail line, access to the property could be disrupted.

The rail corridor would cross land on the Walker River Paiute Reservation. Construction and operation of a rail line on this land will require land agreements between DOE, the U.S. Department of the Interior, Bureau of Indian Affairs, and the Walker River Paiute Tribe. Prior to construction, DOE would be required to obtain both the permission to survey for a right-of-way and a right-of-way grant in accordance with 25 CFR Part 169, “Rights-of-Way over Indian Lands.” These regulations state that “Rights-of-way for railroads shall not exceed 15 meters (50 feet) in width on each side of the centerline of the road, except where there are heavy cuts and fills, when they shall not exceed 30 meters (100 feet) in width on each side of the road.”

A portion of the Mina rail corridor, approximately 13 kilometers (8 miles) long, would cross through the Hawthorne Army Depot. A right-of-way grant to construct and operate a railroad through this area would require an agreement with the Department of Defense and the U.S. Army Corps of Engineers for the use of the land and the existing rail line.

Approximately 27 kilometers (17 miles) of common corridor segment 6 of the Mina rail corridor would be within the boundaries of the Nevada Test Site, which is managed by the DOE. Construction of a rail line within this area would require land use authorization from the DOE Nevada Site Office and the BLM.

BLM would require the DOE to obtain a ***right-of-way grant*** to construct and operate a railroad on public land. The Department would adjust the width of the construction right-of-way where practicable to avoid or minimize land-use conflicts and restrictions. Construction and operation of the railroad in the Mina rail corridor through existing rights-of-way would require an evaluation of the impact to the road or utility or use of the right-of-way with both the right-of-way holder and the BLM. DOE would protect existing utility rights-of-way from damage so that disruption to utility service or damage to lines would be at most small and temporary.

The implementation of several mining engineering practices in these areas could allow access to mining claims without affecting the claimant or the rail line, depending on the exact locations of the claims and access needs. Construction of the rail line would result in loss of forage. Because the corridor intersects grazing allotments, a rail line could create a barrier to livestock movement. Livestock could have difficulty accessing water if there was a deep cut or a high fill associated with the rail line. Ranch operations and livestock rotations could be disrupted. Livestock mortality could occur along roads used during rail line construction and operations and possibly by trains during the operations phase. Construction and operation of a rail line through the Mina corridor could impact access to land used by the public for recreation, requiring individuals to alter their access routes.

2.4.2 AIR QUALITY

The Mina rail corridor would pass through rural parts of Nevada that are in areas that are considered by the U.S. Environmental Protection Agency to be either ***in attainment*** or unclassifiable for ***criteria pollutant*** standards pursuant to ***National Ambient Air Quality Standards***. Most rural areas of the United States are either in attainment or unclassifiable for all pollutants.

The impacts to air quality during rail line construction and subsequent operation would be small. During the relatively short-term period for construction of a rail line in the Mina Corridor, equipment emissions would result in a minimal contribution of criteria pollutants to the region. The criteria pollutants emitted would primarily come from the operation of construction equipment in rural areas or areas that are currently uninhabited. Construction activities would also emit ***fugitive dust*** that would require DOE to implement dust suppression measures. Impacts to these air quality criteria pollutant concentrations and fugitive dust generation should decrease as the rail line and rail facility construction is completed and the railroad becomes operational. During operations these impacts would be smaller but would last longer during the period of operation.

Impacts associated with railroad operations and maintenance activities would be small.

2.4.3 HYDROLOGY

Hydrologic hazards in the Mina rail corridor could include flash floods. Impacts to surface water associated with the alteration of drainage patterns or changes to erosion and sedimentation rates or locations would be small and localized. Impacts on surface-water resources resulting from construction activities would generally be small and limited to within the nominal width of the construction right-of-way. Impacts to springs near the corridor would be small. DOE would use appropriate engineering standards and construction practices to help avoid minimize potential impacts on surface water resources.

Impacts associated with railroad operations and maintenance activities on surface water would be small.

The groundwater analysis for this Nevada Rail Corridor SEIS based its calculations of water demand for the construction of a rail line in the Mina rail corridor on earthwork needs and subsequent water for requirements for compaction. Based on these considerations, total water demand for the Mina rail corridor would be approximately 7.32 million cubic meters (5,950 acre-feet). Groundwater use during the construction phase could result in a short-term decrease in the amount of available water in some hydrologic basins.

DOE would request the Nevada State Engineer to approve any potential plans to pump groundwater from new or existing wells and otherwise obtain groundwater from other regional resources, so as to not adversely affect groundwater resources in the region. Groundwater demands during operation of the railroad would be small and be limited to water needed to support maintenance activities and a reduced workforce. These needs would be small and have little effect on regional resources.

2.4.4 BIOLOGICAL RESOURCES AND SOILS

The Mina rail corridor would primarily cross through remote areas that are characterized by a variety of vegetation communities, special status species (plants and animals including their habitats), game habitats, surface water flows, and soil conditions. The corridor only crosses one riparian area along the Walker River and one spring near Goldfield.

Some vegetation communities would be disturbed during construction activities within the 400-meter (0.25-mile)-wide corridor. With the exception of the few riparian areas in the corridor, none of the plant communities encountered are considered by BLM to be sensitive (unique or rare). The total land area disturbed within these vegetation communities in the corridor would be small when compared to the other land areas in Nevada that also support them.

The Mina rail corridor would cross through habitat that supports a low abundance of the desert tortoise (*Gopherus agasizii*), a federally listed threatened species under the Endangered Species Act. Disturbance of this habitat could disrupt normal movements or possibly result in some individual tortoise deaths. DOE would work with U.S. Fish and Wildlife Services to help limit impacts to the desert tortoise.

The rail corridor would also cross riparian habitat for the Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*), a federally listed threatened species under the Endangered Species Act. Construction of a bridge over the Walker River downstream of Walker Dam would have to occur when the water flow is low and the species would be rare or absent. Construction activities could temporarily degrade downstream water quality. As such, impacts would be temporary and small.

The rail corridor would cross habitat for some game species including bighorn sheep, pronghorn sheep, mule deer, and mountain lions, as well as herd management areas for wild horses and burro herds. During construction activities, the movement of these animals could temporarily be disrupted due to noise and land disturbance and they would likely move away from the area. Noise from passing trains during rail road operations could minimally disturb some animals. Impacts would be small and would likely diminish over time as animals acclimated to the presence of passing trains.

Soil erosion could increase from land disturbance during construction activities within the construction right-of way. Prime farmland occupies less than 1 percent of the soils in the corridor. DOE would use erosion control methods to help reduce the potential of direct impacts during construction. Use of hazardous materials would be controlled to limit the potential for soil contamination. Impacts to soil would be temporary and small.

Impacts associated with railroad operations and maintenance activities would be small.

2.4.5 CULTURAL RESOURCES

There could be impacts to cultural resources at different locations in the Mina rail corridor. There are several cultural resources, which include archaeological and historic sites and structures, in the corridor that are eligible or potentially eligible for inclusion on the *National Register of Historical Places*. Construction activities could degrade, cause the removal of, or alter the setting of cultural resources sites and cause the loss of cultural resources.

Before starting construction, DOE would perform additional field surveys and inventories to further locate and identify cultural resources along the corridor. The Department would work closely with other federal agencies, tribal authorities, and the state agencies to help avoid and mitigate potential adverse impacts to identified cultural resources in the corridor. DOE would use procedures and work with other agencies to help protect cultural resources encountered during the construction phase as a result of surface disturbances. Steps would be taken to avoid and protect them and to mitigate potential adverse impacts from both project related activities and the actions of others.

Railroad operations and maintenance activities are not expected to result in any additional impacts to cultural resources at archeological or historic sites.

2.4.6 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

The impact analysis for occupational health and safety focused on transportation impacts, worker industrial safety impacts, incident-free radiological impacts and nonradiological impacts, and radiological impacts with respect to accidents.

Nonradiological transportation impacts during the construction phase of the project are expected to primarily result from traffic accidents involving workers commuting to and from the construction sites and transporting rail line construction materials to the construction sites and from vehicle emissions produced by commuting workers and material deliveries. Those impacts during the construction phase of the project are estimated to be 4 fatalities from traffic accidents and 0.54 latent cancer fatalities from vehicle emissions.

The largest potential for radiological exposure during the operations phase of the railroad would be to workers involved in the transportation of spent nuclear fuel and radioactive high level waste. That impact could be about 0.40 latent cancer fatalities.

Industrial safety impacts resulting from railroad construction and operation are estimated to be about 0.92 fatalities for the combined involved worker and noninvolved worker population.

DOE estimated nonradiological occupational health and safety impacts in terms of exposure of workers to physical hazards and nonradioactive hazardous chemicals over the region of influence for the Mina corridor. These estimates were based on the estimated number of hours worked and occupational incident rates for total recordable cases, lost workday cases, and fatalities. DOE estimated radiological impacts to workers and the public for incident-free transportation, transportation accidents and severe transportation accidents.

DOE estimated the following fatalities:

- Less than one latent cancer fatality to workers and the public from radiological impacts for up to 50 years of railroad operations in the Mina rail corridor.
- Nonradiological fatality impacts to workers from industrial hazards from railroad construction and operation in the Mina rail corridor could be 0.92.
- During railroad construction in the Mina rail corridor, there could be four vehicular-related fatalities.

- During railroad operations in the Mina rail corridor, there could be 3.6 vehicular-related fatalities.
- During railroad construction and operations in the Mina corridor, there could be 1.3 rail-related fatalities.

2.4.7 SOCIOECONOMICS

The socioeconomic impacts analysis used a set of socioeconomic variables to provide a socioeconomic profile of conditions in the Mina rail corridor region of influence. Those variables considered changes to employment, population, economic measures, housing, and public services. The expected employment levels are a significant contributor to the analysis of socioeconomic impacts.

During the construction phase of the project, DOE estimated that the workforce employment levels for construction would range from about 340 to 2,100, depending on the length of the rail line, earthwork requirements, and phase of the project. Based on the identified levels of worker employment and the temporary nature of a linear construction project, the socioeconomic impacts to the local communities would be both short term and small.

During the operations phase of the project, DOE estimated that the workforce levels for operating and maintaining the railway would be much less than that estimated for the construction phase. There would be an estimated 42 workers involved in railroad operations. Given the relatively low number of employees necessary for railroad operations, the potential for socioeconomic impacts in the corridor are estimated to be small.

These socioeconomic for both the construction and the operations phase are generally considered positive because of jobs created, increased disposable income, increases in gross regional product, and increases in services to local citizens as a result of increased tax revenue to local and state governments.

2.4.8 NOISE AND VIBRATION

2.4.8.1 Noise

For the most part, the Mina rail corridor would pass through areas that are remote from human habitation. Thus, the potential impacts for noise from the construction of a rail line would be temporary. The distances from construction activities to the nearest receptors would be great; therefore, construction noise levels would be below the Federal Transit Administration noise guidelines.

DOE estimates that construction noise and construction- and operation-train noise would be audible to receptors in Silver Peak and Goldfield. There would be no adverse noise impacts associated with these receptors because they would not experience a 3 dBA increase <u>and</u> 65 DNL or greater noise levels. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. However, because transportation noise sources are audible throughout the United States, the audibility of train noise itself does not constitute an adverse noise impact.

2.4.8.2 Vibration

Based on the proposed construction equipment and Federal Transit Administration vibration data, DOE estimated potential ground-borne vibration levels due to construction activity. The vibration levels are below Federal Transit Administration building vibration damage criteria (0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings). Therefore, DOE would expect no damage to buildings due to vibration during construction. In addition, because of relatively low vibration levels and the temporary nature of construction, human annoyance due to construction vibration would be low.

DOE evaluated the potential impacts from vibration for construction and operations trains by using train-induced vibration levels as a function of distance from a rail line, along with vibration levels likely to result in building damage or annoyance, in combination with information on the location of residences or other buildings in relation to the rail line. Because vibration is a function of train speed, construction-train vibration would be lower than operations-train vibration. Freight trains operating at 80 kilometers (50 miles) per hour would produce an annoyance-based vibration contour extending approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no buildings within approximately 24 meters of the Mina rail corridor, so construction and operations trains would produce no adverse vibration impacts

2.4.9 AESTHETICS

The Mina rail corridor would pass primarily through Class III (the BLM designation that provides for the partial retention of the existing character of the landscape) and IV (the BLM designation that provides for management activities that require major modifications of the existing character of the landscape) areas. Railroad construction and operations in these areas would be consistent with the BLM management objectives for these areas. Therefore, DOE expects potential impacts to aesthetic resources would be small.

2.4.10 UTILITIES, ENERGY, AND MATERIALS

Potential impacts to utilities, energy and materials would be small. Construction and operations needs would place limited demands on utilities such as public water and waste water systems, telecommunications systems and electric power. Regional service providers can be expected to adjust to increasing needs. Needs for motor fuel during construction and operations activities would represent a very small fraction of Nevada's motor fuel consumption and not affect regional availability. Raw materials consumed during the construction phase such as concrete, steel, and rock are expected to be available from regional or national sources.

2.4.11 WASTE MANAGEMENT

DOE would store and use hazardous materials such as oil, gasoline, diesel fuel, and solvents during railroad construction and operations, primarily for the operation and maintenance of equipment and cleaning of equipment and facilities, and associated hazardous wastes would be generated. Ample disposal capacity for hazardous wastes is available in the western United States.

DOE would dispose of nonrecyclable or nonreusable waste in permitted landfills. During construction, it is likely that while some of the larger landfills would not see an appreciable change in the amount of waste received if they were utilized, some of the smaller landfills, if utilized, might see a substantial, although manageable, change in daily receipt of solid and industrial and special wastes. The estimated average daily disposal mass would be about 1.5 metric tons (1.7 tons).

During the railroad operations phase, the generation of wastes would be substantially less than during the construction phase.

2.4.12 ENVIRONMENTAL JUSTICE

Because there would be small changes in long-term population attributable to activities in the corridor, impacts or stresses to the housing stock, infrastructure systems, or social services would be unlikely. A portion of the Mina rail corridor would cross lands in Esmeralda County where most of the land is managed by the BLM or owned by the Department of Defense, resulting in a sparse population. As a consequence, there are no concentrations of low-income or minority populations in Esmeralda County that the construction or operation of a railroad in the Mina rail corridor would be likely to affect.

Likewise, a rail line in the corridor would be unlikely to affect low-income or majority populations in Lyon County.

Nye County has a minority population of approximately 13 percent with approximately 11 percent of the total population considered low income.

Impacts from rail line construction and operations in the Mina rail corridor would be small overall and would be unlikely to cause a disproportionately high and adverse effect on the low-income or minority populations along the corridor. There are no special pathways for minority populations.

3. AFFECTED ENVIRONMENT AND EVALUATION OF IMPACTS – MINA RAIL CORRIDOR

This chapter describes the affected environment along the Mina rail corridor and potential impacts to environmental resources from constructing and operating a railroad in the corridor. Section 3.1 describes the bases and methodology DOE used to perform the evaluation; Section 3.2 describes the affected environment for each resource area and potential impacts to those resources.

Glossary terms are shown in ***bold italics***.

3.1 Bases and Methodology

3.1.1 BASES FOR EVALUATION

To evaluate potential environmental ***impacts*** and determine if the Mina ***rail corridor*** warrants further study, the bases for corridor evaluation are the *Mina Rail Route Feasibility Study* (DIRS 180222-BSC 2006, all); baseline and affected environment information from federal, state, and local sources; public scoping comments; and design and engineering knowledge the U.S. Department of Energy (DOE or the Department) has derived from its analyses of the Caliente rail corridor at the alignment level (DIRS 180877-Nevada Rail Partners 2007, all). This Nevada Rail Corridor SEIS presentation of the Mina rail corridor analysis is commensurate in content and detail with the presentation of corridor-level information in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS; DIRS 155970-DOE 2002, Chapter 6). This chapter describes the environmental attributes of the Mina rail corridor and potential impacts from implementing the Proposed Action.

3.1.2 METHODOLOGY

For the Mina rail corridor analysis, DOE performed a rail corridor design study to provide engineering, construction, and operations feasibility information (DIRS 180877-Nevada Rail Partners 2007, all). The study used many of the same methods used to advance the Caliente rail corridor design, as described in Section 2.2.3. DOE established baseline environmental conditions for each resource area through the collection of federal, State of Nevada, and local data commensurate with the information in the Yucca Mountain FEIS for the Mina rail corridor. Using the established baseline and ***affected environment***, while considering the evolution of engineering and design changes, DOE evaluated the magnitude and range of potential ***impacts*** for the Mina rail corridor.

For each resource area in this Nevada Rail Corridor SEIS, DOE evaluated impacts within a specified ***region of influence***. Table 3-1 lists information on the region of influence for each resource area; DOE used these same regions of influence for the cumulative impacts analysis (see Chapter 4).

Table 3-1. Regions of influence for each resource area analyzed in this Nevada Rail Corridor SEIS.

Resource area	Region of influence[a]
Land use and ownership	Land use and ownership entirely or partially within the 400-meter-wide rail corridor. Includes land use and ownership outside the corridor that could incur cumulative impacts.
Air quality	The U.S. Environmental Protection Agency (EPA)-designated air basins through which the corridor would pass.
Hydrology	The 400-meter width of the corridor and a 1-kilometer-wide area along each side of the corridor. *Surface Water:* Areas near where construction would take place that would be susceptible to erosion, areas affected by permanent changes in flow, and areas downstream of construction that could be affected by eroded soil or potential spills of construction contaminants. *Groundwater:* Aquifers that would underlie areas of construction and operation and aquifers DOE could use to obtain water for construction and operations support.
Biological resources	Resources within the 400-meter-wide corridor and a 5-kilometer-wide area along each side of the corridor. Includes habitat (including wetlands and riparian areas), sensitive species, and migratory ranges of big game animals and wild horses and burros that a rail line could affect.
Cultural resources	Coverage within the 400-meter-wide corridor. This area includes the area of potential disturbances that could have indirect impacts on cultural resources.
Occupational and public health and safety	*Traffic impacts:* The 400-meter width of the corridor and public highways used by workers and for shipments during construction and operations. *Worker industrial safety impacts:* The 400-meter-wide rail corridor. *Incident-free radiological and nonradiological impacts:* The 800-meter area on either side of the centerline of the rail corridor. *Radiological impacts with respect to accidents:* An area within an 80-kilometer radius from a potential occurrence location in the rail corridor.
Socioeconomics	Counties in Nevada the rail line would cross (Churchill, Lyon, Mineral, Esmeralda, and Nye) and the two areas where most workers would live, Clark County and the Carson City/Washoe County area.
Noise and vibration	Inhabited commercial and residential areas where noise and vibration from rail line construction and operations could be a concern.
Aesthetic resources	The viewshed around the rail corridor.
Utilities, energy, and materials	The regional supply infrastructure that would support rail line construction and operations.
Waste management	Counties in Nevada that a potential rail line would cross and that have existing municipal sanitary waste landfills; disposal facilities for other types of wastes.
Environmental justice	Locations of minority, low-income, and Native American populations along the rail corridor; this includes the regions of influence listed above.

a. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

3.2 Affected Environment and Potential Impacts – Mina Rail Corridor

3.2.1 LAND USE AND OWNERSHIP

In the Yucca Mountain FEIS, DOE determined that an evaluation of impacts to land use and ownership should identify the current ownership of the land that its activities could disturb, and the present and anticipated future uses of the land. The Department defined the region of influence for land use and ownership impacts as land areas that would be disturbed or the ownership or use of which would change as a result of constructing and operating a railroad. In the Yucca Mountain FEIS, DOE evaluated land use and ownership in the 400-meter (0.25-mile)-wide corridor. The Department chose this width to provide enough space for final alignment to route the rail line around sensitive land features or engineering obstacles. The Yucca Mountain FEIS anticipated actual construction and operation in the corridor would mostly require less than about 61 meters (200 feet) of the 400-meter width. DOE has since determined, based on the Department's conceptual engineering for the Caliente rail alignment, that actual construction in the corridor would likely require less than 300 meters (1,000 feet) of the 400-meter width (DIRS 180877-Nevada Rail Partners 2007, p. 2-10). However, for consistency with the Yucca Mountain FEIS analysis, this Nevada Rail Corridor SEIS analysis uses the 400-meter corridor width.

Based on these criteria, DOE evaluated the potential impacts to land use and ownership from proposed railroad construction and operations. The BLM administers more than 45,000 square kilometers (11 million acres) in Lyon, Mineral, Esmeralda, and Nye Counties. Traditional land uses in most of the Mina rail corridor region of influence that would be directly and indirectly affected include grazing, mining, energy development, general recreation, utility rights-of-way, and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing and mining.

Some BLM-administered lands have special designations that identify their uses or why they have been set aside. These include Wildlife Habitat Management Areas, Areas of Critical Environmental Concern, Wilderness Areas, and Wilderness Study Areas. Public lands in the Mina rail corridor region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as Special Recreation Management Areas.

Figures 3-1 and 3-2 show land ownership along the Mina rail corridor and its options. Most of the land that would be used for construction and operation of rail road in the Mina rail corridor would be BLM-administered land in Lyon, Mineral, Esmeralda, and Nye Counties. The proposed Mina rail corridor would cross three BLM administrative areas: Carson City, Battle Mountain, and Las Vegas. Each BLM Field Office manages lands within its administrative boundaries according to one or more Management Framework Plan or Resource Management Plan. The Las Vegas, Tonopah, and Carson City plans would apply to the Mina rail corridor. In addition to BLM authority, the range of potentially affected land ownership and management authority includes private land holdings (including land designated for commercial development), DOE lands, U.S. Department of Defense lands, and American Indian trust lands and reservations.

To evaluate land use and ownership in the Mina rail corridor, DOE obtained data from the latest editions of BLM Master Title Plats and online land record databases, such as BLM LR2000 (DIRS 182772-MTS 2007, p. 21). The Department also evaluated county and state land records and information from other federal agencies, universities, or commercial developments.

In response to a DOE application for a public land order, the BLM has segregated specific lands encompassing the Mina rail corridor from surface and mineral for 2 years (until January 10, 2009), as described in the *Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada* (72 *Federal Register* [*FR*] 1235, January 10, 2007).

3.2.1.1 Land Use and Ownership Affected Environment

Approximately 1 to 2 percent (1.6 to 2.7 square kilometers [400 to 670 acres) of the land in the Mina rail corridor is privately owned, with another 5 to 12 percent (12.5 to 20.1 square kilometers [3,100 to 5,000 acres], depending on option) on the Walker River Paiute Reservation (see Figures 3-1 and 3-2). Of the remaining land, approximately 3 percent (5.3 square kilometers [1,300 acres) is DOE-managed land on the Nevada Test Site. Approximately 3 percent (4.7 square kilometers [1,200 acres) has been withdrawn to the U.S. Department of Defense for the Hawthorne Army Depot, through which the Mina rail corridor would pass. Most of the land in the Mina rail corridor, approximately 80 to 85 percent (132.1 to 133.9 square kilometers [32,900 to 34,000 acres]), depending on option, is BLM-administered public land. Specifically, the BLM Carson City Field Office manages the land containing portions of the three Schurz bypass options and the first half of Mina common corridor segment 1 in accordance with the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all). The remainder of the land encompassing the Schurz Bypass options is on the Walker River Paiute Reservation. South of the Reservation, the corridor would cross through land managed by the BLM Battle Mountain Field Office/Tonopah Field Station, with land use and management objectives governed by the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all). The BLM Las Vegas Field Office manages the remaining land the corridor would cross from approximately Beatty Wash to Yucca Mountain in accordance with the *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (DIRS 176043-BLM 1998, all).

Construction of a railroad in the Mina rail corridor would begin near Wabuska, Nevada. From there, on the Walker River Paiute Reservation, the corridor proceeds southeast toward the town of Schurz. The three Schurz bypass options would be primarily on the Walker River Paiute Reservation. Schurz bypass options 1 and 2 would leave the existing Department of Defense Branchline approximately 29 kilometers (18 miles) northwest of Schurz, continue east of the Weber Reservoir, and cross U.S. Highway 95 east of Schurz. The first 1.8 kilometers (1.1 miles) of Schurz bypass options 1 and 2 would cross BLM-administered land; the remaining portions would cross the Walker River Paiute Reservation. Schurz bypass options 1 and 2 would not cross any private allotments on the Reservation (DIRS 180222-BSC 2006, p. 16). Both bypass options cross the Black Mountain Grazing allotment (DIRS 182772-MTS 2007, p. 21).

Schurz bypass option 3 would be almost entirely on the Walker River Paiute Reservation. This option would come within 91 meters (300 feet) of a private allotment along the Walker River and, as it bypassed the town of Schurz, would be about 800 meters (0.5 mile) east of private allotments that are used for agriculture and contain no private residences (DIRS 180222-BSC 2006, p. 16). Schurz bypass option 3 would also cross the Parker Butte Grazing Allotment (DIRS 182772-MTS 2007, p. 22).

South of Schurz bypass options 1, 2, and 3, the Mina rail corridor would include common corridor segment 1, which would be approximately 150 kilometers (92 miles) long, with 34 kilometers (21 miles) on an existing Department of Defense-managed rail line. The remaining 110 kilometers (71 miles) of common corridor segment 1 would cross predominantly BLM-administered public lands.

Figure 3-1. Mina rail corridor land use (north).

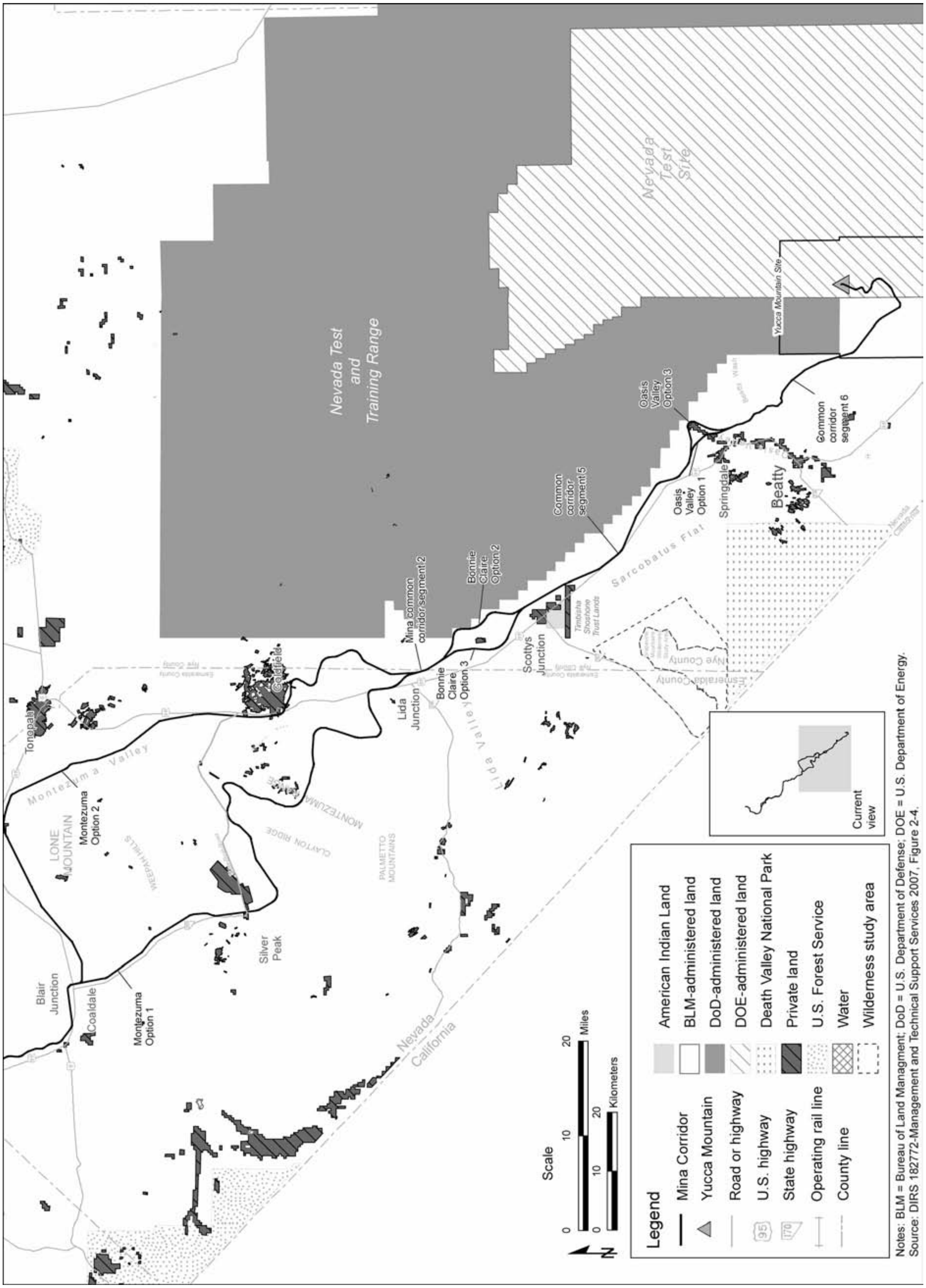


Figure 3-2. Mina rail corridor land use (south).

Due east of the Hawthorne Army Depot, common corridor segment 1 would cross approximately 3.2 kilometers (2 miles) of private property. As it traveled south, the center of the corridor would be within 150 meters (500 feet) of three other private land parcels and then pass just to the east of private property in Soda Springs Valley, southeast of Luning, and near Sodaville. It would pass through a mineral material site (an area in which the BLM has granted temporary rights to another party to obtain materials such as sand and gravel) at Redlich Pass. Common corridor segment 1 would cross a portion of a mineral material site at Coaldale and Blair Junction and then pass through another mineral material site. In addition, it would cross the Gillis Mountain, Garfield Flat, Pilot-Table Mountain, Bellville, Monte Cristo, and Silver Peak grazing allotments and an allotment the BLM Battle Mountain District/Tonopah Field Office has designated as the Columbia Salt Marsh. The corridor would also cross linear rights-of-way that include power transmission lines, telephones lines, State Route 361, U.S. Highway 95, water pipelines, and roads (DIRS 182772-MTS 2007, p. 22).

At this point, there are two options for the Mina rail corridor, Montezuma options 1 and 2, to bypass the Montezuma Range. From about 5.3 kilometers (3.3 miles) north to 5 kilometers (3 miles) south of Silver Peak, Montezuma option 1 would cross land the BLM has designated as suitable for disposal (sale). Montezuma option 1 would cross rights-of-way for power transmission lines, State Route 265, and access roads. Specifically, it would cross three mineral material sites at Goldfield Hills, touch one site at Lida Junction, and cross another at Scottys Junction. Montezuma option 1 would cross the Sheep Mountain, Silver Peak, Yellow Hills, Montezuma, and Magruder Mountain grazing allotments. It would also cross an allotment the BLM Battle Mountain District/Tonopah Field Office has designated as the Columbia Salt Marsh, and another listed as an unallocated allotment. The BLM administers most of the land along Montezuma option 1, except for one small piece of private property near Silver Peak (DIRS 182772-MTS 2007, p. 22).

Montezuma option 2 would tend to follow an abandoned rail line of the former Tonopah and Goldfield Railroad through Montezuma Valley, bypassing Tonopah on the west side and continuing through the town of Goldfield to the south until it connected to common corridor segment 2. As with Montezuma option 1, the BLM administers most of the land along Montezuma option 2; a small percentage of the land is privately owned. Montezuma option 2 would cross approximately 1.6 kilometers (1 mile) of a private allotment commonly called Millers. This property had been the location of a mill site for silver ore and a station on the former Tonopah and Goldfield Railroad; a portion of this property is of cultural significance (see Section 3.2.5). The BLM has designated lands to the east and west of this property as suitable for disposal. The corridor would cross more than 40 privately owned parcels of land near the town of Goldfield. Montezuma option 2 would cross rights-of-way for access roads, power transmission lines, and water pipelines. It would pass through two mineral material sites. Montezuma option 2 would also cross the Monte Cristo and Montezuma Grazing Allotments and an allotment the BLM Battle Mountain District/Tonopah Field Office has designated as the Columbia Salt Marsh (DIRS 182772-MTS 2007, p. 22).

Common corridor segment 2 would begin at the end of Montezuma option 1 or 2 at a point just east of Lida Junction. All of common corridor segment 2 would cross BLM-administered land and the Montezuma and Razorback Grazing Allotments (DIRS 182772-MTS 2007, p. 22).

The Mina rail corridor would continue south into Bonnie Claire options 2 and 3, common corridor segment 5, Oasis Valley options 1 and 3, and common corridor segment 6. Bonnie Claire options 2 and 3 would cross the Montezuma Grazing Allotment. Common corridor segment 5 would cross the Montezuma and Magruder Mountain Grazing Allotments. Oasis Valley options 1 and 3 would cross private property the Razorback Grazing Allotment. Common corridor segment 6 would cross the Montezuma and Razorback Grazing Allotments and a grazing allotment in Crater Flat west of Yucca Mountain the BLM has designated as unused (DIRS 182772-MTS 2007, p. 24).

DOE queried information for ***unpatented mining claims*** from the BLM LR2000 database (DIRS 182772-MTS 2007, p. 24) using the legal description for the Mina rail corridor (meridian, township, range, and section) and plotted locations of unpatented mining claims by sections (Figures 3-3 and 3-4). Of these, most of the unpatented mining claims are within the Goldfield area of the Mina rail corridor.

The Mina rail corridor and its options would not cross any Wilderness Areas or Wilderness Study Areas, Special Recreation Management Areas, or Areas of Critical Environmental Concern. It would cross areas used by the public for dispersed recreation, such as off-highway vehicle use and hunting.

3.2.1.2 Potential Impacts to Land Use and Ownership

The predominant land-use and ownership conflicts associated with the Mina rail corridor would involve private land holdings, the Walker River Paiute Reservation, the Hawthorne Army Depot, the Nevada Test Site, land the BLM has proposed as suitable for disposal, unpatented mining claims, rights-of-way, and grazing allotments.

Construction of a railroad in the Mina rail corridor would disturb approximately 37 to 41 square kilometers (9,000 to 10,000 acres) of land, depending on option. The Mina rail corridor would cross up to 15 separate grazing allotments. The approximate disturbance area associated with the proposed Mina rail corridor would constitute less than 1 percent of the land within those 15 grazing allotments. Within this regional perspective of nearby existing and reasonably foreseeable land uses and land ownership, the commitment of land for the proposed Mina rail corridor would constitute a minor proportion of overall land commitment. Impacts to private land could be approximately 1.6 to 2.7 square kilometers (400 to 670 acres), depending on option. This land consists of primarily agricultural and mineral uses and contains no private residences.

The Mina rail corridor would cross public lands managed by the BLM Carson City Field Office, the Battle Mountain/Tonopah offices, and the Las Vegas Field Office. Each has a resource management plan that establishes goals and objectives for the management of resources, which include public land uses and designations (DIRS 179560-BLM 2001, all; DIRS 173224-BLM 1997, all; DIRS 176043-BLM-1998, all). The Mina rail corridor would not cross or affect any Wilderness Areas, Wilderness Study Areas, or areas of Critical Environmental Concern. The Mina rail corridor would be consistent with the goals and policies of the resource management plans in the BLM-administered areas through which it passes.

As described in Section 3.2.1.1, a rail line in the Mina rail corridor would cross private lands. If in locating the final rail alignment DOE could not avoid private lands, the Department would need to acquire access to them to construct and operate the railroad. If private property was divided by the rail line, access to the property could be disrupted.

The rail corridor would cross land on the Walker River Paiute Reservation. Construction and operation of a railroad on this land would require an agreement between DOE, the Bureau of Indian Affairs, and the Walker River Paiute Tribe. Prior to construction, DOE would be required to obtain both the permission to survey for a right-of-way and a right-of-way grant in accordance with 25 CFR Part 169, "Rights-of-Way Over Indian Lands." These regulations state that "Rights-of-way for railroads shall not exceed 15 meters (50 feet) in width on each side of the centerline of the road, except where there are heavy cuts and fills, when they shall not exceed 30 meters (100 feet) in width on each side of the road."

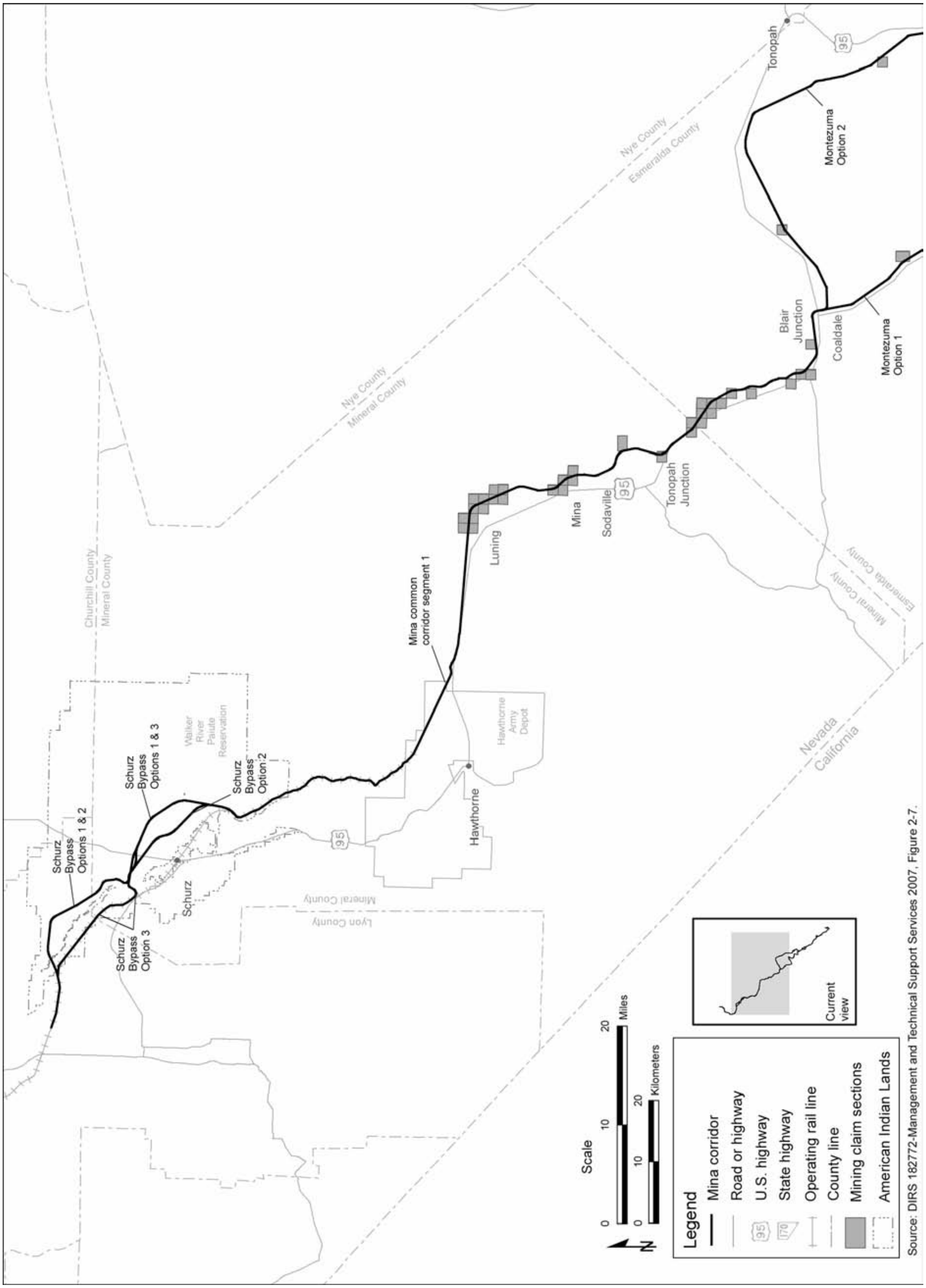


Figure 3-3. Sections containing unpatented mining claims within the Mina rail corridor (north).

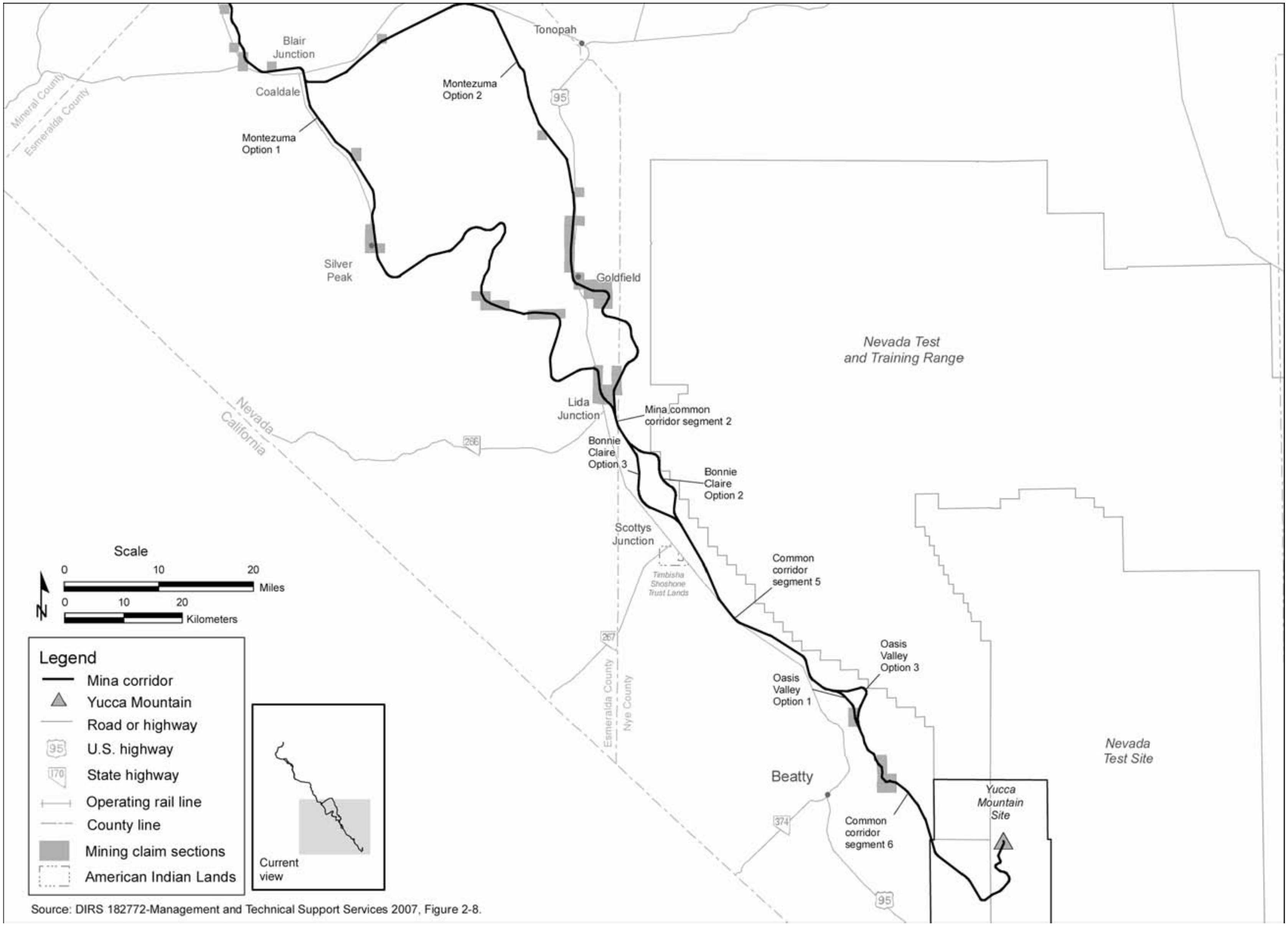


Figure 3-4. Sections containing unpatented mining claims within the Mina rail corridor (south).

The Mina rail corridor would not cross any privately held lands on the Reservation. Schurz option 3 would be within 91 meters (300 feet) of a private allotment. This and other privately held lands near Schurz option 3 are used for agriculture; there are no private residences on this land.

A portion of the Mina rail corridor, approximately 13 kilometers (8 miles) long, would cross through the Hawthorne Army Depot. To construct and operate a railroad through this area would require an agreement between DOE, the U.S. Department of Defense, and the U.S. Army Corps of Engineers for the use of the land and the existing rail line.

Approximately 27 kilometers (17 miles) of common corridor segment 6 would be within the boundaries of the Nevada Test Site, which DOE manages. Rail line construction with this area would require land use authorization from the DOE Nevada Site Office and the BLM.

BLM would require DOE to obtain a ***right-of-way grant*** to construct and operate a railroad on public land. DOE anticipates the right-of-way would have a nominal width of approximately 300 meters (1,000 feet) during construction, which is more than the 61-meter (200-feet)-wide corridor discussed in the Yucca Mountain FEIS, and within the 400-meter (0.25 mile)-wide corridor analyzed in this Nevada Rail Corridor SEIS. The Department would adjust the width of the construction right-of-way where practicable to avoid or minimize land-use conflicts and restrictions. Construction and operation of the railroad in the Mina rail corridor through existing rights-of-way would require an evaluation of the impact to the road or utility or use of the right-of-way with both the right-of-way holder and the BLM. DOE would protect existing utility rights-of-way from damage so that disruption to utility service or damage to lines would be, at most, small and temporary. The land needed to operate the railroad would be generally less than the land needed during construction. Therefore, DOE would reclaim the land no longer needed in accordance with standards set forth by the BLM as a condition of the right-of-way grant.

There could be impacts to mining activities such as mine operations or exploration if access roads were temporarily blocked or altered, making development of a claim less profitable. The Mina rail corridor ***region of influence*** contains a variety of mineral resources, with mining claims filed in accordance with BLM requirements, and several operating mines. Establishment of mining claims on federal land does not necessarily ever lead to actual development of mining operations on those sites. The implementation of several mining engineering practices in these areas could allow access to mining claims without affecting the claimant or the rail line, depending on the exact locations of the claims and access needs.

BLM has designated public land for disposal to allow for community expansion. While this designation provides the opportunity for disposal, it does not require it. Because disposal is a discretionary action, the BLM could choose not to dispose of these parcels if other priorities arose.

Grazing operations are a major BLM land-management program in the Mina rail corridor region of influence. Rail line construction would result in loss of forage. Because the corridor intersects grazing allotments, a rail line could create a barrier to livestock movement. Livestock could have difficulty accessing water if there was a deep cut or a high fill associated with the rail line. Ranching operations and livestock rotations could be disrupted. Livestock could be lost due to collisions with vehicles along roads used during the construction and operations phases, and possibly by collisions with trains during the operations phase.

A rail line in the Mina rail corridor could impact access to land the public uses for recreation, requiring individuals to alter their access routes. Recreational events, such as off-highway vehicle racing, on courses that cross the area of the Mina rail corridor would need to be rerouted. Alterations in access to land used by hunters, hikers, and others could affect recreational experiences.

During the operations phase, train and track inspection and maintenance activities would be confined to areas disturbed during the construction phase. Therefore, there would be no additional disturbances to land use and ownership.

3.2.2 AIR QUALITY

This section provides information on the existing air quality status in areas through which the Mina rail corridor would pass: Lyon, Mineral, Esmeralda, and Nye Counties, a small portion of Churchill County, and the Walker River Paiute Reservation. It also provides background information on the general climate in the area.

The air quality region of influence includes the Environmental Protection Agency-designated air basins through which the corridor would pass.

The Mina rail corridor air quality evaluation used the same qualitative methods described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Appendix G). DOE evaluated the route for identified ***nonattainment*** or maintenance areas, and identified ***criteria pollutants*** potentially generated by construction or operations activities. Because the Department did not identify any nonattainment or maintenance areas, no detailed estimates of emission rates or comparisons to threshold levels for conformity were made.

3.2.2.1 Air Quality Affected Environment

The Mina rail corridor would pass through rural parts of Nevada that are either ***in attainment*** or unclassifiable under U.S. Environmental Protection Agency criteria pollutant standards. If there are not enough air quality data to determine the status of a remote or sparsely populated area, then the Environmental Protection Agency lists the area as unclassifiable. The agency considers unclassifiable areas as any area that cannot be classified on the basis of available information as meeting or not meeting the ***national ambient air quality standard*** for the pollutant. Unclassifiable areas are treated as attainment areas under the Clean Air Act and its implementing regulations. Most rural areas of the United States are either in attainment or unclassifiable for all pollutants. Table 3-2 lists federal standards for criteria pollutants.

Monthly climate summaries for Beatty and Goldfield (DIRS 182772-MTS 2007, p. 27) indicate that the southern portions of the Mina rail corridor have the highest annual precipitation, with annual averages of about 16 centimeters (6.5 inches). The northern portions of the corridor through Mina, Hawthorne, Schurz, and Wabuska have less precipitation, about 11 to 13 centimeters (4.5 to 5 inches) annually. Goldfield, at an elevation of about 1,700 meters (5,700 feet) has the highest average annual snowfall, 38 centimeters (15 inches). Average annual snowfall for most of the rest of the corridor is 10 to 13 centimeters (4 to 5 inches). The southernmost portions of the corridor have even less snowfall. Average annual temperatures vary mainly by elevation, highest at the lower elevations such as Beatty at 1,000 meters (3,300 feet) and lowest at higher elevations such as Tonopah and Goldfield at 1,600 and 1,700 meters (5,400 and 5,700 feet), respectively (DIRS 182772-MTS 2007, p. 27).

3.2.2.2 Potential Air Quality Impacts

Pollutants from construction equipment emissions would include ***carbon monoxide***, ***nitrogen dioxide***, ***sulfur dioxide***, and ***particulate matter*** with aerodynamic diameters equal to or less than 10 micrometers (***PM_{10}***) and equal to or less than 2.5 micrometers (***$PM_{2.5}$***).

Table 3-2. Federal standards for criteria pollutants.

Pollutant	Averaging time	National Ambient Air Quality Standards[a] Primary[b]	Secondary[c]
Ozone (O_3)[d]	1-hour	0.12 parts per million (ppm) (235 micrograms per cubic meter [μg/m^3])	Same as primary standard
	8-hour	0.08 ppm	
Carbon monoxide (CO)	8-hour	9.0 ppm (10 μg/m^3)	None
	1-hour	35 ppm (40 μg/m^3)	
Nitrogen dioxide (NO_2)	Annual average	0.053 ppm (100 μg/m^3)	Same as primary standard
	1-hour	-	
Sulfur dioxide (SO_2)	Annual average	80 μg/m^3 (0.03 ppm)	-
	24-hour	365 μg/m^3 (0.14 ppm)	-
	3-hour	-	1,300 μg/m^3 (0.5 ppm)
	1-hour	-	-
Suspended particulate matter (PM_{10})	24-hour	150 μg/m^3	Same as primary standard
	Annual arithmetic mean	50 μg/m^3	
Fine particulate matter ($PM_{2.5}$)[d]	24-hour	35 μg/m^3	Same as primary standard
	Annual arithmetic mean	15 μg/m^3	
Lead (Pb)	30-day average	-	-
	Calendar quarter	1.5 μg/m^3	Same as primary standard

a. National Ambient Air Quality Standards (other than O_3, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once a year. The O_3 standard is attained when the fourth highest 8-hour concentration in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when 99 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the EPA for further clarification and current federal policies.

b. National Primary Standards: The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

c. National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

d. The Environmental Protection Agency revised the level of the 24-hour $PM_{2.5}$ standard to 35 micrograms per cubic meter (μg/m^3) and retained the level of the annual $PM_{2.5}$ standard at 15.μg/m^3 (71 *FR* 61144, October 17, 2006).

Construction activities such as surface disturbance and use of haul trucks in the Mina rail corridor region of influence would emit PM_{10} and $PM_{2.5}$ in the form of ***fugitive dust***. Fugitive dust is a type of nonpoint source air pollution (small airborne particles that do not originate from a specific point). There could be short-term increases in concentrations of these air quality criteria pollutants as construction progressed along the corridor. The plumes associated with fugitive dust generation are often localized to the area being disturbed and are temporary. In ***arid*** areas such as the Mina corridor region of influence, generation and control of fugitive dust will always be a concern. DOE would implement mitigation measures to minimize emissions, reduce dust concentrations during construction activities, and meet current air quality standards for these pollutants. Thus, impacts would be small.

During railroad operations, potential impacts to air quality would result from diesel locomotives, which would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$. Fugitive dust emissions would be greatly reduced during railroad operations as excavation would cease and equipment traffic would be limited to maintenance vehicles.

3.2.3 Hydrology

This section describes surface-water and groundwater resources, and impacts to those resources. The hydrology region of influence includes surface-water and groundwater resources within the 400-meter (0.25-mile)-wide corridor and within a 1-kilometer (0.6-mile) region of influence along each side of the corridor. The region of influence for surface water includes areas near construction activities, areas that would be affected by permanent changes in surface-water flow, and areas downstream of construction. The region of influence for groundwater includes hydrographic regions.

The Yucca Mountain FEIS analyzed surface water resources within the 400-meter (0.25-mile)-wide corridor and within 1 kilometer (0.6 mile) along each side of the corridor, and springs within 5 kilometers (3 miles) along each side of the corridor. The attributes used to assess surface water were the potential for introduction and movement of contaminants, potential for changes to runoff and infiltration rates, alterations in natural drainage, and potential for flooding or dredging and filling actions to aggravate or worsen any of these conditions.

The Yucca Mountain FEIS analysis also addressed the potential for a change in infiltration rates that could affect groundwater, the potential for introduction of contaminants, the availability of water for use for construction, the potential for changing flow patterns, and the potential that such use would affect other users.

DOE obtained information from (1) the National Hydrography Dataset Waterbody geospatial data that the U.S. Geological Survey developed in cooperation with Environmental Protection Agency; (2) the Geographic Names Information System Nevada geospatial database developed by the U.S. Geological Survey and the BLM; and (3) the National Wetlands Inventory database managed by the U.S. Fish and Wildlife Service (DIRS 182772-MTS 2007, p. 30).

3.2.3.1 Hydrology Affected Environment

3.2.3.1.1 Surface Water

The analysis of surface-water resources discusses proximity of the Mina rail corridor to ***playas***, seeps, springs, ***floodplains***, ***wetlands***, and ***perennial*** surface waters and is commensurate with the analyses in the Yucca Mountain FEIS. The National Wetlands Inventory identifies surface-water resources such as wetlands or lakes along the Mina rail corridor and its options. For clarification, most lakes identified for the Mina rail corridor are actually playas and are referred to as such in this section. In general, a playa forms in semiarid and ***arid*** environments when surface-water runoff temporarily fills a depression on the surface of the ground with water, creating a lake; playas are seasonal. Wetlands typically occur where surface water collects or groundwater discharges, which makes the area wet for extended periods.

The National Wetlands Inventory indicates that the only perennial surface water the Mina rail corridor and its options would cross is the Walker River. Schurz bypass options 1 or 2 would cross the Walker River just north of the Weber Reservoir, and Schurz bypass option 3 would cross it just south of the Weber Reservoir.

Table 3-3 summarizes surface-water resources within the region of influence and their proximity to the Mina rail corridor. This table also lists the location of a riparian area in relation to the corridor, further discussed in Section 3.2.4.

Table 3-3. Surface-water resources along the Mina rail corridor[a] (page 1 of 3).

Mina rail corridor option/common corridor segment	Distance from corridor	Feature[b]
Schurz bypass 1	Would be within/cross	Perennial stream/riparian area; corridor would cross the Walker River north of the Weber Reservoir.
Schurz bypass 1	Would be within/cross	Wetlands; corridor would cross and be adjacent to freshwater emergent wetland areas, where it would cross the Walker River.
Schurz bypasses 1 and 2	0.5 kilometer to 1 kilometer	Perennial lake/pond; corridor would be adjacent to Weber Reservoir.
Schurz bypass 3	Would be within/cross	Perennial stream; corridor would cross Walker River just north of the town of Schurz.
Schurz bypass 3	4 kilometers	Spring; Paiute Spring, and one unnamed spring, 3 kilometers west of U.S. Highway 95, 10 kilometers from the town of Schurz.
Schurz bypasses 1 and 3	Would be within/cross	Playas; corridor would cross five unnamed playas and be adjacent to several other unnamed playas in an unnamed valley, just south of the Calico Hills, approximately 8 kilometers east of Schurz.
Schurz bypasses 1 and 2	Would be within/cross	Playas; corridor would cross two unnamed playas, approximately 4.5 kilometers east of Schurz.
Schurz bypasses 1 and 3	1.2 to 1.3 kilometers	Springs; Double Springs and an unnamed spring, 10 kilometers east of the town of Schurz on the Walker River Paiute Reservation.
Schurz bypass 1	0.1 to 1 kilometer	Playas; playas, freshwater emergent wetland areas, and freshwater forested/shrub wetland areas adjacent to the corridor as all options come together joining with the existing Union Pacific Railroad Hazen Branchline. These areas are north of Walker Lake, adjacent to U.S. Highway 95, 7 kilometers from the town of Schurz.
Schurz bypass 1	2.6 to 4. 3 kilometers	Spring; three unnamed spring/seeps just north of Walker River, adjacent to U.S. Highway 95.

Table 3-3. Surface-water resources along the Mina rail corridor[a] (page 2 of 3).

Mina rail corridor option/common corridor segment	Distance from corridor	Feature[b]
Common corridor segment 1	Would be within/cross	Playas; corridor would cross two unnamed playas about 14 kilometers east of the town of Hawthorne.
Common corridor segment 1	Would be within/cross	Playas; corridor would cross large playas at the foot of the Garfield Hills along U.S. Highway 95, 20 kilometers outside of Hawthorne.
Common corridor segment 1	0.5 kilometer	Playa; corridor would be adjacent to a playa in Soda Springs Valley, along U.S. Highway 95, about 23 kilometers outside of Hawthorne.
Common corridor segment 1	1 kilometer	Playa; corridor would be adjacent to a large playa in Alkali Flat, just south of the town of Luning.
Common corridor segment 1	Crosses/encroaches	Playa; corridor would encroach and cross a large playa in the town of Mina.
Common corridor segment 1	3.5 kilometers	Spring; Southern Pacific Spring, 5 kilometers east of the town of Mina.
Common corridor segment 1	2.1 to 2.3 kilometers	Springs; Soda Springs, including two unnamed springs, just north of the town of Sodaville, along U.S. Highway 95.
Common corridor segment 1	2.6 kilometers	Springs; Martin Spring and an unnamed spring, 6 kilometers east from the town of Sodaville.
Common corridor segment 1	4.4 to 4.6 kilometers	Springs; three unnamed springs at the base of the Pilot Mountains, east of Sodaville.
Common corridor segment 1	3.2 to 4.9 kilometers	Springs; three unnamed springs within the Rhodes Salt Marsh, approximately 3 kilometers along U.S. Highway 95.
Common corridor segment 1	0.2 kilometer	Spring; corridor would encroach an unnamed spring 2 kilometers north of Coaldale.
Montezuma 2	Would be within/cross	Playa; corridor would cross two large playas and one small playa approximately 13 kilometers east of Blair Junction along U.S. Highway 95.
Montezuma 2	Would be within/cross	Small playas; corridor would cross and be adjacent to several small playas, approximately 18 to 20 kilometers from Blair Junction.
Montezuma 2	Would be within/cross	Playas; corridor would cross three small playas, totaling 0.0041 square kilometer, 10 kilometers southwest of Tonopah.

Table 3-3. Surface-water resources along the Mina rail corridor[a] (page 3 of 3).

Mina rail corridor option/common corridor segment	Distance from corridor	Feature[b]
Montezuma 2	1 kilometer	Playa; Millers Pond, a small playa, is adjacent to the corridor along U.S. Highway 95, approximately 5 kilometers from Millers.
Montezuma 2	1.9 to 2 kilometers	Springs; West Spring and three unnamed springs, 3 kilometers northwest of the town of Goldfield.
Montezuma 2	3.8 kilometers	Springs; Sulphur Spring and two unnamed springs, 4 kilometers west of Goldfield.
Montezuma 2	0.9 kilometer	Spring; Slaughterhouse Spring, 1.5 kilometers west of the town of Goldfield.
Montezuma 2	Would be within/cross	Spring; Rabbit Spring and one unnamed spring, within the outskirts of the town of Goldfield.
Montezuma 2	0.4 kilometer	Playa; large playa adjacent to corridor in Stonewall Flat, 3 kilometers northeast of Lida Junction.
Montezuma 1	0.5 kilometer	Spring; Hot Springs adjacent to the corridor in the town of Silver Peak.
Montezuma 1	0.9 kilometer	Spring; Silver Peak Spring adjacent to the corridor in the town of Silver Peak.
Montezuma 1	0.2 to 10 kilometers	Pond; evaporative pond east of the corridor just outside of Silver Peak, associated with local mining operations.
Montezuma 1	Would be within/cross	Pond; corridor would cross mine tailing pond in the town of Silver Peak.
Montezuma 1	4.6 to 4.7 kilometers	Spring; two springs (Twin Springs) 15 kilometers northeast of the town of Silver Peak.
Montezuma 1	3.1 to 3.6 kilometers	Spring; two unnamed springs near the top of Montezuma Peak, in the Montezuma Range.
Bonnie Claire 3	Would be within/cross	Playa; corridor would cross a large playa along U.S. Highway 95, 6 kilometers south of Lida Junction.
Oasis Valley 1	0.4 to 4.5 kilometers	Springs; More than 40 springs in the area of Oasis Valley between Springdale and Beatty along U.S. Highway 95.
Oasis Valley 3	0.2 kilometer	Pond; perennial pond, Colson Pond, is adjacent to the corridor in Oasis Valley, 7 kilometers from Springdale.
Oasis Valley 3	Would be within/cross	Spring; Warm Springs located adjacent to Colson Pond, within the corridor in Oasis Valley, 7 kilometers from Springdale.

a. Source: DIRS 182772-MTS 2007, pp. 31 and 32.
b. To convert kilometers to miles, multiply by 0.62137, to convert square kilometers to acres, multiply by 247.10.

In addition to the surface-water resources identified in Table 3-3, the following floodplains occur within the region of influence of the Mina rail corridor:

<u>Montezuma option 1</u>

- Floodplain from Jackson Wash and Jackson Wash tributaries
- Alkali Lake Playa floodplain (not mapped by the Federal Emergency Management Agency)

<u>Montezuma option 2</u>

- Floodplain between Stonewall Mountains and Cuprite Hills and is associated with Stonewall Flat

<u>Bonnie Claire 3</u>

- Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat

<u>Common corridor segment 5</u>

- Floodplain of the Amargosa River within Thirsty Canyon

<u>Oasis Valley option 1</u>

- Floodplain of the Amargosa River within Thirsty Canyon

<u>Oasis Valley option 3</u>

- Beatty Wash floodplain extending from the Amargosa River floodplain

<u>Common corridor segment 6</u>

- Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (rail line would cross wash and tributaries)
- Drill Hole Wash draining east side of Yucca Mountain to Fortymile Wash (wash and tributary crossed)
- Midway Valley Wash draining east side of Yucca Mountain to Drill Hole Wash, then to Fortymile Wash

3.2.3.1.2 Groundwater

The State of Nevada is divided into hydrographic regions (groundwater basins) and subbasins (hydrographic areas).

The Mina rail corridor and its options would cross three hydrographic regions: Death Valley Basin (Region 14), Central (Region 10), and Walker River (Region 9). Figure 3-5 shows these hydrographic regions and their hydrographic areas. *Water Resources Assessment—Mina Rail Corridor* (DIRS 180887-Converse Consultants 2007, all) contains a quantitative overview of existing groundwater appropriations for each basin in the corridor and includes details on the status, type of use, and approximate quantity of water currently used in each basin.

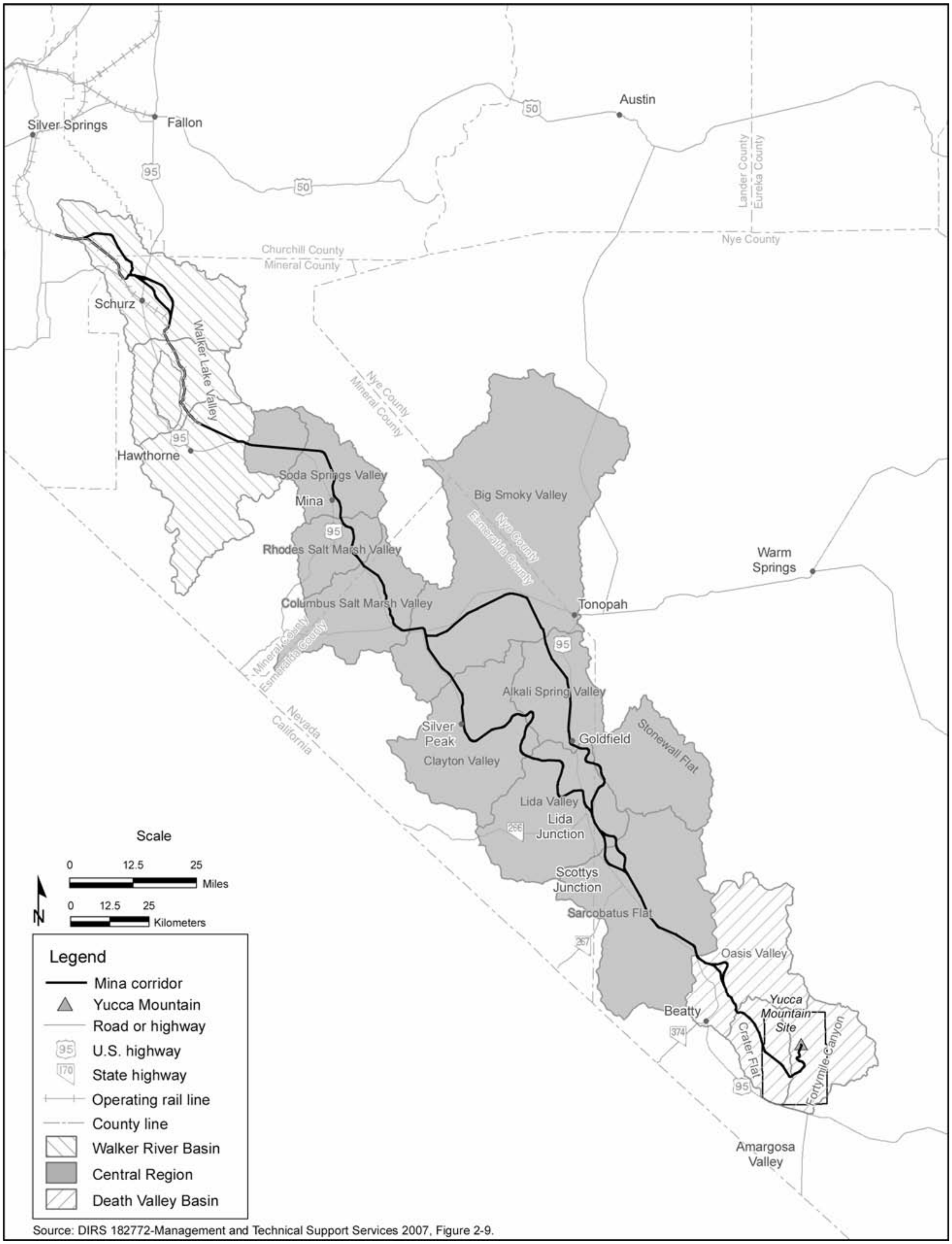


Figure 3-5. Hydrographic regions and areas associated with the Mina rail corridor.

3.2.3.2 Potential Impacts to Hydrology

3.2.3.2.1 Surface Water

Construction in previously undeveloped areas often results in changes to natural drainage. Construction could include regrading that would allow runoff from a number of minor drainage channels to collect in a single ***culvert*** or pass under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. This would cause some localized changes in drainage patterns, but this probably would occur only in areas where natural drainage channels are small. Compaction of soil during construction could reduce water infiltration rates and change natural runoff and drainage patterns. However, some activities would disturb and loosen the ground for some time, which could cause higher infiltration rates. DOE would adhere to engineering design standards. Therefore, impacts associated with the alteration of drainage patterns or changes to erosion and sedimentation rates or locations would be small and localized.

Rail line construction could affect floodplains, either through direct alteration of the stream-channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain.

Construction impacts associated with these floodplains would be similar to other identified drainage areas (the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas could reduce the area through which floodwaters would naturally flow, which could cause water levels to rise at the upstream side of crossings. Sedimentation would be likely to occur on the upstream side of crossings in areas where the flow of water was restricted enough to cause ponding. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, p. 6-79). Therefore, impacts to floodplains from construction of the rail line that result in restrictions in flow and sedimentation would be small.

The Mina rail corridor is in a region where flash flooding is a primary concern. Although such flooding can be violent and hazardous, it is generally limited in its extent and duration, limiting the potential for impacts associated with the corridor; that is, any damage would be expected to be confined to a small portion of the corridor.

Construction of a bridge over the Walker River could have a temporary impact on the quality and flow of the river. Bridge construction would occur during periods of low flow, and DOE would implement erosion-control measures to ensure that these temporary impacts would be small. Bridge construction also could cause the temporary disturbance of freshwater emergent wetlands adjacent to the Walker River.

Installation of culverts or bridges at crossings of ephemeral streams along the corridor could alter drainage patterns and change erosion and sedimentation rates. These impacts would be confined to the area immediately around the crossing and would be small because DOE would comply with appropriate standards to design stream crossings to allow for the flow of flood waters and would implement erosion-control measures during construction of those crossings. For the same reasons, alteration of drainages would be unlikely to increase future flood damage, increase the impacts of floods on human health and safety, or cause harm to the natural and beneficial values of floodplains.

Some streams, adjacent wetlands, and ephemeral washes within the interstate Walker River and Death Valley hydrographic regions (see Figure 3-5) could be regulated under Section 404 of the Clean Water Act. The Department would meet the requirements of the Act prior to constructing crossings of any regulated streams, wetlands, or washes, including conducting an evaluation of alternative crossing locations and designs that would minimize impacts to wetlands and other waters. Impacts to regulated drainages would be the same as those described above.

The Mina corridor would cross three springs: Rabbit Springs and Warm Springs, and an unnamed spring. All three are in the Mina rail corridor. DOE would adjust the rail alignment in the corridor to avoid conducting surface-disturbing activities that may impact these springs.

Construction-related impacts could involve the possible release and spread of contaminants by precipitation or intermittent runoff events or, for options near surface water, possible release to the surface water, and the need for dredging or filling of ephemeral waters. Construction-related materials that could cause contamination would consist of petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to support equipment operations.

Railroad operations in the Mina rail corridor would have little impact on surface waters beyond the alterations to drainage during rail line construction. Access roads and the rail roadbed would have runoff rates different from those of the natural terrain but, given the relatively small size of the potentially affected areas in a single drainage system, there would be little impact on overall runoff quantities.

Rail line maintenance would require periodic inspections of flood-prone areas (particularly after flood events) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired.

3.2.3.2.2 Groundwater

Rail line construction would require water for soil compaction, dust control, and workforce use. The water DOE would use during the construction phase would come primarily from hydrographic basins. If the hydrographic basin is designated, this means that the permitted groundwater rights approach or exceed the estimated ***perennial yield***, water resources are being depleted or require additional administration, and the State Engineer has declared preferred uses of the water. Table 3-4 lists the designation status of the hydrographic basins and the percentage of the Mina rail corridor that would be in the respective basin. Approximately 39 percent of the total Mina rail corridor would be in designated basins.

DOE evaluated the water demand for rail line construction on the basis of earthwork needs and water needed for compaction. Earthwork needs would include excavation of common soil (alluvial material), ripable rock, and drill and blast (solid bedrock). Based on these considerations, total water demand for the Mina rail corridor would be approximately 7.32 million cubic meters (5,950 acre-feet) (DIRS 180877-BSC 2007, p. 2-7).

DOE estimates that the number of wells required to support construction of a rail line in the Mina rail corridor ranges from 86 to 108 wells at 60 to 77 sites, depending on corridor option. Of these, some locations might have two wells where production is anticipated to be low. Consistent with the groundwater resources analysis in the Yucca Mountain FEIS, DOE also assumed a 1-year period for construction activities in the vicinity of each well. The pumping of groundwater from multiple wells for rail line construction could cause a temporary decrease in groundwater resources resulting from the increased demand. Groundwater withdrawal could temporarily decrease the amount of water available for underflow to a downgradient basin or spring discharge. The Nevada State Engineer would need to approve water production from any well DOE proposed to install to support rail line construction. To grant approval, the State Engineer would have to determine that the short-term demand would not cause adverse impacts for other uses and users of the groundwater resource.

Table 3-4. Hydrographic basins the Mina rail corridor would cross.[a,b,c]

Hydrographic basin (and subbasin where applicable)	Length (kilometers)	Percent of total	Designated
Alkali Spring Valley	8	1.9	No
Big Smoky Valley/Tonopah Flat	24	5.8	Yes
Clayton Valley	53	12.8	No
Columbia Salt Marsh Valley	30	7.2	No
Crater Flat	29	7.0	No
Fortymile Canyon/Jackass Flats	14	3.4	No
Lida Valley	51	12.4	No
Oasis Valley	23	5.7	Yes
Rhodes Salt Marsh Valley	17	4.2	No
Sarcobatus Flat	48	11.7	Yes
Soda Springs Valley/Eastern Part	29	7.2	Yes
Soda Springs Valley/Western Part	18	4.5	Yes
Walker Lake Valley/Schurz Subarea	51	12.5	No
Walker Lake Valley/Whiskey Flat-Hawthorne Subarea	15	3.7	Yes

a. Source: DIRS 182772-MTS 2007, pp. 34 and 35.
b. To calculate water demand for each basin, multiply 5,600 acre-feet by the percentage of total.
c. Mina rail corridor basis of analysis consists of Schurz bypass option 1, common corridor segment 1, Montezuma option 1, common corridor segment 2, Bonnie Claire option 3, common corridor segment 5, Oasis Valley option 1, and common corridor segment 6.

Potential impacts to groundwater during the construction phase could include changes to infiltration rates, and new sources of contamination that could migrate to groundwater. Potential impacts would be spread over a large geographic area, so they would be small and temporary for a resource in a single area. Section 3.2.3.2.1 discussion of impacts to surface water describes potential contaminants that rail line construction could release. These contaminants would be the same for groundwater.

Construction activities would disturb and loosen the ground, which could produce greater infiltration rates. However, this situation would be short-lived because the access road and rail roadbed materials would become compacted and less porous. In either case, localized changes in infiltration would cause no noticeable change in the amount of recharge in the area.

If DOE obtained water from a source other than a newly installed well, such as importing water from another source, water would be obtained only from appropriated sources. That is, the water would be from allocations that the Nevada State Engineer had previously determined did not adversely affect groundwater resources.

Railroad operations would have little effect on groundwater resources. Water needs along the corridor would be greatly reduced and limited to water needed for maintenance and to support a greatly reduced work force. Possible changes to recharge, if any, would be the same as those at the completion of construction of the construction phase.

3.2.4 BIOLOGICAL RESOURCES AND SOILS

This section describes biological resources along the Mina rail corridor. Consistent with the Yucca Mountain FEIS, DOE considered the potential for impacts to vegetation communities; special status species (plants and animals), including their habitat; springs, wetlands, and riparian areas; big game habitat; and wild horse and burro ***herd management areas*** that could occur within the 400-meter (0.25-mile)-wide corridor. The analysis considered special status species and big game habitat within 5 kilometers (3 miles) of the corridor that could be affected by rail line construction. DOE also analyzed springs and riparian areas that could be affected by permanent changes in surface-water flows (see Table 3-3). Finally, DOE characterized soils, including soils that could support prime farmland, within the 400-meter-wide corridor (DIRS 182772-MTS 2007, p. 37).

DOE obtained location records for special status species from a statewide database managed by the Natural Heritage Program (DIRS 182772-MTS 2007, p. 37) that contains records of incidental observations of rare or protected plants, fish, and wildlife species. Other information sources included (1) the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all); (2) the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all); (3) the *Biological Field Findings Report for Potential Rail Alignments along the Mina Route* (DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, all); and (4) the *Mina Rail Route Feasibility Study* (DIRS 180222-BSC 2006, all). Additionally, DOE obtained location information from the National Hydrography Dataset Waterbody geospatial data that the U.S. Geological Survey developed in cooperation with the U.S. Environmental Protection Agency, the Geographic Names Information System Nevada geospatial database, and BLM Wild Horse and Burro Management Area Maps (DIRS 182772-MTS 2007, p. 37).

DOE obtained information from (1) the National Hydrography Dataset Waterbody geospatial data that the U.S. Geological Survey developed in cooperation with Environmental Protection Agency (2) the Geographic Names Information System Nevada geospatial database developed by the U.S. Geological Survey and the BLM and (3) the National Wetlands Inventory database managed by the U.S. Fish and Wildlife Service (DIRS 182772-MTS 2007, p. 37).

DOE used soil survey databases from the U.S. Department of Agriculture, Natural Resources Conservation Service (DIRS 176781-USDA 2006, all), to identify soil types and characteristics along the Mina rail corridor.

3.2.4.1 Biological Resources and Soils Affected Environment

3.2.4.1.1 Biological Resources

The following vegetation communities occur along the Mina rail corridor (DIRS 155970-DOE 2002, p. 3-70; DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, all):

- Stabilized dunes, vegetated dunes, and sandy soils occur in isolated areas, primarily along the northern portions of the corridor, and riparian vegetation occurs along the Walker River.
- Mixed salt desert scrub occurs at low elevations in flat valley bottoms or salt flats along the northern portions of the corridor to about the Montezuma Valley.
- The semi-desert shrub steppe community is found along portions of Montezuma option 2 west of Tonopah.
- Mojave mid-elevation mixed salt desert scrub occurs at the southern ends of Montezuma options 1 and 2 and inter-mountain sagebrush steppe occurs as Montezuma 1 crossed the Montezuma Mountain Range.
- Creosote-bursage, blackbrush, hopsage, and Mojave mixed scrub occur along the southern portions of the corridor from about common corridor segment 2 to Yucca Mountain.

The corridor and its options would cross habitat for two species classified as threatened under the Endangered Species Act: the desert tortoise (*Gopherus agasizii*) and Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*). The desert tortoise also is classified as threatened by Nevada (Nevada Administrative Code 503.080). About 50 kilometers (30 miles) of the southern portion of the corridor from Beatty Wash to Yucca Mountain is habitat for desert tortoises. However, the abundance of desert tortoises along this portion of the corridor is low to very low (DIRS 103281-Karl 1981, pp. 76 to 92; DIRS 101914-Rautenstrauch and O'Farrell 1998, pp. 407 to 411). The corridor would cross potential habitat for the Lahontan cutthroat trout at the Walker River north or south of Weber Reservoir. The Lahontan cutthroat trout occurs in Walker Lake and in the Walker River upstream to the Weber Reservoir during spawning. The upstream spawning migration of trout is blocked by the Weber Reservoir dam, although the Bureau of Indian Affairs might build a fish ladder around that dam that will enable Lahontan cutthroat trout to migrate upstream of the dam. There are no areas classified as critical habitat for these threatened species within or near the corridor.

The Railroad Valley springfish (*Crenychthis nevadae*), which is federally and state (Nevada Administrative Code 503.065) classified as threatened, and the Sodaville milkvetch (*Atragalus lentiginousus Douglas var. sesquimetralis*), a species classified as critically endangered by Nevada (Nevada Administrative Code 527.010), occur in or near Soda Spring at Sodaville. This spring is about 2.1 kilometers (1.3 miles) from the Mina rail corridor (DIRS 180222-BSC 2006, p. 22). The federally and state-listed (Nevada Administrative Code 503.050) endangered Southwestern willow flycatcher (*Empidonax traillii extimus)* has been observed about 4.3 kilometers (2.7 miles) from the corridor north of Beatty along U.S. Highway 95 (DIRS 182772-MTS 2007, p. 38).

No plant species classified as sensitive by the BLM in Nevada have been found within the 400-meter (0.25-mile)-wide corridor. However, the following four BLM sensitive plant species have been observed within 5 kilometers (3 miles) of the corridor (DIRS 182772-MTS 2007, p. 38; DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, all).

- Oryctes (*Oryctes nevadensis*) occurs about 5 kilometers (3 miles) from the southern portion of the Schurz bypass options, 2.6 kilometers (1.6 miles) from the start of common corridor segment 1, and about 0.64 kilometer (0.4 mile) from Mina common corridor segment 1 north of the town of Mina.
- Eastwood milkweed (*Asclepias eastwoodiana*) has been found about 4 kilometers (2.5 miles) east of Montezuma option 1 north the town of Silver Peak and west of Weepah Hills.
- Nevada dune beardtongue (*Penstemon arenarius*) has been found about 0.64 kilometer (0.4 mile) west of common corridor segment 6 in Sarcobatus Flats.
- Two populations of the black woollypod (*Astragalus funereus)* have been documented 0.1 and 0.48 kilometer (0.06 and 0.3 mile) outside the corridor just south of Beatty Wash.

The Oasis Valley pyrg or springsnail (*Pyrgulopsis micrococcus*), a BLM-designated sensitive species, has been observed in springs from about 1.8 to more than 5 kilometers (1.1 to 3 miles) west of Oasis Valley option 1 and common corridor segment 6 north of Beatty (DIRS 182772-MTS 2007, p. 38).

The state-protected Amargosa toad (*Bufo nelsoni*) (Nevada Administrative Code 503.075) occurs in numerous springs in Oasis Valley from 1.1 to more than 5 kilometers (0.7 to 3 miles) west of Oasis Valley option 1. The Oasis Valley speckled dace (*Rhinichthys osculus* ssp.), which also is state protected (Nevada Administrative Code 503.065), occurs more than 2.6 kilometers (1.6 miles) from Oasis Valley option 1 in the same areas.

Portions of common corridor segment 6 cross habitat for the chuckwalla (*Sauromalus ater*), a lizard classified as sensitive by the BLM in Nevada.

The Mina rail corridor would cross habitat for numerous birds classified as sensitive by the BLM in Nevada, including the western burrowing owl (*Athenes cunicularia*), peregrine falcon (*Falco peregrinus*), loggerhead shrike (*Lanius ludovicianus*), sage thrasher (*Oreoscotes montanus*), phainopepla (*Phainopepla nitens*), and Brewer's sparrow (*Spizella breweri*). Golden eagles (*Aquila chrysaetos*) are found throughout the corridor and bald eagles (*Haliaeetus leucocephalus*) winter along portions of the Walker River on the Walker River Paiute Reservation. These two species are protected under the Bald and Golden Eagle Protection Act. In addition, all migratory birds found along the corridor are protected under the Migratory Bird Treaty Act.

A documented occurrence of the fringed myotis (*Myotis thysanodes*), a BLM-designated sensitive species and state-protected bat (Nevada Administrative Code 503.030), took place on the west edge of Jackass Flats about 5 kilometers (3 miles) from the corridor (DIRS 182772-MTS 2007, p. 38). Other BLM-designated sensitive bats that may occur along the Mina rail corridor include the Townsend's big-eared bat (*Corynorhinus townsendii*); the spotted bat (*Euderma maculatum),* a Nevada threatened species; the California myotis (*Myotis californicus*); the western small-footed bat (*Myotis ciliolabrum*); the western pipistrelle (*Pipistrellus hesperus*); and the state-protected pallid bat (*Antrozous pallidus*) (DIRS 182772-MTS 2007, p. 39). The corridor may cross habitat for other mammals classified as sensitive by the BLM in Nevada, including the pygmy rabbit (*Brachylagus idahoensis*), and the dark kangaroo mouse (*Microdipidops megacephalus albiventer*).

From Hawthorne to Redlich Pass, common corridor segment 1 would pass near areas designated by the BLM as desert bighorn sheep (*Ovis Canadensis nelsoni*) yearlong habitat, and common corridor segment 2 would pass near yearlong bighorn sheep habitat north of Lone Mountain. Mina common corridor segment 6 would cross a bighorn sheep movement corridor in the Beatty Wash area. Portions of Mina common corridor segment 1 from Thorne to Blair Junction would be within 5 kilometers (3 miles) of BLM-designated yearlong habitat for pronghorn antelope (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*). Montezuma option 2 would cross yearlong pronghorn antelope habitat in Montezuma Valley. Montezuma option 1 would cross yearlong mule deer habitat near the town of Silver Peak and in the Montezuma Range, and Oasis Valley option 3 would cross seasonal mule deer habitat. Mountain lions (*Felis concolor*), which are also classified as a game species in Nevada, are found throughout southern and central Nevada (DIRS 176043-BLM 1998, all, DIRS 173224-BLM 1997, all, DIRS 179560-BLM 2001, all).

The Mina rail corridor would cross four wild horse and burro management areas: Montezuma Peak, Goldfield, Stonewall, and Bullfrog. The corridor would pass within 5 kilometers (3 miles) of the Garfield Flat, Silver Peak, and Pilot Mountain (or Dunlap) Herd Management Areas (DIRS 182772-MTS 2007, p. 39).

The only riparian area the Mina rail corridor would cross would be along the Walker River (see Table 3-3). There are freshwater emergent wetlands and riparian habitat at both locations being considered for crossing that river. Section 3.2.3.1.1 describes playas and associated potential wetlands within and near the corridor.

Springs within the 400-meter (0.25-mile)-wide corridor are Rabbit Spring and one unnamed spring, which are on the upstream edge of Montezuma corridor option 2 near the town of Goldfield. Table 3-3 lists surface-water resources in the Mina rail corridor. Additional warm springs located adjacent to Colson Pond in the Oasis Valley would be within the 400-meter-wide corridor.

3.2.4.1.2 Soils

The Farmland Protection Policy Act requires Federal agencies to take into account the adverse effects of their programs on the preservation of farmlands, including the conversion of ***prime farmland***. DOE used the soil survey databases (DIRS 176781-USDA 2006, all) to locate soils along the corridor that are classified as supporting prime farmland. Less than 1 percent of the Mina rail corridor contains soils classified as prime farmland. Those soils are on the Walker River Paiute Reservation.

A number of soil types occur throughout the Mina rail corridor. The soil types in the vicinity of the corridor can be classified in more general terms as sandy soils or dune areas, which are characteristically alkaline, salty, and basic, containing calcium carbonate, and light-colored soils. These soils also include rocky outcrops; talus slopes; and granitic and gravelly areas (DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, p. 31, Table 1). The Schurz bypass options would pass through areas of primarily sandy soils and between Hawthorne and Blair Junction, the corridor would contain mostly areas of alluvial soils. Montezuma option 1 would pass through areas of fine-grained soils at the playa in Clayton Valley, and Montezuma option 2 would pass through areas consisting of primarily sandy soils. The remainder of the corridor, south of Lida Junction, would pass through areas of alluvial and rocky soils (DIRS 180222-BSC 2006, p. 27, Table 3.2-1).

Other soil characteristics that are particularly relevant to the proposed rail corridor are ***erodes easily*** and ***blowing soil***. Soil with either of these characteristics can be quite susceptible to erosion. The erodes easily characteristic is a measure of the susceptibility of bare soil to be detached and moved by water. These soils, which tend to contain relatively high amounts of silts and ***loams***, tend to erode easily when disturbed. Approximately 19 percent of the Mina rail corridor has soils with this characteristic (DIRS 176781-USDA 2006, all). The blowing soil characteristic is based on the soil survey classification of susceptibility of a given soil to wind erosion. The blowing soil characteristic identifies areas where fine-textured, sandy materials predominate and where uncontrolled soil disturbance could result in increased wind erosion. Depending on options, between 23 and 26 percent of the Mina rail corridor would have soils with the blowing soil characteristic (DIRS 176781-USDA 2006, all).

3.2.4.2 Potential Impacts to Biological Resources and Soils

Rail line construction in the Mina rail corridor would involve clearing of vegetation, excavation, and filling for subgrade within the 400-meter (0.25-mile)-wide corridor. Maximum land disturbance within this area is approximately 37 to 41 square kilometers (9,000 to 10,000 acres).

With the exception of riparian areas, none of the vegetation communities in the Mina corridor (described in Section 3.2.4.1) are unique or rare in the region. A bridge over the riparian area along the Walker River would minimize disturbance to that vegetation community. The total land area disturbed within all community types would be small compared to the existing area of Nevada that supports those communities.

Clearing vegetation and disturbing the soil could create habitat for colonization by ***noxious weeds*** and ***invasive species*** in the Mina corridor. This could result in an increase in the abundance of such plants corridor, which in turn could lead to suppression of native species and increased fuel loads for wildfires. Reclamation of disturbed areas would enhance the recovery of native vegetation and reduce colonization by noxious weeds and invasive species.

There is desert tortoise habitat for about 50 kilometers (30 miles) along the southern end of the Mina rail corridor. Rail line construction would result in the permanent loss of desert tortoise habitat within the corridor. In addition, these construction activities could cause mortality of individual desert tortoises; however, desert tortoises are not abundant in this area and the likelihood of encountering tortoises would be low. Therefore, losses would be few. Relocating tortoises encountered along the route prior to construction would minimize losses of individuals. The presence of the rail line could interfere with the normal movements of individual tortoises. DOE would consult with the U.S. Fish and Wildlife Service (under Section 7 of the Endangered Species Act) regarding this species and would comply with all terms and conditions imposed by the U.S. Fish and Wildlife Service.

The Lahontan cutthroat trout, a federally listed species, occurs in the Walker River downstream of the Weber Dam during spawning and could occur upstream of that dam in the future if a fish ladder is constructed. Construction of a bridge across the Walker River could increase turbidity and sedimentation, which would temporarily degrade the quality of water. However, the bridge would be constructed during periods of low flow, when the species would be rare or absent from the river, so impacts would be small. The bridge would not affect the ability of trout to migrate up the river.

The only other federally listed species near the corridor are the southwestern willow flycatcher and the Railroad Valley springfish. There is no habitat for these species in the corridor and they would not be affected.

One population of the Sodaville milkvetch, a state-protected plant species, occurs near springs that are about 2.1 kilometers (1.3 miles) from the corridor and would not be affected. There are no known populations of BLM-designated sensitive plant species within the 400-meter (0.25-mile) corridor that could be directly or indirectly affected by land-clearing activities and rail line construction. There are populations of four BLM-designated sensitive plant species that have been documented within 5 kilometers (3 miles). DOE anticipates that corridor activities would not extend to these areas and that construction activities would not affect these populations.

Two state-protected species, the Amargosa toad and the Oasis Valley speckled dace, and one BLM-protected species, the Oasis Valley pyrg or spring snail, occur in springs outside the corridor, but within 5 kilometers (3 miles) in and near Oasis Valley. DOE anticipates that corridor activities would not extend to these areas and that construction activities would not affect these populations.

Rail line construction could impact BLM-designated sensitive birds and other migratory birds through loss of suitable nesting and foraging habitat, and birds avoiding areas where there were construction activities. Rail line construction could also impact BLM-designated sensitive bat and other mammal species through loss of suitable habitat, and avoidance of areas where there were construction activities. The area of permanent loss of habitat would be small compared to available habitat in the region.

The Mina rail corridor would cross habitat for bighorn sheep, pronghorn antelope, mule deer, and mountain lions. It also would cross wild horse and burro herd management areas. Construction activities would reduce some habitat in these areas and have the potential to disrupt movement patterns of wild horses, burros, and game species. These animals would probably avoid contact with humans at construction locations and would temporarily move to other areas during the construction phase.

Construction of the Schurz bypass options would cause impacts to wetlands and riparian habitat during construction of a bridge over the Walker River. The affected wetland and riparian areas would be small compared to the total area of these community types in the corridor. Construction of the bridge could also cause temporary increases in sedimentation, but would not alter the natural flow or stream channel of the Walker River. Prior to initiating construction activities, DOE would consult with the U.S. Army Corps of Engineers to determine if a Section 404 permit under the Clean Water Act would be required.

The Mina rail corridor would cross three springs (see Table 3-3): Rabbit Springs and Warm Springs, and an unnamed spring. All three are in the Mina corridor. DOE would adjust the rail alignment to avoid conducting surface-disturbing activities that could affect these springs.

Impacts to soils during the construction phase would be primarily due to land disturbance. Less than 1 percent of soils in the Mina rail corridor are classified as prime farmland. These are located along the

Schurz bypass options on the Walker River Paiute Reservation. Soils throughout the corridor probably would be subject to an increase in erosion potential during the construction phase. DOE would implement dust-suppression and other measures to reduce this potential. As construction proceeded, the rail roadbed would be covered with ballast rock, which would virtually halt erosion from that area. As construction ended, disturbed areas (other than the rail roadbed and access roads) would slowly recover. Other permanent erosion-control systems would be installed as appropriate. Introduction of contaminants into the soil would also be a potential concern. Proper control of hazardous materials during construction and prompt response to spills or releases would, however, reduce this concern. Impacts to soils would be limited to disturbed areas and would be temporary and small.

Railroad operations would not lead to additional habitat losses, although maintenance activities would prevent habitat recovery in the narrow band occupied by the rail line and access roads. There could be loss of habitat due to inadvertent fires along the right-of-way from rolling-equipment operations and maintenance activities. Although passing trains probably would cause mortality of individuals of some species, losses would be unlikely to affect regional populations because all species are widespread geographically.

Passing trains could disrupt wildlife, including game animals, horses, and burros, but such effects would be transitory. Noise from a train probably would disturb animals close to the track throughout the operations phase, but this disturbance would diminish with distance from the track and over time as animals acclimated to daily disturbances from passing trains. The frequency of trains using the corridor (an average of 17 one-way trains per week) indicates that disturbance of animals near the rail line would probably be minimal. Noise from the trains could cause animals to move away from the tracks and, possibly, cause changes in migratory patterns.

Impacts to soils during the operations phase would be small because train movement would not disturb soils, and maintenance of the railbed and rails would involve minimal disturbance beyond that which had occurred during the construction phase.

3.2.5 CULTURAL RESOURCES

Cultural resources include any historic and archaeological sites, buildings, structures, landscapes, or objects resulting from or modified by human activity and can include mining, ranching, and linear features such as roads and trails. Cultural resources designated as historic properties warrant consideration with regard to potential adverse impacts resulting from proposed federal actions.

The region of influence for cultural resources is the 400-meter (0.25-mile)-wide corridor. This area includes the area of potential disturbances that could have indirect impacts on cultural resources. DOE conducted an archeological site file search using records from the Desert Research Institute, the Nevada Cultural Resources Information System, and archeological information repositories at the Harry Reid Center at the University of Nevada-Las Vegas, and the Nevada State Museum in Carson City.

3.2.5.1 Cultural Resources Affected Environment

In 2007, DOE conducted a records search for the Mina rail corridor for a width of 400 meters (0.25 mile) and identified several cultural resources sites along the Schurz bypass options, some of which are eligible or potentially eligible for listing on the *National Register of Historic Places*. These include the historic Rawhide Western Railroad grade and Reese River Road stage route, and several prehistoric sites.

The Mina rail corridor would follow various lengths of some historic railroads between Hawthorne and Tonopah Junction, south toward the town of Silver Peak, and intersect or follow many segments of the former Las Vegas and Tonopah line along common corridor segment 2, south of the town of Goldfield. In these locations, DOE would refurbish the historic rail beds for use with the proposed rail line. Eligible or unevaluated resources associated with the railroads include the Sodaville to Tonopah freight road, railroad stations, abandoned grades, construction-related features, workers' encampments, and resources associated with Luning, Mina, Coaldale, and other towns established along the rail lines.

A portion of the Mina rail corridor would run just south of Miller's Townsite, a station on the Tonopah and Goldfield Railroad and a mill site for silver ore. The corridor would pass near known historic graves and the historic cemetery at Miller's Townsite. In addition, the corridor would run adjacent to Cuprite, an unrecorded railroad station along the abandoned rail line of the former Bullfrog Goldfield Railroad near Ralston. The station had a post office and served the mining camps of Lida, Hornsilver, Bonnie Claire, and Tule Canyon in the early twentieth century. Also, a number of prehistoric sites, some of which are eligible or potentially eligible for listing on the *National Register of Historic Places*, are located nearby.

A portion of the Mina rail corridor would run just west of the current boundary of the Goldfield Historic District, but early photographs of Goldfield reflect that the town extended west to the base of Malpais Mesa. To the north, a portion of the corridor would be just east of the Goldfield Cemetery, but there is historic confusion over some burial-plot locations, so the actual boundary location is in question. The corridor would also run through the extensive historic Goldfield dump, which is eligible for listing on the *National Register of Historic Places*. In addition, there is the potential for buried prehistoric sites at nearby springs, as evidenced by prehistoric rock art (DIRS 182772-MTS 2007, p. 42).

Other areas of the Mina rail corridor would be within 1.6 kilometers (1 mile) of several cultural resource sites, including a Western Shoshone village, petroglyphs near Beatty and Schurz, and Black Cone in Crater Flats, which ethnographers and American Indians have identified as places of religious significance or power (DIRS 102043-AIWS 1998, all).

The site-file search for the Mina rail corridor identified 132 previously recorded archaeological sites (see Table 3-5). The prehistoric and historic sites identified range in size from isolated artifacts and scatters of artifacts to town sites and transportation networks (such as stage roads and railroad grades). About 21 percent are considered to be eligible for listing on the *National Register of Historic Places*. There are 35 sites that have not been evaluated for eligibility. Based on the results of site-file searches for the Mina rail corridor, it appears that less than 5 percent of the corridor has been surveyed (DIRS 182772-MTS 2007, p. 43).

3.2.5.2 Potential Impacts to Cultural Resources

Prior to construction of a rail line, field surveys to identify cultural resources and potentially, measures to mitigate impacts to those resources, would be required. If cultural resources were encountered, a qualified archaeologist coordinating with the Nevada State Historic Preservation Officer and DOE would participate in directing activities to ensure that the resources were properly protected or the impact mitigated. DOE would implement procedures to avoid or reduce direct impacts to cultural resources in construction areas of surface-disturbing activities. Nevertheless, there could be direct impacts to cultural resources (such as disturbing the sites or crushing artifacts) during construction activities.

There could be indirect impacts to cultural resources during the construction phase as a result of increased access and increased numbers of workers near cultural resource sites. These factors would increase the probability for either intentional or inadvertent indirect impacts to cultural resources. However, overall impacts would be small.

No additional direct or indirect impacts to cultural resources would be expected during the operations phase.

Table 3-5. Number of previously recorded cultural resource sites within the 400-meter (0.25-mile) area of the Mina rail corridor.[a]

National Register of Historic Places status	Prehistoric	Historic	Prehistoric and historic	Unknown	***Totals***
Eligible	2	22	4	0	28
Not eligible	41	17	11	0	69
Unknown	15	15	2	3	35
Totals	58	54	17	3	132

a. Source: DIRS 182772-MTS 2007, p. 43.

3.2.6 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

The analysis for occupational and public health and safety focuses on traffic, worker industrial safety, incident-free radiological and nonradiological impacts, and radiological impacts related to accidents. To estimate transportation impacts, DOE defines the region of influence for the Mina rail corridor as beginning at the Hazen siding in Churchill County, Nevada, and ending at Yucca Mountain. The impacts do not include those from transportation from the Nevada border to the Hazen siding. The region of influence for each includes:

- Traffic impacts: The 400-meter (0.25-mile)-wide rail corridor and public highways that would be used by workers and for shipments of materials and supplies during the construction and operations phases
- Worker industrial safety impacts: The 400-meter (0.25-mile)-wide rail corridor
- Incident-free radiological and nonradiological impacts: The 800-meter (0.5-mile)-wide area on either side of the centerline of the rail corridor
- Radiological impacts related to accidents: An area within an 80-kilometer (50-mile) radius from a potential occurrence location in the rail corridor

DOE obtained information from the Bureau of Labor Statistics for 2005. The Department also used the RADTRAN 5 computer program (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all) and the RISKIND computer program (DIRS 101483-Yuan et al. 1995, all) where applicable.

3.2.6.1 Occupational and Public Health and Safety Affected Environment

During the construction and operations phases, common industrial hazards could cause health and safety impacts to workers. The categories of worker impacts include total recordable cases per 100 full-time-equivalent workers, lost-workday cases per 100 full-time-equivalent workers, and fatalities per 100 full-time-equivalent workers. Total recordable cases are occupational injuries or occupation-related illness that result in (1) a fatality, regardless of the time between the injury or the onset of the illness and death, (2) lost workday cases (nonfatal), and (3) incidents that result in the transfer of a worker to another job, termination of employment, medical treatment, loss of consciousness, or restriction of motion during work activities.

Table 3-6 lists Bureau of Labor Statistics incident-rate statistics for 2005 used to estimate total recordable cases, lost workday cases, and fatalities for involved and noninvolved workers during the construction and operations phases. For this analysis, involved workers are personnel who would be involved in construction or operations activities. Noninvolved workers are personnel who would be involved in

Table 3-6. Incident-rate statistics for estimation of industrial safety impacts from railroad construction and operations in the Mina rail corridor.[a]

Activity	Total recordable cases per 100 FTEs[b]		Lost workday cases per 100 FTEs		Fatalities per 100 FTEs	
	Involved	Noninvolved	Involved	Noninvolved	Involved	Noninvolved
Construction	5.6	2.4	3.1	1.3	0.011	0.0035
Operations	2.5	2.4	1.9	1.3	0.018	0.0035

a. Sources: DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all.
b. FTE = full-time equivalent; one full-time equivalent is 2,000 labor hours.

management, administration, and security. The Bureau of Labor Statistics compiled the health and safety statistics by employment sectors; the sectors used for this analysis include Heavy and Civil Engineering Construction; Management of Companies and Enterprises; Transportation and Warehousing: Rail Transportation; and Support Activities for Transportation. Sectors analyzed for fatality incident statistics included Construction, Professional and Business Services, and Transportation and Warehousing.

3.2.6.2 Potential Impacts to Occupational and Public Health and Safety

The occupational and public health and safety impact analysis focused on transportation impacts, worker industrial safety impacts, incident-free radiological and nonradiological impacts, and radiological and nonradiological impacts in relation to accidents.

3.2.6.2.1 Industrial Safety

The analysis based the estimates of industrial safety impacts from railroad construction on full-time-equivalent workers per year; with the assumption that there are 2,000 hours per worker-year this would be about 6,500 full-time-equivalent worker-years (DIRS 182772-MTS 2007, p. 44). The analysis based the estimates of industrial safety impacts from railroad operations in the Mina rail corridor on about 60 full-time-equivalent workers each year, about 2,000 worker-years. Table 3-7 lists estimated industrial safety impacts to workers during construction and the estimated industrial safety impacts of railroad operations based on Bureau of Labor Statistics in the Mina rail corridor for up to 50 years.

Table 3-7. Impacts to workers from industrial hazards during the construction and operations phases.[a]

Group and industrial hazard category	Construction	Operations[b]	Total
Involved worker			
Total recordable cases[c]	300	37	337
Lost workday cases	170	28	198
Fatalities	0.6	0.26	0.86
Noninvolved worker			
Total recordable cases	30	12	42
Lost workday cases	16	6.4	22.4
Fatalities	0.04	0.02	0.06
Totals[d]			
Total recordable cases	330	49	379
Lost workday cases	180	35	215
Fatalities	0.6	0.3	0.92

a. Estimates of worker-years multiplied by accident rate (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).
b. Totals for railroad operations occurring up to a 50-year operations period.
c. Total recordable cases include injuries and illness.
d. Totals might differ from sums of values due to rounding.

3.2.6.2.2 Transportation

This analysis includes estimated impacts from the transportation of construction material to the construction sites and impacts from commuting workers. There could be traffic fatalities and vehicle emission impacts during the movement of equipment and delivery of materials for construction, worker commutes to and from construction sites, and transport of water to construction sites. Table 3-8 lists the impacts of transportation during the construction phase. As shown, four of the fatalities could be from traffic accidents during the construction phase. An additional 0.54 fatality could be from cancer related to vehicle emissions during the construction phase.

Table 3-8. Transportation impacts during railroad construction in the Mina corridor.[a]

Transportation impact category	Traffic fatalities	Latent cancer fatalities	***Total***
Vehicle emission impacts (cancer fatality)			
Material delivery vehicles	–	0.04	
Worker commuting	–	0.5	
Subtotal		0.54	
Transportation accidents (fatalities)			
Material delivery vehicles	0.3	–	
Worker commuting	3.7	–	
Subtotal	4.0		
Totals[b]	4.0	0.54	4.6

a. Source: DIRS 182772-MTS 2007, p. 45.
b. Numbers are presented using two significant figures. Totals might differ from sums of values due to rounding.

The transportation of ***spent nuclear fuel*** and ***high-level radioactive*** waste in the Mina rail corridor could result in radiological and nonradiological impacts to workers and the public. Radiological impacts could result from ***radiation*** the rail ***cask*** contents would emit during incident-free transportation, from ***radionuclides*** released from the cask during transportation accidents, or from radiation the cask contents emitted because of a loss of shielding during a transportation accident. Nonradiological impacts (vehicle emission-related fatalities) could result from diesel locomotives and fugitive dust, and from nonradiological transportation accidents that involved workers and members of the public.

To estimate transportation impacts, DOE defined the region of influence beginning at the Hazen siding in Churchill County, Nevada, and ending at Yucca Mountain. For incident-free transportation, the potential human health impacts for transportation workers and populations along the corridor were estimated. Transportation workers would include train crews, security escorts, workers at the staging yard, and workers who could be exposed to radiation at sidings when a train carrying loaded casks passed. Members of the public would include people living within 0.8 kilometers (0.5 mile) of the Mina rail corridor and around the staging yard. The analysis used the RADTRAN 5 computer program (DIRS 150898-Neuhauser and Kanipe 2000; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000) and the RISKIND computer program (DIRS 101483-Yuan et al. 1995) to estimate these impacts.

For transportation accidents, DOE estimated radiological impacts for accidents that involved releases of radioactive material from the shipping casks, accidents that involved a reduction in the shielding of the shipping casks, and accidents in which no release of radioactive material and no deformation of shielding occurred. For these accidents, the analysis used the RADTRAN 5 program to estimate radiological accident risks (probability of occurrence times consequences) for a complete spectrum of accidents. In addition, DOE estimated the number of traffic fatalities that would result from nonradiological transportation accidents.

Chapter 6 and Appendix J of the Yucca Mountain FEIS describe the methods and data DOE used to estimate the radiation doses for workers and members of the public. Since DOE completed the Yucca

Mountain FEIS, the repository design and operational plans have evolved. There have also been changes to some of the data DOE used to estimate radiation doses and radiological impacts. These changes include the use of updated latent cancer fatality conversion factors, radiation dosimetry, additional escorts, dedicated trains, 2000 Census data, shipment estimates, radionuclide inventories, exposure times and staffing estimates, and sabotage release fractions (DIRS 182772-MTS 2007, p. 46).

3.2.6.2.2.1 Workers along the Mina Rail Corridor. During the shipment of spent nuclear fuel and high-level radioactive waste from the Hazen siding to the repository, workers on the trains and those working along the rail line could be exposed to direct radiation from approximately 9,500 shipping casks. Table 3-9 lists the estimated radiation doses and impacts for involved workers. The estimated collective radiation dose for the operations phase would be 310 person-rem. The estimated number of latent cancer fatalities would be 0.18 (about 1 chance in 6 that there would be one cancer fatality in the exposed worker population) for a radiation-related latent cancer fatality in this group.

3.2.6.2.2.2 Workers at the Staging Yard. When shipping casks arrived at the staging yard, personnel would remove the railcars that carried the casks from the train, inspect them, and transfer them to another train for transport to Yucca Mountain. The escorts who had accompanied the shipping casks from their origin would be present during the inspection. For purposes of this analysis, DOE assumed these workers, inspectors, and escorts would be exposed to direct radiation from approximately 9,500 shipping casks. In addition, the analysis assumed that noninvolved workers would be exposed to direct radiation during these activities.

The estimated collective radiation dose for involved and noninvolved workers at the staging yard would be 250 person-rem. The estimated number of latent cancer fatalities for these workers would be 0.15. Staging yard and other facilities workers would participate in a radiation protection program and would not be exposed to radiation greater than the administrative control level for repository facilities of 0.5 rem per year. This requirement could limit the number of hours a worker would be able to work at the staging yard to fewer than 2,000 per year.

3.2.6.2.2.3 Maximally Exposed Workers. The maximally exposed worker could be an escort. This person could receive an estimated radiation dose of about 17 rem, based on a 0.5-rem-per-year radiation dose administrative control level (DIRS 174942-BSC 2005, Section 4.9.3.3). The estimated probability of a latent cancer fatality for a maximally exposed worker would be 0.01. Escorts and other railroad workers would participate in a radiation protection program and would not be exposed to radiation greater than the radiation dose administrative control level for repository facilities of 0.5 rem per year (DIRS 174942-BSC 2005, Section 4.9.3.3). In some cases, this requirement could limit escorts to work fewer than 2,000 hours per year on the railroad.

3.2.6.2.2.4 Members of the Public along the Mina Rail Corridor. During the shipment of spent nuclear fuel and high-level radioactive waste from the Hazen siding to Yucca Mountain, people along the rail line could be exposed to direct radiation from approximately 9,500 shipping casks.

Table 3-9 lists the radiation impacts for members of the public along the Mina rail corridor. The estimated collective radiation dose over the operations phase for members of the public would be 1.4 person-rem. The estimated number of latent cancer fatalities would be 0.00082 (about 1 chance in 1,200 that there would be one cancer fatality in the group of exposed members of the public).

The ***maximally exposed individual*** could be a person who lived beside the rail line operations right-of-way. The estimated radiation dose for this individual would be 0.0078 rem over the operations phase. The estimated probability of a latent cancer fatality for this individual would be 0.0000047.

Table 3-9. Operations impacts of transportation for the Mina rail corridor.[a]

Transportation impact category	Traffic fatalities	Radiation dose (rem or person-rem)	Probability of LCFs[b]	Number of LCFs	***Total***
Maximally exposed individual		0.0078	0.0000047	–	
Workers		550		0.33	
Along corridor	–	310	–	0.18	
At staging yard		250		0.15	
Maximally exposed worker	–	17	0.01	–	
Incident-free radiological impacts(LCFs)					
Public	–	1.4	–	0.00082	
Radiological accident (LCFs)		0.012	–	0.0000074	
Vehicle emission impacts (cancer fatalities)					
Waste transportation	–	–	–	0.0034	
Worker commuting	–	–	–	0.4	
Transportation accidents (fatalities)					
Waste transportation	0.31	–	–	–	
Worker commuting	3.3	–	–	–	
Totals	3.6	–	–	0.7	4.3

a. Source: DIRS 182772-MTS 2007, p. 46.
b. LCF = latent cancer fatality.

People along the Mina rail corridor could be exposed to diesel exhaust and fugitive dust from railroad operations and maintenance. Table 3-8 lists these nonradiological vehicle emission impacts. There could be 0.0034 fatality from waste transportation and 0.4 fatality from workers commuting.

3.2.6.2.3 Accidents

The potential risks of transportation could be associated with three types of accidents: (1) an accident that released radioactive material from the shipping cask, (2) an accident in which no release of radioactive material occurred but there was a deformation of shielding because of lead shield displacement, and (3) an accident in which no release of radioactive material and no deformation of shielding occurred. The impacts from these types of accidents are known as the radiological accident dose risk, and are quantified in terms of latent cancer fatalities. The impacts of traffic fatalities involving the casks were also estimated.

Table 3-9 lists impacts from these types of accidents. Over the operations phase, the estimated dose risk from a radiological accident would be 0.0000074 latent cancer fatality. Over this same time period, the estimated risk of a nonradiological transportation accident fatality would be 0.31.

In summary, Table 3-9 lists the estimated radiological and nonradiological impacts for workers and members of the public from the transportation of spent nuclear fuel and high-level radioactive waste in the Mina rail corridor. The estimated total number of fatalities for rail corridor operations would be 4.3. Approximately three of these fatalities would be from traffic accidents that involved commuting workers; other estimated impacts would be about 1 fatality. Estimated radiological exposures to workers would account for about 8 percent of the estimated fatalities, while radiological exposure of members of the public, and radiological accident risks, would account for less than 0.1 percent of the total fatalities. Estimated fatalities from vehicle emissions would account for about 9 percent of the total fatalities.

3.2.7 SOCIOECONOMICS

The Mina rail corridor would cross portions of Lyon, Mineral, Esmeralda, and Nye Counties and the Walker River Paiute Reservation. Most of the residential areas on the Reservation are within the boundaries of Mineral County, with a portion in Lyon County.

DOE evaluated potential impacts to five socioeconomic variables (employment, population, economic measures, housing, and public services) and developed a profile of the existing socioeconomic conditions in the region of influence. The breadth and depth of the evaluation mirrors that of the original corridor-level analysis provided in the Yucca Mountain FEIS. The analysis includes the present and anticipated impacts to those variables. The region of influence for the socioeconomics analysis is defined as those Nevada counties the Mina rail corridor would cross, and the two areas where most workers would be expected to reside (the Carson City/Washoe County area and Clark County). DOE also developed a general profile of the Walker River Paiute Reservation. The analysis estimated potential changes that could result from the railroad construction and operations.

To evaluate this resource area, DOE obtained data from the U.S. Census Bureau, the Nevada State Demographer, and other local and state sources. In addition, the Department utilized estimates and projections from the socio-demographic forecasting software program REMI, version 9, to develop baselines. The use of these sources is consistent with the Yucca Mountain FEIS in that the REMI projections include the same variables as those included in the Yucca Mountain FEIS.

3.2.7.1 Socioeconomics Affected Environment

3.2.7.1.1 Employment and Population

Table 3-10 lists population estimates and projections anticipated for the 50-year railroad operations phase through 2067, for the four counties the Mina rail corridor would cross. The table also lists population projections for Clark County and the Carson City/Washoe County area, because those jurisdictions, which represent the largest population centers in the southern and northern portions of the corridor, respectively, would potentially provide most of the rail line construction workers (DIRS 182772-MTS 2007, p. 48).

Table 3-10. Population baselines and projections for select Nevada counties and Nevada, 2005 to 2067.[a]

Jurisdiction/ year	2005	2010	2015	2020	2025	2030	2035	2067
Carson City/Washoe County	450,000	510,000	570,000	620,000	660,000	700,000	740,000	1,100,000
Lyon County	49,000	61,000	72,000	81,000	89,000	96,000	100,000	170,000
Mineral County	4,600	4,700	4,800	4,600	4,400	4,300	4,200	3,700
Esmeralda County	1,300	1,100	1,100	1,000	1,000	1,000	1,000	1,100
Nye County	41,000	52,000	61,000	68,000	73,000	78,000	84,000	131,000
Clark County	1,820,000	2,260,000	2,650,000	2,950,000	3,170,000	3,360,000	3,540,000	5,000,000
Nevada	2,540,000	3,060,000	3,540,000	3,900,000	4,190,000	4,430,000	4,680,000	6,650,000

a. Source: DIRS 178610-Bland 2007, all

Unless otherwise noted, all general demographic, social, economic, and housing information was estimated by the U.S. Census Bureau during the 2000 decennial national census and was reported in the Census American FactFinder.

Carson City has a land area of about 360 square kilometers (140 square miles). The person-per-square-mile density is approximately 370, which is considerably more than the average population density in Nevada of 18.2. Carson City had about 21,000 housing units in 2000 and a population of 52,500 that year. Carson City is the metropolitan center nearest the Mina rail corridor starting point. Per capita income in Carson City, $20,943, was near the state's average in the last decennial census. Carson City's unemployment rate of 4.6 was lower than Nevada's unemployment rate of 6.2 percent in 2000.

Washoe County has a land area of about 16,000 square kilometers (6,300 square miles) and a population density of approximately 54 per square mile, about three times the population density of the state. Washoe County had about 140,000 housing units in 2000 and a population of about 340,000. Washoe County has recently experienced strong growth; the 1990s saw an aggregate growth of nearly 33 percent and 2000-2005 saw an additional 16-percent growth in population. Per capita income in Washoe County was $24,277, about 10 percent higher than Nevada's per capita income that year. The Washoe County unemployment rate in 2000 was 5 percent; lower than the state's unemployment rate of 6.2 percent.

The Carson City/Washoe County area had a population of about 450,000 in 2005. The area's economy is dominated by the Services industry, in particular the Accommodations and Food Services sector. Services accounted for almost 42 percent of the area's employment in 2005. Table 3-11 displays information about the demographic, social, housing, and economic characteristics of the Carson City/Washoe County area in 2000.

Table 3-11. Demographic, social, housing, and economic characteristics for select Nevada counties, the Walker River Paiute Reservation, and Nevada.[a]

	Washoe County	Clark County	Esmeralda County	Lyon County	Mineral[b] County	Nye County	Walker River Paiute Reservation	Nevada
2000 Population	340,000	1,380,000	970	35,000	5,100	32,000	850	2,000,000
Minority Population[c]	92,000	547,000	190	5,700	1,500	5,000	740	695,000
Percent Minority	27	40	20	17	30	15	87	35
Individuals in poverty, 2000	33,000	146,000	150	3,500	760	3,500	270	206,000
Percent in Poverty	10	11	15	10	15	11	32	11
Per Capita Income, 1999[d]	$24,277	$21,785	$18,971	$18,543	$16,952	$17,962	$10,092	$21,989
Housing Units	140,000	560,000	830	14,000	2,900	16,000	350	827,000
Housing Units Occupied	130,000	512,000	460	1,300	2,200	13,000	300	751,000
Percent Occupied	92	92	55	91	77	84	87	91
Individuals in civilian labor force	180,000	682,000	460	17,000	2,400	13,000	340	995,000
Employed individuals	170,000	637,000	440	15,000	2,100	12,000	260	933,000
Unemployed individuals	9,000	45,000	15	1,100	310	940	77	62,000
Individuals enrolled in school: K through 12	62,000	250,000	190	7,300	970	5,700	260	367,000

a. Source: DIRS 182772-MTS 2007, pp. 49 and 50.
b. Mineral County numbers include the Walker River Reservation.
c. Minority population is all individuals other than those who classify themselves as "white alone."
d. Values, except per capita income, have been rounded to two or three significant places.

Mineral County has a land area of about 9,800 square kilometers (3,800 square miles) and a population density of 1.4 per square mile. The county experienced population declines in the 1990s. Mineral County continues to experience modest declines in population; its estimated 2005 population was 4,600. It was about 5,100 in 2000. Hawthorne, in Mineral County, had a 2000 estimated population of 3,100 and a

2005 estimated population of 3,000. In the Mina rail corridor, the U.S. Census Bureau identifies only the Hawthorne community as being urban. All other communities are classified as rural. Luning had an estimated 2000 population of 86 people and an estimated 2005 population of 87. Mina had a 2000 estimated population of 310 residents and an estimated 2005 population of 280 (DIRS 182772-MTS 2007, p. 49). There are three major industries in Mineral County: Public Administration, Natural Resources/Mining/Utilities/and Construction and Services. Per capita income was estimated to be $16,952 in the last U.S. Census, about 77 percent of Nevada's per capita income. Unemployment in the county, 12.9 percent, was twice Nevada's unemployment in 2000. The county had about 2,900 housing units and a 23 percent vacancy rate in that year. Table 3-11 lists information about the demographic, social, housing, and economic characteristics of Mineral County in 2000.

Due to the nature of the census data, Mineral County's estimated and projected population figures include residents of the Walker River Paiute Reservation. The Reservation had an estimated population of 810 in 1990 and an estimated population of 850 in 2000 (DIRS 182772-MTS 2007, p. 50). There were about 350 housing units in 2000. Residents of the Reservation work primarily in retail trade, construction, and manufacturing. The 2000 unemployment rate was 22.6 percent, more than 3.5 times the Nevada unemployment rate in the same year. At the time of the last national census, per capita income on the Walker River Paiute Reservation, $10,092, was less than 50 percent of the Nevada per capita income in that year and about 60 percent of Mineral County per capita income. Table 3-11 lists information about the demographic, social, housing, and economic characteristics of the Walker River Paiute Reservation in 2000.

Lyon County has a land area of almost 5,200 square kilometers (2,000 square miles). The county has a population density of about 17.3 per square mile, reflecting the state's average population density per square mile. There were about 14,300 housing units in 2000 while the population was about 34,500. Lyon County grew almost as rapidly as Clark, Nye, and Washoe Counties. It had 49,000 residents in 2005, up from 21,000 in 1990 (DIRS 182772-MTS 2007, p. 50). Services provided about 30 percent of the county's jobs, Retail and Wholesale Trade about 20 percent, and Public Administration about 15 percent. Per capita income, $18,543, was about 14 percent lower than the state average in 2000. Unemployment was 6.9 percent, slightly higher than the state average. Table 3-11 lists information about the demographic, social, housing, and economic characteristics of Lyon County in 2000.

Esmeralda County experienced declines in population in the 1990s, but has reversed that trend in the 21st century, growing by approximately 20 percent from 2000 to 2005. An estimated 1,300 persons lived in Esmeralda County in 2005. In 2000, Goldfield, in Esmeralda County had an estimated population of 420; in 2005, the estimated population was 440. Silver Peak had a 2000 estimated population of 160 and a 2005 estimated population of 130 (DIRS 182772-MTS 2007, p. 50). The approximately 9,300-square-kilometer (3,600-square-mile) county has a population density of just 0.3 a square mile. The county had 833 housing units in 2000, but a 45 percent vacancy rate. The population in 2000 was about 970. Most jobs in Esmeralda County are in the Services industry or in the Public Administration industry, which includes the state and local government sector. Esmeralda County's per capital income was $18,971 in 2000. Unemployment, 3.3 percent, was about 50 percent of Nevada's unemployment rate in 2000. Table 3-11 lists information about the demographic, social, housing, and economic characteristics of Esmeralda County in 2000.

Nye County's land area is more than twice that of Clark County, about 47,000 square kilometers (18,000 square miles). The population per square mile is 1.8, about a tenth of the state's average. Nye County had about 16,000 housing units and a population about 32,000 in 2000. Nye County joined the rapid population escalation by growing approximately 81 percent in the 1990s and another 25 percent from 2000 to 2005. The county's estimated population in 2005 was 41,000. Nye County is dominated by one of the Nation's fastest growing unincorporated communities, Pahrump. Growing in popularity as a residential destination, Pahrump had an estimated population of 33,000 people in 2005 (an increase of 37 percent in 5 years), which represents more than 80 percent of the Nye County's total population that year. The Mina rail corridor would also pass near Beatty and Tonopah in Nye County. The estimated 2005 populations of Beatty and Tonopah were 1,000 and 2,600, respectively (DIRS 182772-MTS 2007, p. 51). Nye County's economy is driven by the Services industry which accounts for 44 percent of the jobs in the county. Other major industries include Retail and Wholesale trade and the Transportation/ Information/Finance/Accounting industry. The estimated per capita income in Nye County at the last national census, $17,962, was about 82 of the per capita income in Nevada. Unemployment was 7.1 percent, higher than the state's 6.2 percent. Table 3-11 lists information about the demographic, social, housing, and economic characteristics of the Nye County in 2000.

Clark County has a land area of almost 21,000 square kilometers (8,000 square miles) and a population density of about 173.9 per square mile. Clark County had about 560,000 housing units in 2000 and a population of about 1.38 million that year. Clark County's population grew even faster than that of Washoe County – a total of 81 percent in the 1990s and approximately 29 percent, to 1.8 million persons, by 2005. Clark County is the metropolitan center nearest the Mina rail corridor ending point. Per capita income in Clark County was $21,785, about the average of Nevada's that year. Unemployment in Clark County, 6.6 percent was slightly above the state's unemployment rate of 6.2 percent. The economy in Clark County is dominated by the Services industry, particularly the Accommodations and Food Services sector which accounts for almost 50 percent of employment in the county. The Transportation/ Information/ Finance/Accounting industry and the Trade industry, which is composed of retail and wholesale trade, are also major components of the economy. Table 3-11 lists information about the demographic, social, housing, and economic characteristics of the Clark County in 2000.

Table 3-11 lists characteristics of the four counties along the Mina rail corridor, the Walker River Paiute Reservation, Clark County, Washoe County, and the State of Nevada. The information in the table is the baseline for determining potential impacts to employment, population, existing housing stock, and demands on educational facilities and other public services. Table 3-12 lists information about the employment baselines in the counties that the Mina rail corridor would cross and information about Clark County and the Carson City/Washoe County area because most rail line construction workers are expected to come from those areas. Information about the State of Nevada is provided for comparison purposes.

Table 3-12. Employment baseline projections in Nevada counties in the Mina rail corridor, 2005 to 2067[a] (page 1 of 2).

Jurisdiction	2005	2010	2015	2020	2025	2035	2067
Carson City/Washoe County employment baseline	310,000	330,000	360,000	370,000	380,000	410,000	580,000
Lyon County employment baseline	14,000	17,000	18,000	19,000	20,000	23,000	37,000
Mineral County employment baseline	2,500	2,400	2,500	2,300	2,300	2,300	2,100
Esmeralda County employment baseline	470	470	450	440	440	430	460
Nye County employment baseline	17,000	19,000	21,000	22,000	23,000	25,000	37,000

Table 3-12. Employment baseline projections in Nevada counties in the Mina rail corridor, 2005 to 2067[a] (page 2 of 2).

Jurisdiction	2005	2010	2015	2020	2025	2035	2067
Clark County employment baseline	1,070,000	1,240,000	1,330,000	1,390,000	1,450,000	1,600,000	2,230,000
Nevada employment baseline	1,520,000	1,720,000	1,830.00	1,920,000	2,000,000	2,180,000	3,031,000

a. Source: DIRS 178610-Bland 2007, all.

3.2.7.1.2 Economic Measures

Baseline economic measures are provided for the four counties that the Mina rail corridor would cross, for Clark County and the combined Carson City/Washoe County area, and for the State of Nevada. Clark County dominates all economic measures in the state and is located near the southern end of the Mina corridor. The metropolitan Carson City/Washoe County area economy, near the northern end of the Mina corridor, is also much larger than the economies in the rural counties. Table 3-13 lists information on three economic measures: state/local government spending, real disposable income, and gross regional product.

Table 3-13. Economic measures: baselines and projections for select Nevada counties and Nevada, 2005 to 2067[a,b] (page 1 of 2).

	2005	2010	2015	2020	2025	2030	2035	2067
Carson City/Washoe County								
State/local government spending	1.90	2.17	2.56	2.89	3.18	3.47	3.77	5.85
Real disposable income	15.73	18.54	21.30	23.65	26.21	28.86	31.72	52.32
Gross regional product	23.00	27.72	33.96	39.31	44.85	51.00	57.82	103.07
Lyon County								
State/local government spending	0.19	0.24	0.30	0.35	0.40	0.44	0.49	0.85
Real disposable income	0.94	1.17	1.37	1.55	1.74	1.94	2.18	4.19
Gross regional product	0.75	0.96	1.17	1.36	1.56	1.78	2.03	4.04
Mineral County								
State/local government spending	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Real disposable income	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13
Gross regional product	0.16	0.14	0.16	0.16	0.18	0.19	0.21	0.25
Esmeralda County								
State/local government spending	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Real disposable income	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.06
Gross regional product	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.06
Nye County								
State/local government spending	0.16	0.20	0.25	0.29	0.32	0.36	0.39	0.64
Real disposable income	1.00	1.25	1.44	1.61	1.78	1.97	2.20	3.97
Gross regional product	1.06	1.30	1.55	1.80	2.05	2.34	2.67	4.95

Table 3-13. Economic measures: baselines and projections for select Nevada counties and Nevada, 2005 to 2067[a,b] (page 2 of 2).

	2005	2010	2015	2020	2025	2030	2035	2067
Clark County								
State/local government spending	6.55	8.47	10.55	12.15	13.44	14.63	15.79	23.31
Real disposable income	54.70	69.02	79.89	89.56	99.85	111.59	124.94	207.81
Gross regional product	86.68	109.56	131.60	151.93	173.08	197.33	224.63	393.79
Nevada								
State/local government spending	9.71	12.09	14.77	16.85	18.55	20.17	21.78	32.33
Real disposable income	77.40	95.70	110.27	123.18	136.95	152.28	169.52	279.58
Gross regional product	118.32	147.38	177.24	204.50	232.79	264.98	301.08	526.81

a. Source: DIRS 178610-Bland 2007, all.
b. All values are in 2006 dollars, in billions.

3.2.7.1.3 Public Services

3.2.7.1.3.1 Health Care. Lyon, Mineral, Nye, and Esmeralda Counties have some health care facilities, although all four counties are federally designated as health professional shortage areas for primary, dental, and mental health care (DIRS 180466-State of Nevada 2005, all; DIRS 180467-State of Nevada 2005, all; DIRS 173559-State of Nevada [n.d.], all; and DIRS 173560-State of Nevada [n.d.], all). Health care services are concentrated in Clark County, particularly in the Las Vegas area.

There is a public health clinic on the Walker River Paiute Reservation in Schurz. This clinic is staffed full time with a doctor and a nurse. This facility also has emergency medical services and emergency medical technicians (DIRS 180118-Gormsen and Merritt 2007, all).

3.2.7.1.3.2 Education. Lyon, Mineral, and Nye counties have elementary, middle, and high schools. In Nye County, the Community College of Southern Nevada has a campus in Pahrump that provides postsecondary school education. There are elementary and middle schools in Esmeralda County; high-school students from Esmeralda County attend school in Tonopah, Nye County (DIRS 155970-DOE 2002, p. 3-156).

3.2.7.1.3.3 Fire Protection. Lyon, Mineral, Nye, and Esmeralda counties have professional or volunteer fire departments. At present, the Nevada Test Site provides fire protection services to the Yucca Mountain Site.

3.2.7.1.3.4 Law Enforcement. Lyon, Mineral, Nye, and Esmeralda counties have sheriff's offices, with a ratio of 1.6, 3.9, 2.2, and 5 officers to 1,000 residents, respectively. The Walker River Paiute Reservation has a police department with four law enforcement officers, which yields a ratio of 3.4 officers per 1,000 residents (DIRS 182772-MTS 2007, p. 53).

3.2.7.1.3.5 Public Roadways. Because the Mina rail corridor is primarily in remote and rural areas, the rail line would cross paved highways and roads with low traffic, and low-usage unpaved roads, including county roads, private roads, and off-road vehicle trails. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these roads are not heavily traveled. The exception is the existing Union Pacific Railroad Branchline between Hazen and Wabuska, which crosses public roads with moderate traffic.

3.2.7.2 Potential Socioeconomics Impacts

3.2.7.2.1 Construction Phase

Sections 3.2.7.2.1.1 through 3.2.7.2.1.3 describe potential impacts to socioeconomics associated with construction and operation of a railroad in the Mina rail corridor.

3.2.7.2.1.1 Employment and Population. The incremental changes above the employment and population baselines in Mineral County would be the result of indirect jobs created to meet the consumption needs of workers.

Mineral County had an estimated population of about 4,630 and an employment baseline of 2,550 jobs in 2005. Mineral County could gain an estimated 45 residents as a result of the construction of a rail line in the Mina rail corridor, an increase of less than 1 percent over the population baseline. Mineral County could gain an estimated 90 jobs in 2010, 70 jobs in 2011 and 2012, and 45 jobs over the baseline from 2013 to 2067. The 1-year spike in 2010 would be an increase of about 3.8 percent above the 2010 employment baseline. The average change of 45 jobs is an increase of about 1.8 percent above the employment baseline in 2013.

Generally, potential impacts in Mineral County are expected to be small and transitory in nature.

The estimated number of workers needed to construct a railroad in the corridor would be approximately 6,500 worker-years over a minimum 5-year construction period. The average construction workforce would be 1,900 workers through each of the first 3 years of construction, with a peak of about 2,100 workers. The workforce would fall to 520 and 340 in years 4 and 5, respectively.

The construction labor pool in Clark County, the Carson City/Washoe County area and, to a lesser extent, Nye and Lyon Counties is large and would be able to provide most of the necessary construction workers. DOE estimates that about 50 percent of the workers would come from Clark County and about 50 percent would come from the Carson City/Washoe County area. Therefore, there would be limited in-migration during the construction phase in these or other counties. The baseline projected population growth and development in Clark and Nye Counties (the escalating in-migration of retirees and other individuals) would lead to greater socioeconomic impacts on services, including schools. This projected population growth (unrelated to railroad construction activities) would mask potential impacts from construction activities associated with the rail line.

Estimates for railroad construction workers and expected residential distribution patterns compared to applicable baselines lead to the conclusion that impacts to Esmeralda County would be small. Because of the very large base of available construction workers in the Carson City/Washoe County area and in Clark County and the large labor pool in Lyon and Nye Counties, DOE anticipates that very few workers would be likely to relocate to these communities; therefore, impacts to population and employment baselines would be small.

Population increases associated with a railroad construction workforce in the Mina rail corridor is estimated to be small in relation to the baseline population in Clark County and in Lyon, Nye, and Washoe Counties. Incremental population increases are expected to be minimal because worker in-migration is expected to be minimal. Mineral County’s incremental population increase of about 45 people would be less than 1 percent of the population baseline.

Because of the temporary nature of a linear construction project, workers would not be likely to relocate their families to communities along the corridor. Based on these assumptions, DOE estimates that impacts to population, and therefore to housing and schools, in the counties along the corridor would be small. It is likely that workers would spend a portion of their wages on food, gasoline, and other incidentals, but would spend most earnings in the counties where they live. Therefore, estimated impacts from construction activities on local populations would be small.

The analysis of Mineral County includes potential impacts to the population and employment baseline of the Walker River Paiute Reservation. Impacts to population and employment on the Reservation, if any, when considered individually rather than as part of the impacts to Mineral County, would be small because there would be no change to the employment base from in-migrating workers and no change to population because there would be no change to the employment baseline. The nature of the construction activities is sufficiently short in duration and transitory in nature that migration to Reservation land is considered unlikely.

Of the areas considered, the two most likely to experience changes in population from construction of a railroad in the Mina rail corridor are Clark County and the Carson City/Washoe County area, which are assumed to provide most of the construction workers. Estimates regarding the number of construction workers could affect employment, which in turn could result in changes to population baselines. Because the employment baselines in these areas are large, the expected employment increase of much less than 1 percent in Clark County and the Carson City/Washoe County area, respectively, are small in relation to those baselines. Similarly, the population changes in relation to the baselines are expected to be small and would likely be temporary.

Permanent residential patterns would not be likely to change, so impacts to county housing stocks and public education would be small. Workers and their families would continue to maintain a permanent residence in the counties where they live, with the workers commuting to construction camps for workweek assignments and returning to their permanent residences at the week's end. When considered individually, impacts to population and employment baselines in Esmeralda and Mineral Counties would be larger than that of the other counties considered in this analysis, but less than 1 percent. Esmeralda County would experience a peak population increase of about 20 in 2014, but those new residents would leave the county when after the end of the construction phase. The county could gain as many as 20 jobs at the beginning of the construction phase, but the railroad project would not contribute additional jobs after 2015. Impacts to schools and housing would be unlikely because the number of new residents in the counties as a result of rail line construction activities would be so small.

3.2.7.2.1.2 Economic Measures. The expected changes to economic measures attributable to the construction of a railroad in the Mina rail corridor would peak about 3 years after construction activities began. Changes to gross regional product, real disposable personal Income, and spending by state and local governments would be less than 2 percent above the baselines. Because Clark County and the Carson City/Washoe County area would supply most of the workers and be the permanent residences of most of the workers, Nye and Mineral Counties would be unlikely to experience noticeable changes in economic measures. Esmeralda County could experience a short-term spike in real disposable personal income and in gross regional product of 16.5 percent and 14.5 percent, respectively. Almost all of the incremental change would occur in the Accommodations and Food service industries. Spending by state and local governments could also have a short-term, but moderate increase of 4.2 percent, as local governments increased oversight personnel. The changes above the baselines would have no long-term effects on the economy.

Socioeconomic impacts attributable to the construction phase would be small in the four counties the rail line would cross. The impacts would also be small in Clark County and in the Carson City/Washoe County area, the population centers where most workers would live. The impacts would be positive; jobs would be created, real disposal personal income would increase, gross regional product would increase more quickly, and local and state governments would receive more revenue to provide public services.

3.2.7.2.1.3 Public Services. Construction impacts to public services at the county level would likely be small because the population projections with the project show very limited increases in overall counts. An additional demand on local health care capacity would be the primary impact on public services. The area that is likely to experience the greatest impact is southern Nye County.

3.2.7.2.2 Operations Phase

Sections 3.2.7.2.2.1 and 3.2.7.2.2.3 describe potential socioeconomic impacts during the railroad operations phase.

3.2.7.2.2.1 Employment and Population. Changes from baseline employment and population for some counties during railroad operations could induce socioeconomic impacts. There would be workers boarding the train as it enters the region and there would be escorts who would arrive with the cask trains. Regional workers would be needed for each train crew. There would be an estimated 42 workers for railroad operations. Because these operations workers would live in the railhead county, the most discernable impacts to population and employment from railroad operations would likely occur in Mineral County. Mineral County could gain about 45 residents as a result of railroad operations in the Mina rail corridor, an increase of less than 1 percent over the population baseline. Mineral County could gain about 45 jobs over the baseline railroad operations. This would be about a 1.8 percent increase over the employment baseline in 2015. Because the estimated operations workforce is small, increases in baseline population projections in the counties would not be likely to change. No impacts to housing would be likely from train crews. Changes to the employment and population baselines in Clark, Lyon, Nye, and Washoe Counties would be nearly imperceptible because of the large labor forces and population bases in these counties; current population growth in these counties would mask additional requirements for housing and public education. No impacts would be expected in Esmeralda County.

3.2.7.2.2.2 Economic Measures. Changes to economic measures would be expected to end in the final year of the construction phase. The impacts to baseline gross regional product, real disposable personal income, and spending by state and local governments would be less than 1 percent in Clark and Nye County and the Carson City/Washoe County area. In Mineral County, the impact of changes to economic baselines would be less than 2 percent. In Esmeralda County, the changes from the baseline would be very small when construction activities are completed and measures return to the projected baselines.

Socioeconomic impacts attributable to the operations phase would be small in the four counties the rail line would cross. The impacts would be small in Nye County and in Mineral County where most operations workers would live. The impacts would be positive; jobs would be created, real disposal personal income would increase, gross regional product would increase more quickly, and local and state governments would receive more revenue to provide public services.

3.2.7.2.2.3 Public Services. Railroad operations in the Mina rail corridor would result in small impacts to health care capacity in Lyon, Mineral, Nye, and Esmeralda Counties and on education infrastructure in southern Nye County (Pahrump). The exact extent of impacts to other public services would depend on the total number of workers and their residential locations, and operations activities in relation to existing system capacity. However, workers could create small to moderate impacts in the form of additional demand for fire-protection services in Lyon, Mineral, Nye, and Esmeralda Counties.

3.2.8 NOISE AND VIBRATION

Day-night average noise level (DNL): The energy average of A-weighted decibels (dBA) sound level over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the day.

A-weighted decibels (dBA): A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

The Yucca Mountain FEIS analysis for noise considered typical day-night sound levels and the distance of the rail line from communities, and estimated the impacts to communities from railroad construction and operations. The Yucca Mountain FEIS analysis for vibration considered the typical background level of ground vibration, the number of trains, and the distance of the rail line from historic structures or sites of cultural significance, and estimated the impacts from railroad operations.

The Yucca Mountain FEIS noise analysis used daytime and nighttime noise standards adopted by the State of Washington (Washington Administrative Code 173-58-040 to 173-60-040) for residential and commercial areas as benchmarks and for establishing the region of influence for potential impacts. To evaluate the impacts of noise from construction and operations activities for receptors in the region of influence near transportation facilities and corridors, DOE used benchmarks of:

- 60 ***A-weighted decibels*** (dBA) for residential use (nighttime reduction to 50 dBA)
- 65 dBA for light commercial
- 70 dBA for industrial zones

The analysis in the Yucca Mountain FEIS assumed that a limitation of 10 dBA above the benchmark is allowable if the duration is less than 5 minutes in an hour.

DOE has updated the criteria to determine the level of potential impacts from noise and vibration along the Mina rail corridor. For noise impacts from construction activities, DOE used U.S. Department of Transportation, Federal Transit Administration, methods (DIRS 177297-Hanson, Towers, and Meister 2006, all) and construction noise guidelines listed in Table 3-14.

Table 3-14. Federal Transit Administration construction noise guidelines.[a,b]

Land use	8-hour L_{eq} (dBA)		30-day average DNL (dBA)
	Day	Night	
Residential	80	70	75[c]
Commercial	85	85	80[d]
Industrial	90	90	85[d]

a. Source: DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-8.
b. dBA=A-weighted decibels; DNL = day-night average noise level; L_{eq} = equivalent sound level.
c. In urban areas with very high ambient noise levels (DNL greater than 65 dBA), DNL from construction projects should not exceed existing ambient +10 dBA.
d. Twenty-four hour L_{eq}, not DNL.

For operation of trains during the construction and operations phases, DOE analyzed noise impacts under established Surface Transportation Board (STB) criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e (6)), with the following criteria:

- An increase in noise exposure as measured by DNL of 3 dBA or more
- An increase to a noise level of 65 DNL or greater

If the estimated noise-level increase at a location would exceed either criterion, the STB then estimates the number of affected receptors (such as schools, libraries, residences, retirement communities, and nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, current noise research indicates that both criteria must be met to cause an adverse noise impact (DIRS 173225-STB 2003, p. 4-82). That is, sound levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more for an adverse noise impact to occur.

Consistent with the analysis conducted in the Yucca Mountain FEIS, DOE based the estimates of potential operations impacts from noise on the passage of a two-locomotive, 10-railcar train traveling at 80 kilometers (50 miles) per hour. Current estimates of train size are similar, with two to three locomotives and four to nine cask, buffer, and escort cars, with six railcars being typical (DIRS 175036-BSC 2005). DOE considered the proximity of the Mina rail corridor to centers of population and frequency of shipments. Table 3-15 lists communities within 5 kilometers (3 miles) of the Mina rail corridor.

Table 3-15. Communities within 5 kilometers of the Mina rail corridor.

Community name	Approximate distance (kilometers)[a]
Goldfield	0.1
Silver Peak	0.3
Hawthorne	0.7
Mina	1.5
Schurz	1.8
Luning	2.7
Sodaville	2.7

a. To convert kilometers to miles, multiply by 0.62137.

There are three potential ground-borne vibration (vibration propagating through the ground) impacts of general concern: annoyance to humans, damage to buildings, and interference with vibration-sensitive activities. The approach for analyzing potential vibration impacts is based on estimates of project-generated vibration and measurements of current ambient vibration conditions. To evaluate potential vibration impacts from construction and operation activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded 80 VdB (human annoyance criterion for infrequent events) or if the vibration levels (measured as peak particle velocity) exceeded 0.20 inches per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be a vibration impact (DIRS 177297-Hanson, Towers, and Meister 2006, all).

The region of influence for noise and vibration for construction and operation of a railroad along the Mina rail corridor includes the construction right-of-way out to variable distances, depending on several analytical factors (***ambient noise*** level, train speed, number of trains per day, and number of railcars).

3.2.8.1 Noise and Vibration Affected Environment

Most of the Mina rail corridor would pass through unpopulated BLM-administered public lands, primarily in a quiet ***desert*** environment where natural phenomena such as wind, rain, and wildlife account for most of the ambient sound. The sound level at a specific location depends on nearby and distant sources of sound. Sound levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation noise. Manmade noise in some areas of the region of influence is caused by vehicles traveling along public highways and high-altitude commercial jets. Baseline sound conditions vary somewhat in the Mina rail corridor and are site-specific. Most of the region of influence for the Mina rail corridor is typical of other desert environments in which the DNL values range from 14 dBA on calm days up to 38 dBA on windy days (DIRS 102224-Brattstrom and Bondello 1983, p. 170). In 2005, DOE conducted noise measurements in Goldfield. Ambient noise levels ranged from 30 to 44 dBA with a day-night sound level of 47 dBA (DIRS 182772-MTS 2007, p.

57). In March 2007, DOE conducted noise measurements near Silver Peak, Mina, and Schurz (DIRS 182772-MTS 2007, p. 57). The noise associated with railroad operations is part of the existing environment in the Schurz area where the presence of the railroad is very evident. The sounds associated with the existing branchline include wayside noise (noise generated by the cars and locomotives), and horn sounding. The Federal Railroad Administration requires train engineers to sound horns when approaching most grade crossings. Horn sounding is generally not required at private crossings. Wayside noise and horn sounding are common in Schurz and along other portions of the existing Department of Defense branchline. The day-night sound levels ranged from 34 to 48 dBA, consistent with expectations for rural towns. The other rural communities along the Mina rail corridor would likely have similar background noise levels (DIRS 182772-MTS 2007, p. 57).

Ambient vibration levels were so low that they were essentially immeasurable for Schurz, Mina, and Silver Peak. The measured ambient vibration level in Goldfield was 25 VdB.

3.2.8.2 Potential Noise and Vibration Impacts

The conclusion of this analysis using the updated impact criteria from the Federal Transit Administration and STB are broadly consistent with the conclusion that would be obtained using the methodology presented in the Yucca Mountain FEIS.

3.2.8.2.1 Noise

3.2.8.2.1.1 Construction. For the most part, the Mina rail corridor would pass through areas that are remote from human habitation. Thus, the potential for noise impacts during the construction phase would be limited. Nevertheless, some people could be affected, including persons living near the corridor, using nearby recreational areas, or living in nearby rural communities. The distances from construction activities to the nearest receptors would be great; therefore, construction noise levels would be below the Federal Transit Administration noise guidelines listed in Table 3-14.

3.2.8.2.1.2 Construction Train Noise. As the rail roadbed, track, and bridges were completed, construction trains would be employed to move railroad ties, ballast, and other rail-construction equipment to other construction areas. Up to 16 one-way trains per day could pass by certain receptor locations construction phase. As with operations trains, locomotive horn sounding at grade crossings would be the dominant noise source.

DOE estimates that construction-train noise would be audible to receptors in Silver Peak and Goldfield. There would be no adverse noise impacts associated with these receptors because they would not experience a 3 dBA increase and 65 DNL or greater noise levels. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. However, because transportation noise sources are audible throughout the United States, the audibility of train noise itself does not constitute an adverse noise impact.

3.2.8.2.1.3 Operations. DOE based the estimates of potential operations impacts from noise on the passage of a two- to three-locomotive, four- to eight-railcar train (one to five cask cars, two buffer cars, and one escort car). Because train speed has a direct correlation to noise generated, DOE used the top train speed to conservatively estimate potential noise levels. At present, there is no train activity in Mina, Silver Peak, or Goldfield.

DOE estimates that operations train noise would be audible to receptors in Silver Peak and Goldfield. There would be no adverse noise impacts associated with these receptors because they would not experience a 3 dBA increase and 65 DNL or greater noise levels. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. However, because transportation noise sources are audible throughout the United States, the audibility of train noise itself does not constitute an adverse noise impact.

3.2.8.2.2 Vibration Impact

3.2.8.2.2.1 Construction. Based on the proposed construction equipment and Federal Transit Administration vibration data, DOE estimated potential ground-borne vibration levels due to construction activity. The vibration levels would be below Federal Transit Administration building vibration damage criteria (0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings). Therefore, DOE would expect no damage to buildings due to vibration during construction. In addition, because of relatively low vibration levels and the temporary nature of construction, human annoyance due to construction vibration would be low.

3.2.8.2.2.2 Construction and Operations Train Vibration. DOE evaluated the potential impacts from vibration for construction and operations trains by using train-induced vibration levels as a function of distance from a rail line, along with vibration levels likely to result in building damage or annoyance, in combination with information on the location of residences or other buildings in relation to the rail line.

Construction trains would travel at lower speeds than operations trains. Because vibration is a function of train speed, construction-train vibration would be lower than operations-train vibration. Freight trains operating at 80 kilometers (50 miles) per hour would produce an annoyance-based vibration contour extending approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no buildings within approximately 24 meters of the Mina rail corridor, so operations trains would produce no adverse vibration impacts; neither would there be adverse vibration impacts from construction trains.

Unlike noise, vibration impacts are evaluated on the basis of maximum level. A freight train traveling at 80 kilometers (50 miles) per hour will generate a vibration velocity level of 95 decibels with respect to 1 micro-inch per second (VdB), measured 3 meters (10 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). This level of vibration is substantially lower than levels that can cause cosmetic building damage (0.20 inch per second), nominally a vibration velocity of 106 VdB, or 100 VdB, assuming a crest factor of 2 (DIRS 176857-Martin 1980, all). This level of vibration is even lower than that which can cause structural damage (126 VdB) (DIRS 175495-Nicholls, Johnson, and Duvall 1971, all). There are no buildings within 3 meters of the Mina rail corridor; therefore, there would be no adverse vibration impacts to buildings.

3.2.9 AESTHETICS

The region of influence for aesthetics is the ***viewshed*** surrounding the 400-meter (0.25-mile)-wide corridor and all support facilities.

Most of the land in the Mina rail corridor is BLM-administered land, with additional areas under the jurisdiction of the Walker River Paiute Tribe, the U.S. Army, or private land owners. Because the Mina rail corridor would primarily cross BLM-administered land, DOE used the BLM methodologies for classifying visual resource quality and determining impacts to visual resources (DIRS 173053-BLM 1986, all; DIRS 173052-BLM 1984, all).

The BLM classifies lands under its jurisdiction using the visual resource management classification system. Classifications are based on a particular area's ***scenic quality***, visual sensitivity (***sensitivity levels***), and distance from travel or observation points (DIRS 101505-BLM 1986, all). The BLM uses a combination of the ratings of these three factors to assign a visual resource inventory class to a piece of land, ranging from Class I to Class IV, with Class I representing the highest visual values. Each visual resource class is subsequently associated with a management objective, defining the way the land may be developed or used. Each BLM district assigns visual resource management classes to its lands during the resource management planning process.

BLM management objectives associated with the four Visual Resource Management classes are:

- Class I: To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention.
- Class II: To retain the existing character of the landscape. The level of change to the characteristic landscape should be low.
- Class III: To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
- Class IV: To provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

The BLM uses visual resource contrast ratings to assess the visual impacts of proposed projects and activities on the existing landscape (DIRS 173053-BLM 1986, all). The BLM looks at basic elements of design to determine levels of contrast created between a proposed project and the existing viewshed. Contrast ratings are determined from locations called "key observation points," which are usually along commonly traveled routes such as highways or frequently used county roads or in communities. Depending on the visual resource management objective for a particular location, varying levels of contrast are acceptable. BLM Handbook H-8431-1, *Visual Resource Contrast Rating* (DIRS 173053-BLM 1986, all) describes this process.

BLM Visual Resource Management classifications for lands along the Mina rail corridor were primarily taken from the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all), the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), and the *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (DIRS 176043-BLM 1998, all). Visual Resource Management classifications for lands not administered by the BLM were assigned using BLM methodologies (DIRS 173053-BLM 1986, all; DIRS 173052-BLM 1984, all) and considering scenic quality ratings reported in the Yucca Mountain FEIS where applicable (DIRS 155970-DOE 2002, pp. 3-158 and 3-159).

3.2.9.1 Aesthetics Affected Environment

Applicable BLM resource management plans (DIRS 173224- BLM 1997, all; DIRS 103079-BLM 1998, all; DIRS 179560-BLM 2001, all) show that most of the Mina rail corridor would be in Visual Resource Management Class III or IV lands, with the exception of a small section of existing rail line east of Walker Lake that crosses a Class II area. Other than east of Walker Lake, the Mina rail corridor in Churchill and Mineral Counties and on the Walker River Paiute Reservation would cross exclusively through areas considered Class III by default classification of the Carson City BLM office (DIRS 179571-Knight 2007, all). Montezuma option 1 would cross a Class III area centered on State Route 265 from Blair Junction to Silver Peak, and would be within about 2 kilometers (1.2 miles) of Class II areas in the Montezuma Range and Clayton Ridge areas. Approximately 10 kilometers (6 miles) of common corridor segment 6 would also be in Class III lands before it crossed the Yucca Mountain Site boundary.

3.2.9.2 Potential Aesthetics Impacts

The greatest impact on visual resources during the construction phase would be the presence of workers, camps, vehicles, large earth-moving equipment, laydown yards, borrow areas, and dust generation. These activities, however, would have a short duration. The Mina rail corridor and its options have all been affected to some extent by human activity. Only a limited portion of the overall construction time would be spent in one place; the exception to this would be places where major structures such as bridges would be built.

During the operations phase, visual impacts would be due to the existence of the rail line. The passage of 17 trains per week would have a small impact.

Construction and operation of a railroad through the primarily Class III and IV areas along the Mina rail corridor would generally be consistent with the BLM visual resource management objectives for these areas. Therefore, DOE expects the potential impacts to aesthetic resources would be small.

3.2.10 Utilities, Energy, and Materials

3.2.10.1 Utilities, Energy, and Materials Affected Environment

The Mina rail corridor would be in remote Nevada countryside, but is within the southern Nevada supply chain for the commodities required during the construction and operations phases.

3.2.10.2 Potential Utilities, Energy, and Materials Impacts

This section describes potential impacts to utilities, energy, and materials as a result of constructing and operating a railroad in the Mina rail corridor. Consumption of motor fuel, steel, and concrete during the construction and operations phases could impact the availability of these materials in the region of influence.

Electric power for construction would be initially supplied by portable generators. New power lines would be installed to provide power for construction services and would be extended, via underground distribution, along the rail roadbed to meet all other construction and operational needs.

The major providers of electricity in the region of influence, including the Nevada Power Company, Sierra Pacific Power Company, Valley Electric Association, Inc., and Lincoln County Power District No. 1 would have adequate generating capacity or power-purchase capabilities to supply the project during peak demand without disrupting service to the providers' respective coverage areas. Demand is expected to remain relatively stable in the serviced areas, increasing at about 1 to 2 percent annually, and is not expected to impact the capacity of service providers. In cooperation with the affected utilities, DOE would perform electrical capacity analyses to ensure adequate capacity exists, including the evaluation of the conditions of existing electric facilities and determination of appropriate interface equipment to meet the needs of both parties, prior to any connection into a transmission or distribution line; therefore, impacts to electricity services would be small.

Construction equipment would consume motor fuel (diesel and gasoline), which would represent the largest energy resource usage during the construction phase. The total motor fuel use in Nevada in 2005 was about 5.8 billion liters (1.5 billion gallons) (DIRS 182772-MTS 2007, p. 61). Table 3-16 includes the estimated amounts of diesel fuel and gasoline expected to be consumed during the construction phase.

Table 3-16. Construction materials and fuel estimates for the Mina rail corridor.[a]

Length (kilometers)[b,c]	Diesel fuel use (million liters)[d]	Gasoline use (million liters)	Steel (thousand metric tons)[e]	Concrete (thousand metric tons)
410	125	2.5	67	260

a. Sources: DIRS 180877-Nevada Rail Partners 2007, Table 2-1; DIRS 182772-MTS 2007, p. 61.
b. Corridor length listed for comparative evaluation.
c. To convert kilometers to miles, multiply by 0.623.
d. To convert liters to gallons, multiply by 0.264.
e. To convert metric tons to tons, multiply by 1.102.

Approximately 27 percent of the total construction phase fuel consumption would occur in the peak construction year. This would represent only about 0.6 percent of the motor fuel consumed annually in Nevada. Unlike overall state use, construction activities would use primarily diesel fuel, and during the peak year would consume about 2.2 percent of all special fuel (mainly diesel) used annually in Nevada. Nevada motor fuel use will continue to increase in the future, so the actual project percent use would be lower than these values (DIRS 182772-MTS 2007, p. 61).

Steel for rails, concrete (principally for rail ties, bridges, and drainage structures), and rock for ballast would be the primary materials that the construction of a rail line would consume. Table 3-16 lists estimates of steel and concrete consumption. Nationally, steel rail production often exceeds the need and there would be sufficient production flexibility and capacity to meet rail line construction demands. Thus, the impact on steel availability would be small. Because DOE would purchase precast concrete components from national suppliers in staggered preordered phases, and because construction would involve a small amount of cast-in-place concrete via the use of onsite batch plants, the impact on availability of concrete would be small.

During the operations phase, the amount of motor fuel used by locomotives would be small compared to regional availability. The amount of materials needed for rail line maintenance activities would be negligible and would not impact the supply.

3.2.11 WASTE MANAGEMENT

The region of influence for waste management includes counties the Mina rail corridor would cross and that have existing municipal sanitary waste landfills and disposal facilities for other types of wastes.

3.2.11.1 Waste Management Affected Environment

The Mina rail corridor would run through the Walker River Paiute Reservation, and Lyon, Mineral, Esmeralda, and Nye Counties. Of these, Lyon County and the Walker River Paiute Reservation have no landfill. The Goldfield landfill, in Esmeralda County, which serves a population of fewer than 1,500 received about 3.6 metric tons (4 tons) of solid waste per day in 2003. Nye County disposed of about 250 metric tons (280 tons) of waste during 2003 at three different landfills, but the county plans to close two of these landfills by 2011, which would represent 96 percent of the county's current waste disposal capacity. The Hawthorne Landfill in Mineral County disposed of about 25 metric tons (28 tons) per day in 2003; it has an estimated closure date of 2041. In comparison, the Apex Landfill in Clark County, which serves the Las Vegas Valley and has an estimated closure data of 2047, received 8,000 metric tons (8,800 tons) daily during 2003 (DIRS 182772-MTS 2007, pp. 61 to 62).

3.2.11.2 Potential Waste Management Impacts

Construction activities would generate hazardous and nonhazardous solid wastes, and recyclable material. DOE would dispose of nonhazardous wastes in permitted landfills. Hazardous waste such as corrosives and solvents would be shipped to a permitted hazardous waste treatment and disposal facility. All waste would be handled in accordance with applicable environmental, occupational safety, and public health and safety requirements.

Railroad construction and operations would generate solid municipal waste, estimated to be approximately 750 metric tons (830 tons) during the peak year of construction (DIRS 180922-Nevada Rail Partners 2007, Table 6-3). Approximately 25 percent of the generated waste would be recyclable, which would result in 550 metric tons (620 tons) of waste for disposal at municipal landfills (DIRS 180922-Nevada Rail Partners 2007, Table 6-3). The estimated total mass of waste during the construction phase would be about 2,000 metric tons (2,200 tons). This mass of waste would occupy about 5,000 cubic meters (6,600 cubic yards) of landfill volume at a waste density of 420 kilograms per cubic meter (700 pounds per cubic yard), which is typical of smaller landfills. The estimated average daily disposal mass would be about 1.5 metric tons (1.7 tons) (derived from DIRS 180922-Nevada Rail Partners 2007, Table 6-3).

For the landfills in rural counties, this would represent an increase in waste disposal volume. As an example, disposal of solid waste during the construction phase could represent a nearly 50-percent increase in daily waste volume for the Goldfield landfill and could hasten its closure (now estimated to be in 2023 (DIRS 182772-MTS 2007, p. 62). Waste generated during the construction phase could be trucked to larger landfills, where impacts on waste disposal capacity would be small.

Railroad operations would periodically generate waste during maintenance activities. Some locomotive and railcar maintenance could generate used oil and solvents that DOE would recycle or dispose of as hazardous waste.

3.2.12 ENVIRONMENTAL JUSTICE

3.2.12.1 Environmental Justice Affected Environment

The largest concentration of ***low-income*** or ***minority*** populations in the Mina rail corridor occurs in Mineral County and on the Walker River Paiute Reservation. The corridor would cross American Indian tribal lands, with the three Schurz bypass options almost entirely on the Walker River Paiute Reservation (DIRS 180222-BSC 2006, p. 16).

There are approximately 1.4 square kilometers (350 acres) of the Reservation lands in the corridor (DIRS 180222-BSC 2006, p. 15). The population of the Reservation, estimated to be 853 persons in 2000, is low-income and consists mainly of American Indians, a minority population.

The poverty rate in Mineral County is 15 percent, which exceeds the rate of poverty (11 percent) in the State of Nevada, while the poverty rate of Walker River Paiute Reservation residents is 32 percent. Nevada’s per capita income is approximately the same as the national average of about $22,000 but the per capita income on the Reservation is less than half that of residents in the state. Table 3-17 lists Walker River Paiute Reservation, Mineral County, and State of Nevada economic characteristics.

The Mineral County unemployment rate is approximately twice the rate of the state; with Nevada unemployment statistics mirroring the Nation’s unemployment rate. The unemployment rate on the Walker River Paiute Reservation however, is more than three times that of the state. Table 3-18 lists labor and employment characteristics on the Walker River Paiute Reservation, in Mineral County, and in Nevada.

Table 3-17. Economic characteristics of the Walker River Paiute Reservation, Mineral County, and the State of Nevada, 2000.[a]

Characteristic	Walker River Paiute Reservation	Mineral County	Nevada
Total population	853	5,100	2,000,000
Median household income (dollars)	$24,000	$33,000	$45,000
Per capita income (dollars)	$10,000	$17,000	$22,000
Individuals below poverty level	270	760	210,000
Percent individuals below poverty level	32	15	11

a. Source: DIRS 182772-MTS 2007, p. 63.

3.2.12.2 Potential Environmental Justice Impacts

3.2.12.2.1 Socioeconomics

Because there would be small changes in long-term population attributable to activities in the Mina rail corridor, impacts or stresses to the housing stock, infrastructure systems, or social services would be unlikely. A portion of the Mina rail corridor would cross lands in Esmeralda County where most of the land is administered by the BLM or owned by the U.S. Department of Defense, resulting in a sparse population. As a consequence, there are no concentrations of low-income or minority populations in Esmeralda County that construction or operation of a railroad in the Mina rail corridor would be likely to affect. DOE further concluded that there were no special pathways (unique practices and activities creating opportunities for increased impacts) that could not be mitigated. Likewise, a railroad in the corridor would be unlikely to affect low-income or minority populations in Lyon County.

Table 3-18. Labor and employment characteristics of the Walker River Paiute Reservation, Mineral County, and the State of Nevada, 2000.[a]

Characteristic	Walker River Paiute Reservation	Mineral County	Nevada
Total population	853	5,070	2,000,000
Population 16 years and older	570	4,000	1,540,000
In labor force, civilian	340	2,400	990,000
Employed	260	2,100	930,000
Unemployed	77	310	62,000
Percent unemployed	23	13	6.2
Labor participation rate	60	60	65
Individuals employed in construction industry	28	130	86,000

a. Source: DIRS 182772-MTS 2007, p. 64.

Nye County has a minority population of approximately 13 percent, with approximately 11 percent of the total population considered low income.

Socioeconomic impacts from railroad construction and operation in the Mina rail corridor would be small overall and would be unlikely to adversely or disproportionately affect the low-income or minority populations along the corridor. Impacts to socioeconomic variables would be neither high nor adverse.

4. CUMULATIVE IMPACTS – MINA RAIL CORRIDOR

This chapter describes potential cumulative impacts in connection with constructing and operating a railroad in the Mina rail corridor. This analysis considers past, present, and reasonably foreseeable future and continuing actions. This chapter also addresses unavoidable adverse impacts, the relationship between short-term uses and long-term productivity, and potentially irreversible or irretrievable commitments of resources for the Mina rail corridor.

Glossary terms are shown in ***bold italics***.

4.1 Introduction

The U.S. Department of Energy (DOE or the Department) combined potential ***impacts*** reported in Chapter 3 of this Nevada Rail Corridor SEIS with the potential impacts of other relevant past, present, and ***reasonably foreseeable future actions*** in the ***region of influence*** for the Mina rail corridor. These combined impacts are called ***cumulative impacts***. Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500 to 1508) that implement the procedural requirements of the National Environmental Policy Act (42 United States Code [U.S.C.] 4321 *et seq.*) (NEPA) require a cumulative impacts analysis as part of the environmental impact statement (EIS) process.

Cumulative Impact: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

DOE structured the cumulative impact assessments in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DIRS 155970-DOE 2002, Section 8.4.2) (Yucca Mountain FEIS) by identifying actions that could have effects that coincided in time and space with the effects from the proposed repository and associated transportation activities. The analysis of cumulative transportation impacts reported in the Yucca Mountain FEIS evaluated the environmental impacts of constructing and operating a branch rail line in Nevada combined with the impacts of other federal, non-federal, and private actions.

4.1.1 REGIONS OF INFLUENCE

The regions of influence for this cumulative impacts analysis encompass the potentially affected areas specific to the Mina rail corridor. For the cumulative impacts analysis, the resource-specific regions of influence would generally be the same as those for the resource areas described in Chapter 3 and used for impact analyses in this Nevada Rail Corridor SEIS. Table 3-1 lists the regions of influence for each environmental resource for the Mina rail corridor.

4.1.2 APPROACH AND ANALYTICAL PERSPECTIVE

DOE used the following approach, analytical perspective, and considerations to perform this cumulative impacts analysis:

- Where the analysis indicated a potential for cumulative impacts, information is quantified to the extent practicable (for example, land disturbance and water demand); however, the cumulative impacts analysis is primarily ***qualitative***.

- The analysis considers federal, state and local government, and private activities.
- Projects included in the analysis have potential interaction in time (the foreseeable future) or space with the effects from implementation of the Proposed Action.
- Effects from past and existing projects and activities are primarily considered in the Chapter 3 discussions for each resource area (such as mining and grazing).
- DOE considers reasonably foreseeable actions as those future actions for which there is a reasonable expectation that the action could occur, such as a Proposed Action under analysis, a project that has already started, or a future action that has obligated funding.

DOE has assessed potential cumulative impacts under the Proposed Action qualitatively and quantitatively to the extent available information allows. Not all quantitative information is additive because of different methodologies or conflicting regions of influence.

DOE identified activities relevant to the cumulative impacts analysis from reviews of information available from government agencies, such as environmental impact statements, land-use and natural resource management plans, and from private organizations. DOE reviewed this information for relevance to this cumulative impacts analysis based on potential geographical and temporal relationships with construction and operation of the proposed rail line in the Mina rail corridor. Not all actions identified in this analysis would have cumulative impacts on all resource areas.

This section describes some future actions in general terms because the projects are in an early stage of planning or development, or they are broad concepts of activity (for example, Bureau of Land Management [BLM] resource management planning). This analysis focuses more on geographic interaction of projects than timing of interactions because the actual timeframes for many of the reasonably foreseeable future actions are uncertain.

The approach taken for this cumulative impact analysis is consistent with the intent of CEQ regulations at 40 CFR 1502.22, *Incomplete or Unavailable Information*. This regulation directs agencies how to proceed when evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information. While information describing the characteristics and potential effects of other projects and activities within the regions of influence is primarily qualitative and, in some cases is incomplete or unavailable, there is enough information to complete cumulative impacts analysis for the Mina rail corridor regions of influence.

4.1.3 RELATIONSHIP OF THIS ANALYSIS TO THE YUCCA MOUNTAIN FEIS CUMULATIVE IMPACTS ANALYSIS

The Yucca Mountain FEIS provided an analysis of potential cumulative impacts associated with construction and operation of a repository at Yucca Mountain. The portions of that analysis relevant and still valid to the Mina rail corridor (DIRS 155970-DOE 2002, Section 8.4.2) is incorporated in this Nevada Rail Corridor SEIS cumulative impacts analysis, as appropriate.

To evaluate potential environmental impacts, including cumulative impacts, of the revised repository design and operational plans, DOE has prepared *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1) (Repository SEIS), which includes an analysis of cumulative impacts as they relate to the Yucca Mountain Repository. Section 4.2.1.2.1 includes a description of the repository, as currently proposed, and additional context about the repository as a reasonably foreseeable action. This Nevada Rail Corridor SEIS incorporates updated cumulative impacts analyses from the Repository SEIS, as appropriate.

4.1.4 RESPONSIBILITY FOR MITIGATION OF CUMULATIVE IMPACTS

DOE is responsible for impacts associated with activities for which it is the project proponent. DOE would plan and design a railroad within the Mina rail corridor to avoid sensitive and regionally important resources like Wilderness Areas and Wilderness Study Areas and to avoid or minimize impacts to sensitive environmental areas (such as wetlands) and private property. In addition, DOE would construct and operate the railroad in compliance with all applicable requirements. Actions undertaken by other proponents are subject to a variety of environmental requirements to avoid, minimize, or otherwise reduce adverse impacts on the environment.

To help comply with requirements and to eliminate or reduce potential environmental impacts, DOE would implement a variety of engineering site planning actions, and ***best management practices,*** all of which are parts of the Proposed Action. The DOE best management practices include the practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the environmental impacts of an action. Such practices would avoid, minimize, or otherwise reduce the direct and indirect environmental impacts of the DOE Proposed Action, thereby avoiding or minimizing the DOE contribution to direct, indirect, and cumulative environmental impacts in the Mina rail corridor cumulative impacts regions of influence.

To the extent the DOE Proposed Action would contribute cumulatively to impacts on regional resources, or to other activities such as BLM land management activities, DOE would take additional ***mitigation*** and monitoring actions to reduce identified impacts associated with its Proposed Action, as practicable. DOE continues to coordinate with public- and private-sector project proponents to foster adequate consideration of cumulative environmental issues.

4.1.5 ORGANIZATION OF THE ANALYSIS

Section 4.2 summarizes potential cumulative impacts associated with implementing the Proposed Action in the Mina rail corridor.

4.2 Mina Rail Corridor

Section 4.2.1 summarizes the projects and activities considered in this Nevada Rail Corridor SEIS cumulative impacts analysis. Section 4.2.2 describes the potential cumulative impacts identified in this Nevada Rail Corridor SEIS. Figure 4-1 shows the locations of these major projects and activities, including:

1. Naval Air Station Fallon
2. Federal and nonfederal actions on the Walker River Paiute Reservation
3. Hawthorne Army Depot
4. Walker River Basin Restoration
5. Monte Cristo’s Castle (proposed state park)
6. Timbisha Shoshone Trust Lands (federal land transfer)
7. Yucca Mountain Geologic Repository
8. Nevada Test Site
9. Nevada Test and Training Range

This section also considers other relevant projects and actions not shown on the map, such as:

- BLM planning and management actions – There are a variety of BLM past, present, and reasonably foreseeable actions within the three BLM management areas (Carson City, Battle Mountain, and Las Vegas) relevant to the Mina rail corridor.
- Various rights-of-way – Many future utility or other rights-of-way corridors are not shown on Figure 4-1 because specific routes are not known. For example, DOE and the BLM are preparing a programmatic EIS for potential designation of energy corridors on federal land in western states (DOE and BLM Energy Corridor Programmatic EIS; 70 *FR* 56647, September 28, 2005).
- Energy and mineral development activities.
- Other regional economic development plans and activities within Lyon, Mineral, Esmeralda, and Nye Counties.

The Mina rail corridor ranges in length from about 410 to 450 kilometers (255 to 280 miles), depending on the option considered. As a linear project, land disturbance and other direct impacts are most likely to occur within the relatively narrow construction and operations rights-of-way. However, for some resources, there could be other direct and indirect impacts outside the rights-of-way.

To evaluate the potential for cumulative impacts, DOE identified and reviewed public and private actions in the Mina rail corridor region of influence to determine if the impacts associated with these actions could coincide in time or space with potential impacts from construction and operation of the proposed railroad in the Mina rail corridor. Only those projects and activities DOE believes would have the potential for cumulative impacts are identified herein. In some cases, similar actions have been grouped together and listed by category of action.

4.2.1 PROJECTS AND ACTIVITIES INCLUDED IN THE CUMULATIVE IMPACTS ANALYSIS

4.2.1.1 Past and Present Actions

The descriptions of existing (baseline) environmental conditions and impacts (see Chapter 3) associated with the various environmental resource regions of influence for the Mina rail corridor considered in this Nevada Rail Corridor SEIS include the relationships between proposed railroad construction, operation, and abandonment, and past and present actions such as:

- Operations at major federal facilities such as the proposed Yucca Mountain Repository, the Nevada Test and Training Range, the Nevada Test Site, the Hawthorne Army Depot, and Naval Air Station Fallon
- BLM resource management planning and land management uses
- Traditional land uses such as regional ranching, mining, and recreation
- Military operations
- Walker River Basin restoration activities
- Residential, commercial, and industrial development activities associated with growth in the Mina rail corridor cumulative impacts region of influence, including the Pahrump area and the Reno-Carson City area adjacent to the northern portion of the Mina rail corridor region of influence.

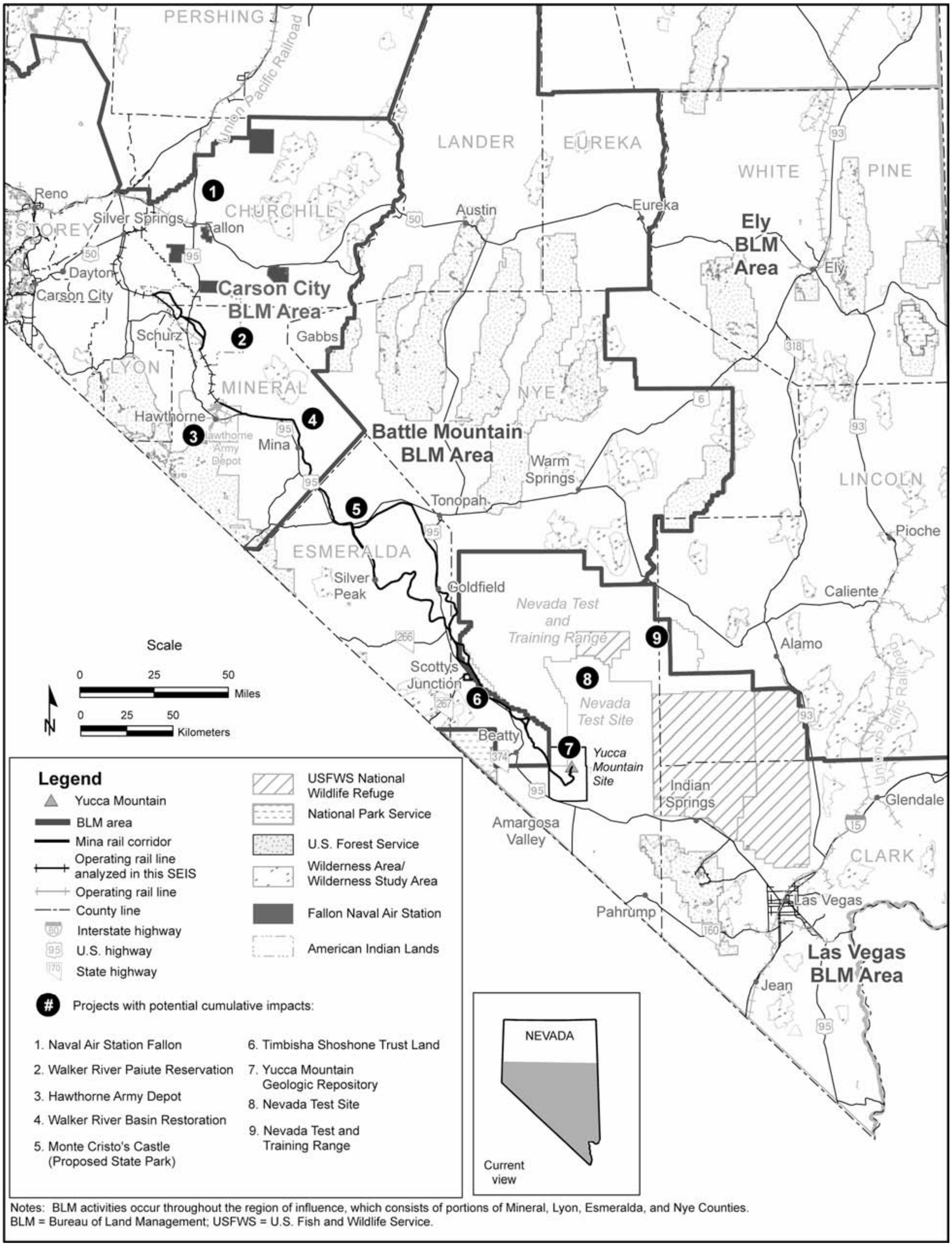


Figure 4-1. Major reasonably foreseeable future actions and continuing activities in the Mina rail corridor cumulative impacts region of influence.

DOE also considered reasonably foreseeable future actions and the continuation of existing actions in the Mina rail corridor cumulative impacts region of influence. Figure 4-1 shows the locations of individual projects and activities.

4.2.1.2 Reasonably Foreseeable Future and Continuing Federal Actions

Sections 4.2.1.2.1 through 4.2.1.2.8 describe reasonably foreseeable future and continuing federal agency actions that could result in cumulative impacts when combined with the incremental impacts of the Proposed Action.

4.2.1.2.1 Yucca Mountain Repository

The Proposed Action in this Nevada Rail Corridor SEIS is directly related to the proposed geologic repository at Yucca Mountain, which is a reasonably foreseeable project (see Figure 4-1, Project #7). In the Yucca Mountain FEIS (DIRS 155970-DOE 2002, all) and the *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Repository SEIS; DOE/EIS-0250F-S1) DOE proposes to construct, operate and monitor, and eventually close a geologic repository for the ***disposal*** of 70,000 metric tons (77,000 tons) of heavy metal of ***spent nuclear fuel*** and ***high-level radioactive waste*** in a ***repository*** at Yucca Mountain in Nye County, Nevada. The Department proposed to dispose of this material using the natural geologic features of Yucca Mountain, along with engineered barriers, as a total system to help ensure long-term ***isolation*** of the materials from the ***accessible environment***. As analyzed in the Repository SEIS, the repository design and associated construction and operational plans require the following:

- DOE spent nuclear fuel and high-level radioactive waste would be placed in disposable ***canisters*** at the DOE sites, and as much as 90 percent of the ***commercial spent nuclear*** fuel would be placed in transportation, aging, and disposal (TAD) canisters at the commercial sites prior to shipment. The remaining commercial spent nuclear fuel (about 10 percent) would be transported to the repository in dual-purpose canisters (canisters suitable for storage and transportation), or would be uncanistered.
- Most spent nuclear fuel and high-level radioactive waste would be transported from 72 commercial and 4 DOE sites to the repository in Nuclear Regulatory Commission-certified transportation casks placed on trains dedicated only to these shipments.
- At the repository, DOE would conduct waste handling activities to manage thermal output of the commercial spent nuclear fuel and to package the spent nuclear fuel into TAD canisters. The disposable canisters and TAD canisters would be placed into ***waste packages*** for disposal in the repository. A waste package is a container that consists of the barrier materials and internal components in which DOE would place the canisters that contained spent nuclear fuel and high-level radioactive waste.
- DOE would place approximately 11,000 waste packages, containing no more than a total of 70,000 metric tons (77,000 tons) of heavy metal, of spent nuclear fuel and high-level radioactive waste in the repository at Yucca Mountain.
- When authorized by the Nuclear Regulatory Commission, the repository would be closed permanently.
- The project would require surface and subsurface facilities and associated infrastructure, such as the onsite road and water distribution networks and emergency response facilities, a four-lane access road that would extend from U.S. Highway 95 to the existing access road at Gate 510.

- DOE assumes that the following facilities would be constructed outside the Yucca Mountain Site boundary: a training facility to support the Project Prototype Testing and the Operator Training and Qualification programs; temporary accommodations for construction workers; a Sample Management Facility to consolidate, upgrade, and improve storage and warehousing for scientific samples and materials; and a marshalling yard and warehouse for construction materials.

The Nuclear Regulatory Commission, through its licensing process, would regulate repository construction, operation and monitoring, and closure. Repository operations would only begin after the Commission granted DOE a license to receive and possess spent nuclear fuel and high-level radioactive waste. DOE is currently preparing an application to the Commission for authorization to construct the repository.

The Yucca Mountain FEIS and this Repository SEIS evaluate the cumulative impacts of two additional inventories (referred to as Modules 1 and 2), which include spent nuclear fuel and high-level radioactive waste in addition to that of the Proposed Action inventory, and other radioactive wastes generally considered unsuitable for near-surface disposal. Inventory Module 1 or 2 could have cumulative impacts on the operation of proposed railroad. Regarding potential cumulative impacts from Inventory Module 1 or 2, there would be no cumulative construction impacts because the need for a new railroad would not change; that is, any rail corridor DOE selected for construction of the proposed railroad to serve the Yucca Mountain FEIS Proposed Action would also serve Module 1 or 2. In addition, because the planned annual shipment rate of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository would be about the same for Module 1 or 2 and the Yucca Mountain FEIS Proposed Action, the only cumulative operations impacts would result because of the assumed increase in the number of casks required for Module 1 or 2. Because the Modules 1 and 2 inventories would exceed the NWPA disposal limit of 70,000 metric tons (77,000 tons) of heavy metal considered in the Yucca Mountain FEIS and Repository SEIS Proposed Actions, the emplacement of any such waste at Yucca Mountain would require legislative action by Congress unless a second licensed repository was in operation. The 70,000 metric tons of heavy metal limit is comprised of 63,000 metric tons (69,000 tons) of heavy metal from commercial utilities and 7,000 metric tons (7,000 tons) of heavy metal from DOE.

DOE is preparing the *Programmatic Environmental Impact Statement for the Global Nuclear Energy Partnership* (DOE/EIS-0396). Global Nuclear Energy Partnership (GNEP) would encourage expansion of domestic and international nuclear energy production while reducing nuclear proliferation risks, and reduce the volume, thermal output, and ***radiotoxicity*** of spent nuclear fuel before disposal in a geologic repository. DOE anticipates that its Programmatic EIS will evaluate a range of alternatives, including a proposal to recycle spent nuclear fuel and separate many of the high-heat ***fission products*** and the uranium and ***transuranic*** components. The full implementation of GNEP would involve the construction and operation of advanced reactors, which would be designed to generate energy while destroying the transuranic elements. DOE also anticipates evaluating project-specific proposals to construct and operate an advanced fuel-cycle research facility at one or more locations in the United States.

The United States use a “once through” fuel cycle in which a nuclear power reactor uses nuclear fuel only once, and then the utility places the spent nuclear fuel in storage while awaiting disposal. GNEP would establish a fuel cycle in which the uranium and transuranic materials would be separated from the spent nuclear fuel and reused in thermal or advanced nuclear reactors.

DOE anticipates that by about 2020 the commercial utilities will have produced about 86,000 metric tons (95,000 tons) of heavy metal of spent nuclear fuel, which exceeds the DOE disposal limit of 63,000 metric tons (69,000 tons) of heavy metal of commercial spent nuclear fuel at the Yucca Mountain Repository. If DOE were to decide, in a GNEP ***Record of Decision***, to proceed with its proposal to recycle spent nuclear fuel, the Department anticipates that the necessary facilities would not commence operations until 2020 or later. Although the spent nuclear fuel-recycling concept has not yet been implemented and the capacity of a separations facility has not been determined, one or more separations facilities could be designed with a total capacity sufficient to recycle the spent nuclear fuel discharged by commercial utilities. GNEP facilities initially could be designed to have the capacity to recycle the amount of spent nuclear fuel being generated by commercial utilities. Consequently, the Department believes there would be no change in the spent nuclear fuel and high-level radioactive waste inventory, and therefore the number of casks of spent nuclear fuel and high-level radioactive waste shipped to the Yucca Mountain repository analyzed under the Proposed Action in this Nevada Rail Corridor SEIS would remain unchanged (that is, the shipment of approximately 9,500 casks containing spent nuclear fuel and high-level radioactive waste that would be produced).

Overall, development of a GNEP fuel cycle has the potential to decrease the amount (number of assemblies) of spent nuclear fuel that would require geologic disposal, but would increase the number of casks of high-level radioactive waste requiring disposal in a geologic repository in the long term. Consequently, A GNEP fuel cycle could affect the nature of the inventory that represents the balance of Inventory Module 1 (that is, commercial spent nuclear fuel in amounts greater than 63,000 metric tons [69,000 tons] of heavy metal). Nevertheless, given the uncertainties inherent at this time in estimating the amount of spent nuclear fuel and high-level radioactive waste that would result from full or partial implementation of GNEP, this Nevada Rail Corridor SEIS analyzes rail transportation of approximately 9,500 casks of spent nuclear fuel and high-level radioactive waste.

The Department is currently preparing the *Disposal of Greater-Than-Class-C Low-Level Radioactive Waste Environmental Impact Statement* (DOE/EIS-0375). This EIS addresses the disposal of wastes with concentrations greater than Class C (GTCC), as defined in Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE Low-Level Radioactive Waste and transuranic waste having characteristics similar to Greater-Than-Class-C waste and which otherwise do not have a path to disposal. DOE proposes to evaluate alternatives for GTCC low-level waste disposal in a geologic repository; in intermediate depth boreholes; and in enhanced near surface facilities. Candidate locations for these disposal facilities would be the Idaho National Laboratory in Idaho; the Los Alamos National Laboratory and the Waste Isolation Pilot Plant in New Mexico; the Nevada Test Site and the proposed Yucca Mountain Repository in Nevada; the Savannah River Site in South Carolina; the Oak Ridge Reservation in Tennessee; and the Hanford Site in Washington. DOE will also evaluate disposal at generic commercial facilities in arid and humid locations. The Repository SEIS evaluates the potential cumulative impacts of disposal of these wastes at Yucca Mountain as a reasonably foreseeable action, which are included in Inventory Module 2.

4.2.1.2.2 Nevada Test Site (Continuation of Activities)

The Nevada Test Site, adjacent to the Nevada Test and Training Range, engages in a number of defense-related material and management activities, waste management, environmental restoration, and non-defense research and development (see Figure 4-1, Project #8). The Nevada Test Site was established in 1951 as the Nation’s proving ground for developing and testing nuclear weapons. The site is on land administratively held by the BLM, but the Nevada Test Site land was withdrawn for use by the Atomic Energy Commission and its successors (including DOE). At present, the DOE National Nuclear Security Administration manages the site. It consists of about 3,200 square kilometers (800,000 acres) of land.

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all) described existing and projected future actions at the Nevada Test Site. That EIS was followed by a *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 162638-DOE 2002, all). DOE activities at the Nevada Test Site include stockpile stewardship and management (helping ensure the U.S.

nuclear weapon stockpile is safe, secure, and reliable), materials disposition (removal of nuclear materials in a safe and timely manner), and nuclear emergency response. Activities at the Nevada Test Site since the 1996 EIS and 2002 supplement analysis have continued to support these missions in accordance with federal law, DOE policies and missions, and NEPA requirements. There are a number of other programmatic DOE waste management initiatives that can affect current and potential future operations at the Nevada Test Site, many of which require NEPA analyses. The Nevada Test Site also produces annual environmental reports that describe program activities and related environmental issues and activities.

DOE is currently preparing the *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement–Complex 2030* (Complex Transformation Supplemental PEIS [formerly known as the Complex 2030 SEIS]; DOE/EIS-0236-S4). That SEIS will analyze the environmental impacts of the continued transformation of the United States nuclear weapons complex by implementing the National Nuclear Security Administration's vision of the complex as it would exist in 2030, and alternatives to that action. Part of the proposed action in that SEIS is to identify one or more sites for conducting National Nuclear Security Administration flight test operations. Existing Department of Defense and DOE test ranges (for example, the White Sands Missile Range in New Mexico and the Nevada Test Site in Nevada) would be considered as alternatives to the continued operation of the Tonopah Test Range in Nevada.

Another part of the proposed action in the Complex Transformation Supplemental PEIS is to accelerate dismantlement activities. The DOE sites that will be considered as potential locations for the consolidated plutonium centers and consolidation of Category I (high strategic significance) and II (moderate strategic significance) special nuclear materials include Los Alamos National Laboratory, the Nevada Test Site, the Pantex Plant, the Y-12 National Security Complex, and the Savannah River Site.

DOE manages several types of radioactive and hazardous waste (***low-level radioactive waste***, ***mixed low-level waste*** [referred to as mixed waste], transuranic waste, high-level radioactive waste, and ***hazardous waste***) generated by past and present nuclear defense research activities at many DOE sites across the United States, including the Nevada Test Site. The Department manages each of those waste types separately because they have different components, levels of radioactivity, and regulatory requirements. DOE needs facilities like the Nevada Test Site to manage its radioactive and hazardous wastes to maintain safe, efficient, and cost-effective control of these wastes; comply with applicable federal and state laws; and protect public health and safety and the environment. In *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DIRS 101816-DOE 1997, all) DOE evaluated the environmental impacts of managing the five waste types. The Nevada Test Site will continue to be a major facility involved in DOE waste management programs, including serving as a disposal site for certain waste types generated off the site, and for on-site wastes primarily from environmental restoration and remediation activities.

The Nevada Test Site is a candidate disposal location for Greater-Than-Class-C Low-Level Radioactive Waste which is currently being examined in the *Disposal of Greater-Than-Class-C Low-Level Radioactive* Waste *Environmental Impact Statement* (DOE/EIS-0375). That DOE EIS will address the disposal of wastes with concentrations greater than Class C, as defined in Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE low-level radioactive waste and transuranic waste having characteristics similar to Greater-Than-Class-C low-level waste and that might not have an identified path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low level waste disposal in a geologic repository; in intermediate-depth boreholes; and in enhanced near-surface facilities.

4.2.1.2.3 BLM Resource Planning and Management

The presence of BLM-administered public land is a very important factor affecting how and where activities occur within the region of influence. Many private and federal projects in the region of influence, including the proposed ***railroad***, would involve use of BLM-administered land. Therefore, these projects would require BLM-issued ***right-of-way grants*** before they could proceed. Right-of-way grants have two general forms: linear (applicable to such projects as transmission lines, railroads, and pipelines), and non-linear (applicable to projects at one specific location). Rights-of-way on BLM-administered land are extensive in the region. These rights-of-way vary greatly in size and scope of activity, ranging from small communication sites to large linear rights-of-way for highways or transmission lines.

The BLM administers most of the public lands along the proposed Mina rail corridor. The BLM manages these lands through a multiple-use concept (which means managing public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people) in accordance with the Federal Lands Policy and Management Act of 1976 (43 U.S.C. 1732 *et seq*.) and other federal legislation. The proposed Mina rail corridor would cross three BLM management areas (Carson City, Battle Mountain, and Las Vegas). The Carson City Field Office manages its federal lands through a Consolidated ***Resource Management Plan*** developed in 2001. The Carson City Field Office was previously divided into eight planning units, all of which were consolidated into the 2001 Carson City Resource Management Plan. The Battle Mountain and Las Vegas management areas are operating under resource management plans adopted in 1998 and 1997, respectively (DIRS 176043-BLM 1998, all; DIRS 173224-BLM 1997, all).

Grazing operations are a major BLM land-management program in the Mina rail corridor region of influence and result in both direct and indirect cumulative impacts to vegetation, habitats, and wildlife.

The Mining and Mineral Policy Act of 1970 (30 U.S.C 1601 *et seq.*) declares that it is the continuing policy of the federal government to foster and encourage private enterprise in the development of a stable domestic minerals industry and orderly economic development of domestic mineral resources, including sand and gravel, geothermal, coal, and oil and gas. Sections 102(a)(7), (8), and (12) of the Federal Land Policy and Management Act of 1976, directs public lands be managed in a manner that recognizes the Nation's need for domestic sources of minerals and other resources. The Geothermal Steam Act of 1970 (30 U.S.C 1001 *et seq*.), which was amended and supplemented by the Energy Policy Act of 1992 as amended (42 U.S.C 13201 *et seq.*) provides the framework for geothermal leasing by the BLM. The BLM Carson City Field Office may issue leases for geothermal resources located in multiple areas within the Mina rail corridor cumulative impacts region of influence.

4.2.1.2.4 Walker River Paiute Reservation (Federal Actions)

The Walker River Paiute Reservation consists of more than 130 square kilometers (323,000 acres) of land between Yerington, Nevada, and Walker Lake (See Figure 4-1, Project #2). Although the Reservation is recognized as a sovereign entity under the non-federal actions discussion below, federal agencies could also be taking actions on the Reservation. The Bureau of Indian Affairs operates the Weber Dam and Weber Reservoir, which impounds water from the Walker River just north of the community of Schurz for use on the Reservation. Constructed in the 1930's, the dam needs several repairs and modifications to address a number of deficiencies identified as a result of inspections and a safety analysis conducted in the 1980s under the Bureau of Indian Affairs Dam Safety Maintenance and Repair Program, created as part of the Indian Dams Safety Act. Additionally, the U.S. Fish and Wildlife Service is involved in recovery efforts for the threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*). Lahontan cutthroat trout are stocked in Walker Lake and occur in the Walker River upstream to Weber Reservoir. Weber Dam currently blocks movement further upstream, and prevents spawning by cutthroat trout;

however, in the near future a fish ladder might be developed at that dam to allow fish movement. Reestablishment of a self-sustaining population of Lahontan cutthroat trout in the Walker River system is a prerequisite for recovery of this species.

4.2.1.2.5 Nevada Test and Training Range (Continuation of Activities)

The U.S. Air Force operates the Nevada Test and Training Range in south-central Nevada (see Figure 4-1, Project #9), a national test and training facility for military equipment and personnel consisting of approximately 12 million square kilometers (3 million acres). Military training maneuvers and jet aircraft are visible in the Mina rail corridor cumulative impacts study area. In 2005, the U.S. Air Force designated the Indian Springs Air Force Auxiliary Airfield to Creech Air Force Base and expanded its mission and infrastructure to play a major role in the war on terrorism. The base is home to two key military operations: the MQ-1 unmanned aerial vehicle and the Unmanned Aerial Vehicle Battle laboratory.

The 1,600-square-kilometer (390,000-acre) BLM-administered National Wild Horse Management Area is within the boundary of the Nevada Test and Training Range. More than 3,200 square kilometers (800,000 acres) of the Nevada Test and Training Range comprise the Desert National Wildlife Range. The U.S. Air Force and the U.S. Fish and Wildlife Service jointly manage this area.

In *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999, all) the U.S. Air Force addressed the potential environmental consequences of extending the land withdrawal to continue using the Nevada Test and Training Range lands for military use. Activities at the Nevada Test and Training Range change, as necessary, to meet military test and training needs.

In 2004, the BLM prepared a resource management plan for about 8,900 square kilometers (2.2 million acres) of withdrawn public lands within the Nevada Test and Training Range (DIRS 178102-BLM 2004, all). The plan guides the management of the affected Nevada Test and Training Range natural resources 20 years into the future (2024). The decisions, directions, allocations, and guidelines within the plan are based on the primary use of the withdrawn area for military training and testing purposes.

4.2.1.2.6 Hawthorne Army Depot

The Hawthorne Army Depot occupies more than 590 square kilometers (147,000 acres) in Mineral County, Nevada (see Figure 4-1, Project #3). Hawthorne Army Depot was commissioned in 1930 as a Naval ammunition depot, and was transferred to the Army in October 1977, and renamed Hawthorne Army Ammunition Plant. It was converted to a government-owned, contactor-operated installation in December 1980. In 1994 the name changed back to the Hawthorne Army Depot. Control of Hawthorne Army Depot is maintained by the U.S. Army, which is responsible for the plans, installation, operation, and equipment of the Depot. The mission of Hawthorne Army Depot is to support the Army, Air Force, and Navy. It also has the capabilities to receive, maintain, store, and issue ammunition and explosive ordnance items. The Hawthorne Army Depot also has the responsibility to renovate, recover, or dispose of unserviceable ammunition and explosives. These latter operations are referred to as demilitarization activities.

The primary ordnance areas at Hawthorne Army Depot extend over 400 square kilometers (100,000 acres) that cross U.S. Highway 95. This area is surrounded on its northeast, east, south, and west by fencing and on its north and northwest by a boundary line that includes a portion of Walker Lake. The southern one-third of Walker Lake is within the ordnance area. The Mount Grant watershed is in the northwest part of the installation. This watershed consists of about 180 square kilometers (45,000 acres), and is a resource that Hawthorne Army Depot maintains to supply its primary potable water needs.

Hawthorne Army Depot has 2,572 buildings and structures, which are comprised of offices, production buildings, ammunition storage magazines, and warehouses. The Depot is bordered by BLM-administered public grazing lands, and the installation completely surrounds the town of Hawthorne. Hawthorne Army Depot is planning to construct a rail siding, known as the Wabuska Spur, which would increase the Depot's outloading capacity.

4.2.1.2.7 Naval Air Station Fallon

Naval Air Station Fallon is in the Lahontan Valley of west-central Nevada, approximately 113 kilometers (70 miles) east of Reno and 10 kilometers (6 miles) southeast of the City of Fallon (See Figure 4-1, Project #1). NAS Fallon administers approximately 32 square kilometers (7,900 acres) of withdrawn and acquired land associated with the air station and 95 square kilometers (234,000 acres) of land associated with the Fallon Range Training Complex. The Fallon Range Training Complex airspace overlies portions of Washoe, Lyon, Churchill, Pershing, Mineral, Nye, Lander, and Eureka counties, most of which is BLM-administered public land.

In January of 2005, the Navy and the BLM issued the *Final Environmental Impact Statement: Proposed Fallon Range Training Complex Requirements Naval Air Station Fallon, Nevada*. The Naval Strike and Air Warfare Center at Naval Air Station Fallon proposes to implement changes at the Fallon Range Training Complex to meet Chief of Naval Operations-mandated training requirements resulting from the real world threat environment. The proposed changes would allow the Navy to update and consolidate Navy training on public and Navy-administered lands and to update existing airspace overlying these lands. The changes evaluated in that EIS include developing new fixed and mobile electronic warfare sites, developing new tracking instrumentation subsystem sites, developing additional targets at two of its training ranges, laying fiber-optic cable to two training ranges, utilizing Navy-administered lands in Dixie Valley for close-air-support training, performing Hellfire missile and high altitude weapons delivery training at two of its training ranges, and changes to special use airspace. That EIS provided a comprehensive evaluation of the environmental impacts, including cumulative impacts, associated with the Navy's proposed changes.

4.2.1.2.8 Timbisha Shoshone Trust Land (Federal Action)

The Secretary of the Interior issued a draft report to Congress (DIRS 103470-Timbisha Shoshone Tribe [n.d.], all) describing a plan to establish trust lands for people of the Timbisha Shoshone Tribe in portions of the Mojave Desert in eastern California and southwestern Nevada (See Figure 4-1, Project #6). On November 1, 2000, the President signed Bill S. 2102 (Public Law 106-423) to provide a permanent land base for the Timbisha Shoshone Tribe within its ancestral homeland in five separate parcels. Lands in the designated area for tribal purposes were then identified, including land parcels containing water rights. The parcel near Scottys Junction (about 11 square kilometers [2,800 acres]) is approximately 3.2 kilometers (2 miles) from the proposed Mina rail corridor. The Timbisha Shoshone Tribe is actively evaluating economic development opportunities on this Scottys Junction parcel. The locations and nature of these future development opportunities are not known and are not considered to be reasonably foreseeable for purposes of this cumulative impacts analysis.

4.2.1.3 Reasonably Foreseeable Future Non-Federal Actions

Non-federal and private actions in the Mina rail corridor cumulative impacts region of influence primarily involve mineral resource development projects, Walker River Paiute tribal activities, and some residential and general economic development initiatives and efforts. As previously noted, many of these privately sponsored projects would interact with the BLM land-management policies and procedures through the need to acquire right-of-way grants to initiate proposed activities on BLM-administered land.

4.2.1.3.1 Walker River Paiute Reservation

The Walker River Paiute Reservation consists of more than 130 square kilometers (323,000 acres) of land between Yerington, Nevada, and Walker Lake (see Figure 4-1, Project #2). The 2000 census reported a population of 853 on the Reservation. The rural community of Schurz is the only community within the boundaries of the Reservation. Land use on the Reservation consists primarily of open range used for cattle grazing or other agricultural activities. The Department of Defense Branchline from Wabuska extends south through the Reservation to its termination point at the Hawthorne Army Depot.

4.2.1.3.2 Power Plants, Transmission Lines, Pipelines, and Other Infrastructure

There are transmission lines, pipelines, and telecommunications infrastructure within the Mina rail corridor cumulative impacts region of influence. The region of influence has the potential for wind, solar, and geothermal energy development, although the magnitude and specific locations of these energy development projects are not known. As indicated in Section 4.2.1.2.3, the BLM may issue geothermal leases within the Mina rail corridor region of influence. The approval of any leases and subsequent development of geothermal resources would be subject to environmental review and would be guided by BLM resource management plans.

The BLM has designated certain corridors in the area that should be used for most utility purposes; however, use of other BLM-administered land requiring new right-of-way grants has traditionally been considered on a case-by-case basis. As previously noted, the DOE and BLM Energy Corridor Programmatic EIS is an attempt to identify appropriate right-of-way corridors throughout the western United States, including Nevada. This effort could influence the location of rights-of-way in the Mina rail corridor cumulative impacts region of influence in future years.

4.2.1.3.3 Mining

The region of influence contains a variety of mineral resources, with ***mining claims*** filed in accordance with BLM requirements, and several operating mines. Establishment of mining claims on federal land do not necessarily ever lead to actual development of mining operations on those sites. Major cumulative impact issues involving mining projects include potential land-use conflicts and wastes from mining operations. Mineral resource locations of note within the region of influence include:

- Nevada Western Silica Corporation holds mining claims for a large, high-grade silica deposit near Lida Junction, south of Goldfield in Esmeralda County. There are at least 24 million cubic meters (32 million cubic yards) of silica on site. The Mina rail corridor passes within 2.4 kilometers (1.5 miles) of the claims.
- Chemetall Foote Corporation runs an operation in Silver Peak, Nevada, that mines lithium carbonate. The company pumps lithium rich groundwater to the ground surface and then collects the lithium powder as the water evaporates. Chemetall Foote pumps the groundwater onto dry lake beds in the Clayton Valley to facilitate the evaporation process. Once removed from the water, the raw lithium material is processed in an on-site plant into market-ready, lithium-containing products.
- Metallic Ventures Gold holds mining claims near Goldfield in a historic high-grade gold-producing district. The project is currently in the pre-feasibility stage of development.

Mining activities are expected to continue within the Mina rail corridor cumulative impacts region of influence. Mining activities are heavily regulated and must comply with all applicable environmental laws, rules, and regulations. The BLM has an extensive regulatory framework for mineral resource development on federal lands that strives to balance mining activities and mineral extraction with other resource management goals.

4.2.1.3.4 Walker River Basin Restoration

The decline in water quality throughout the Walker River Basin, particularly in Walker Lake, and concerns related to the Lahontan Cutthroat Trout, have resulted in organized restoration efforts throughout the basin (See Figure 4-1, Project #4). The water level in Walker Lake has dropped substantially since the late 1800s, and levels of total suspended solids have increased. The increased levels of total dissolved solids, along with other physical, biological, and chemical conditions in the watershed and lake, have stressed fisheries and other aquatic life in the lake and changed the resident fish population. The Walker Lake Working Group is a nonprofit organization building public support for developing a long-term solution to protect the lake without jeopardizing the upstream community. The Group has developed a restoration strategy focused on three objectives: 1) reestablishment of spawning runs of the Lahontan cutthroat trout; 2) providing sufficient water so that total dissolved solids levels are low enough to support the Walker Lake ecosystem; and 3) acquiring and transferring water rights for environmental and recreational purposes.

4.2.1.3.5 Monte Cristo's Castle (Proposed State Park) (This has a federal component involving the BLM.)

In 2005, the State of Nevada proposed a new state park near Blair Junction (See Figure 4-1, Project #5). If approved, the park would be known as Monte Cristo's Castle and would highlight the unique geology of the area. As proposed, the park would include approximately 23 square kilometers (5,800 acres) of land just north of the intersection of U.S. Highway 95 and State Route 265 at Blair Junction. As currently envisioned, the proposed park would include hiking areas and interpretive trails with displays about the unique geologic formations in the area. In June 2007, the Nevada State Legislature provided for establishment of the State Park, which would be on land currently administered by the BLM. To transfer the land to the State of Nevada for establishment of the State Park, the BLM would perform an environmental assessment and other work required as part of the Recreation and Public Purpose Lease process.

4.2.1.3.6 Other Regional Economic Development

Cumulative impacts issues associated with regional economic development actions include socioeconomic effects and overall growth in the region of influence. There are several ongoing or planned regional economic development initiatives in the northern portion of the Mina rail corridor cumulative impacts region of influence south and east of the Carson City/Reno area. For example, a county-owned airport near the community of Silver Springs, Nevada, plans to expand its operations, pave its runway, and promote the development of nearby industrial parks totaling approximately 3.8 square kilometers (950 acres). Western Nevada Rail Park is approximately 1 kilometer (35 miles) east of Reno along Alternate U.S. Highway 50. When complete, the rail park would include roughly 1 square kilometer (240 acres) of industrial park serviced by the Union Pacific Railroad mainline. A master-planned community is being developed near the community of Dayton, Nevada. The development contains approximately 12 square kilometers (2,900 acres) consisting of approximately 2,300 single family homes, 0.02 square kilometer (4 acres) of multi-family units, 0.11 square kilometer (27 acres) of commercial land, 1 square kilometer of industrial land, and 0.08 square kilometer (20 acres) for a resort/casino and an improved 1,600-meter (5,400-foot) airstrip. Support infrastructure, including new elementary, middle, and high schools, fire station, municipal water and wastewater utilities, community center, and a health and fitness center, are already in place to support the development. As the Reno and Carson City metropolitan areas continue to grow and expand, additional privately sponsored developments can be expected within the northern portion of the Mina rail corridor cumulative impacts region of influence.

Additionally, major transportation corridors such as U.S. Highway 95 through the region of influence into both the Reno and Las Vegas areas will continue to grow and expand, and present additional regional economic development opportunities. A perceived need for support to the Nevada Test Site has led the Nye County Economic Development Board to designate the Nevada Science and Technology Corridor. The Science and Technology Corridor extends from Indian Springs in Clark County in the south to Tonopah in the north, passing through the Pahrump Valley, Mercury (entrance to the Nevada Test Site), Amargosa Valley, Beatty and Goldfield, with industrial park and technology initiatives associated with the Tonopah Aeronautics and Technology Park, the Nevada Science and Technology Park in Amargosa Valley, and the Pahrump Center for Technology Training and Development. The locations and nature of specific future development opportunities are not known and are not considered to be reasonably foreseeable for the purposes of this cumulative impacts analysis.

Nye County has completed a Yucca Mountain Project Gateway Area Concept Plan with proposed activities for the area around the entrance to the proposed repository site (DIRS 182345-Nye County 2007, all). This plan presents Nye County’s conceptual, multi-phased land-use guidance for communities adjacent to and near the site entrance area. Nye County proposed this plan with the objective that land development would occur in an orderly and consistent manner and to increase opportunities for industrial and commercial development beneficial to the repository program. Nye County views this plan as a starting point for development of the infrastructure, institutional capacity, and facilities to support the proposed repository. The county developed the plan to use and manage existing initiatives while expanding and improving the area.

4.2.2 POTENTIAL CUMULATIVE IMPACTS

Located primarily in portions of Esmeralda, Nye, Lyon, and Mineral Counties, the Mina rail corridor cumulative impacts region of influence covers millions of acres of land. Most of this land is undeveloped federally managed public land, although much of it has been affected by such human activities as ranching and mining.

Potential cumulative impacts are often discussed herein within the context of the existing regulatory framework (primarily federal and state laws and regulations) and the BLM resource management planning goals and objectives. For example, the existing regulatory frameworks for water and air consider a regional and cumulative impacts perspective, because regulatory decisions consider the potential effects from other projects and a proposed action. As the primary regional land manager, BLM planning and management actions consider the cumulative effects for many resources through stated planning goals and objectives, which are often based on quantitative criteria.

The following analysis of potential cumulative impacts associated with the Mina rail corridor is organized by resource area, with Sections 4.2.2.1 through 4.2.2.12 summarizing potential cumulative impacts in the same order of resource discussions in Chapter 3.

4.2.2.1 Land Use and Ownership

4.2.2.1.1 Land-Use Changes

Many of the past, present, and reasonably foreseeable future actions in the Mina rail corridor region of influence result in land use changes. Land-use change can also alter land ownership and land-management responsibilities, and preclude future activities from these areas. Most of the land in the Mina rail corridor region of influence is BLM-administered land in Lyon, Mineral, Esmeralda, and Nye Counties. The BLM manages more than 45,000 square kilometers (11 million acres) in those four counties. One of the primary land uses in and around the proposed Mina rail corridor on those

BLM-administered lands is grazing. Regional grazing activities are often affected by BLM land-management plans and activities.

Other existing and reasonably foreseeable major land uses in the Mina rail corridor region of influence include:

- Reno and Carson City Expansion – A minimum of approximately 25 square kilometers (6,300 acres) of industrial, commercial, and residential developments associated with growth and expansion of the Reno and Carson City Metropolitan areas into the northern portion of the Mina rail corridor cumulative impacts region of influence.
- Hazen industrial parks – Two industrial parks at Hazen are being developed. The Great Basin Industrial Park, a 9.3-square-kilometer (2,300-acre) industrial and residential project is being developed alongside the existing Union Pacific Railroad mainline. Churchill County has already approved this project. The Rail Park across the Union Pacific Railroad mainline from the Great Basin Industrial Park spans approximately 1.9 square kilometers (480 acres) and is currently in the planning stage.
- Naval Air Station Fallon and the Fallon Range Training Complex – Naval Air Station Fallon administers approximately 30 square kilometers (8,000 acres) of withdrawn and acquired land associated with the air station and 950 square kilometers (234,000) acres of land associated with the Fallon Range Training Complex.
- Walker River Paiute Reservation – Approximately 1,300 square kilometers (323,000 acres) of land managed by the Walker River Paiute Tribal Council.
- Hawthorne Army Depot – Approximately 600 square kilometers (147,000 acres) of land managed by the Army for purposes of receiving, issuing, storing, renovating, inspecting, demilitarizing, and disposing of conventional ammunition. An offer from a private firm of 40 square kilometers (10,000 acres) to expand the Depot's military training and other missions is in the preliminary planning stages.
- Nevada Test and Training Range – About 12,000 square kilometers (3 million acres) of land the U.S. Air Force has withdrawn for special-purpose use, with about 530 square kilometers (130,000 acres) of that land disturbed by Air Force tactical target complexes and associated infrastructure.
- Nevada Test Site – About 3,200 square kilometers (800,000 acres) of land DOE has withdrawn for special-purpose use.
- Yucca Mountain Repository – About 6.3 square kilometers (1,600 acres) of land disturbance, most of which would be on the Nevada Test Site (already withdrawn for Nevada Test Site activities).
- Right-of-way corridors that might be established when the DOE and BLM Energy Corridor Programmatic EIS is completed.

The proposed Mina rail corridor would disturb up to 41 square kilometers (10,000 acres) of land, most of which would be within the nominal width of the rail line construction right-of-way. Therefore, the proposed Mina rail corridor would directly affect about 0.25 percent of the BLM-administered land in the four counties. The Mina rail corridor would cross up to 15 separate grazing allotments, which constitute about 11,700 square kilometers (2.9 million acres) of BLM-administered land. The approximate disturbance area associated with the proposed Mina rail corridor would constitute less than 1 percent of the land within those 15 grazing allotments. Within this regional perspective of nearby existing and reasonably foreseeable land uses and land ownership, the commitment of land for the proposed Mina rail corridor and associated facilities would constitute a small proportion of overall cumulative land commitment. Use of private land for the proposed rail line would be small, and the rail line would not displace existing or planned land uses on private lands over a substantial area, nor would they substantially conflict with applicable land-use plans or goals.

Considering both the proposed railroad and existing and reasonably foreseeable land uses and land ownership in the Mina rail corridor region of influence, cumulative impacts from land-use changes would be small.

4.2.2.1.2 Existing or Potential Land-Use Conflicts

The Federal Government administers most of the land in the Mina rail corridor region of influence, with the BLM, DOE, and the Department of Defense (Air Force and Army) acting as the major federal land managers. The Mina rail corridor region of influence also includes Walker River Paiute Reservation lands. Private land holdings are small, and generally associated with Chemetall Foote Corporation's lithium mine near Silver Peak and other towns in the Mina rail corridor region of influence. Traditional land uses in most of the Mina rail corridor region of influence that would be directly and indirectly affected include grazing, mining, and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing and mining.

Over time, human activity in the area, while relatively minor on a regional basis, has begun to change the natural and traditional conditions, and land-use conflicts occasionally result from this human activity. The Nevada Test Site and Nevada Test and Training Range lands have been withdrawn for special purpose and use. Both of these areas are inaccessible to the general public and land use is that of "dominant use," in which the specific DOE and U.S. Air Force missions, respectively, for these lands have ultimate priority over all other potential land uses. Hawthorne Army Depot and Naval Air Station Fallon lands were also withdrawn for special use, are inaccessible to the general public, and land use is that of dominant use in which the specific Army and Navy missions, respectively, for these lands have ultimate priority over all other potential land uses. Walker River Paiute Reservation lands are managed by a sovereign tribal government and used by Reservation inhabitants accordingly. Around these primary regional land uses are other uses, including mineral development, recreation, urban development, and rights-of-way for various infrastructure. All of these activities and land uses result from a much more intensive land usage involving human activity.

Construction and operation of a railroad in the proposed Mina rail corridor could have direct and indirect conflicts with grazing uses, access to grazing infrastructure, access to mineral resources, recreational resources, other linear rights-of-way (for example, utility corridors), and wildlife movement patterns in some locations.

Even with the existing and reasonably foreseeable land-use changes, the region as a whole would continue its traditional ways, with grazing and wildlife habitat as major land uses. Cumulative impacts related to land-use conflicts would be small.

4.2.2.1.3 Energy and Mineral Development

Existing and potential future energy and mineral development occurs in various locations throughout the Mina rail corridor cumulative impacts region of influence. In addition to the traditional energy and mineral development (primarily hard-rock mining and industrial mineral development), more recently this development includes geothermal and wind resources. The BLM administers energy and mineral development, evaluates and approves various proposed mineral-development operations, and evaluates and approves geothermal energy development projects on federal lands proposed by private companies. The existing energy development environment includes a mix of old and new, involving both non-renewable and renewable energy resource development.

Because of the scope and extent of typical mining operations, mineral resources that become actual operating mines could result in environmental and land-use issues. Within the Mina rail corridor region of influence, most mining-and energy-development activities would occur on federal lands, and the BLM will have a major role in mitigating and monitoring potential effects through its mining and reclamation requirements, NEPA, and other elements of the regulatory framework. Mineral exploration will continue to occur in many parts of the Mina rail corridor region of influence, and some level of conflict from mining exploration and development with other land uses could be unavoidable.

Any potential conflict of the proposed railroad with energy and mineral development would be small in scope and occur in localized areas, and the effects of any such conflicts would be mitigated through the existing regulatory framework and BLM policies and plans. All existing and foreseeable projects would be subject to regulatory requirements and BLM policies and plans related to energy and mineral development. Therefore, cumulative impacts resulting in land-use conflicts related to energy and mineral development in the Mina rail corridor would be small.

4.2.2.1.4 BLM Land Sales and Other Disposals

While specific initiatives for land disposals in the Mina rail corridor region of influence have not yet been developed, the BLM has plans to designate for potential future disposal (sale) approximately 750 square kilometers (185,000 acres) of public lands in the area, including lands that are difficult and uneconomic to manage (for example, scattered parcels south of Hawthorne and in Smith and Mason Valleys, checkerboard lands near Fernley, Silver Springs, and the Carson sink); land that would support community expansion (such as land west of Yerington, land surrounding the towns of Luning, Mina, Sodaville, Fallon, Gabbs, Reno, Verdi, and lands east of Montgomery Pass, near Honey Lake Valley and Dixie Valley); lands with possible agricultural potential (for example, Smith Valley, Mason Valley, Honey Lake Valley, and Edwards Creek); and lands along the East Walker River identified for exchange to benefit BLM programs.

Approximately 91 square kilometers (22,600 acres) have been identified for potential disposal in the vicinity of the Goldfield, about 23 square kilometers (5,800 acres) have been identified for potential disposal near Scottys Junction, and 160 square kilometers (39,000 acres) have been identified for potential disposal near Beatty. Land disposal areas have also been identified near Coaldale Junction, Blair Junction, Silver Peak, and Millers.

While the proposed railroad would operate within the regional context of the BLM land-disposal efforts and any related implications and effects, the railroad would have no affect on, nor would it be affected by, the BLM land-disposal efforts.

4.2.2.1.5 Recreational Land Use

Public lands in the Mina rail corridor region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as recreation management areas. Demand for recreation is increasing as more people move to and recreate in the Mina rail corridor cumulative impacts region of influence. Dispersed recreation, the principal opportunities available within the Mina rail corridor region of influence, requires a variety of sites but needs no special facilities. These opportunities include caving, photography, automobile touring, backpacking, bird watching, fishing, hunting, primitive camping, hiking, rock climbing, and competitive and non-competitive off-highway vehicle events. An example of increasing interest in recreation areas is the proposal for the Monte Cristo's Castle as a state park near Blair Junction; this park would highlight the unique geology of the area and include hiking areas and interpretive trails with displays about the geologic formations in the area.

The BLM has a major role in recreation opportunities in the Mina rail corridor region of influence. BLM field offices regularly evaluate new opportunities for recreational resources that would provide both passively and actively managed recreation opportunities. There are many such areas that the BLM has designated for recreational use, such as a campground and other day-use facilities at Walker Lake, which attract about 35,000 visitors per year. Other forms of dispersed recreation in the region of influence include hunting, camping, and off-highway vehicle use. Increased demand for off-highway vehicle use from the increasing regional population, including the Las Vegas and Reno-Carson City areas, is expected to continue. Many areas of BLM-administered land in Clark County previously used for off-highway vehicle recreation have been closed, causing a shift in use into other BLM areas. As growth and development occur in the Mina rail corridor cumulative impacts region of influence, recreational resources will continue to be in demand, but the potential for conflict with recreational resources also will increase. Recreational resource locations, quality, and availability will evolve as the Mina rail corridor region of influence changes.

For a variety of reasons, the Pahrump area is growing very rapidly. Both developed and undeveloped recreational opportunities in the area are abundant, with very easy access to public lands for activities such as hiking, camping, sightseeing, and rockhounding. The town of Pahrump is planning for development of 6 square kilometers (1,500 acres), to be called the Last Chance Park, on lands currently administered by the BLM and already used for various types of recreation. The plans include construction of access roads, restrooms, parking areas, and turn-outs, and the placing of signs, bike racks, benches, a pole-and-cable fence, trash cans, and picnic tables. Much of the park would be dedicated to horseback riding, hiking, and biking paths, with the remainder allotted to all-terrain vehicle motorized use. Potential environmental impacts and issues will be identified and assessed through the NEPA process.

DOE has sited the proposed Mina rail corridor to avoid Wilderness Areas and other major recreational resources to the maximum extent practicable. Given the limited effects on regional population, vast regional recreational opportunities, and limited direct interaction of the proposed railroad with recreational resources, cumulative impacts to access to and use of recreational resources in the Mina rail corridor region of influence would be small.

4.2.2.1.6 BLM Rights-of-Way

As urbanization and other development occur in the Mina rail corridor region of influence, the need for utility and other rights-of-way will increase. The BLM has developed certain preferred corridors over federal lands that it uses to the maximum extent possible for linear rights-of-way, such as for utilities. This keeps many right-of-way purposes together in one location instead of spreading them out over more dispersed areas.

The land-use changes authorized by a BLM right-of-way grant would also have the potential to impact other resource areas as those land-use changes occur. Before approval of right-of-way applications, the BLM evaluates the impacts of the projects through appropriate NEPA evaluation. Use of land for right-of-way purposes is consistent with BLM regulations and planning processes, and any land-use changes or disturbances associated with those rights-of-way are mitigated to the extent practicable and according to BLM policies. As required for the issuance of rights-of-way, the project proponent prepares and submits to the BLM a Plan of Development for each proposed right-of-way. The Plan of Development describes the methods and procedures to be used to construct the proposed action on the right-of-way, including site-specific stipulations, terms, and conditions to satisfy all BLM requirements. Certain rights-of-way are long-term and result in unavoidable impacts through land disturbance and the exclusion of other present or future land uses.

Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. Land areas for the Mina rail corridor would cross or overlap existing or proposed utility rights-of-way in approximately 22 to 29 locations. This situation would be typical of other linear rights-of-way. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Cumulative impacts to BLM rights-of-way and right-of-way holders would be small.

4.2.2.1.7 Other BLM Land-Management Actions

The Federal Land Policy Management Act of 1976 (Public Law 94-579) mandates that the BLM manage its public lands from a multiple-use perspective. The Federal Land Policy Management Act specifically mentions balancing renewable and nonrenewable resources, including but not limited to, recreation, range, timber, minerals, watershed, wildlife, fish, natural, scenic, scientific, and historic values. Therefore, the BLM mission to manage the lands to meet multiple-use objectives is challenging, because many of the resources and associated values often overlap.

Within the context of the Mina rail corridor cumulative impacts region of influence, the BLM planning process and management goals and objectives within BLM plans are key determinants of the compatibility of the proposed Mina rail corridor with other projects in region of influence. As noted in Section 4.2.1 there are many continuing and reasonably foreseeable activities that involve the BLM. Because the BLM is and will remain the major land manager in and around the Mina rail corridor region of influence, BLM land-management goals, objectives, and subsequent land-management actions will largely determine if and how new projects and activities occur.

BLM resource management objectives and goals can serve to encourage or restrict activities in certain locations. Areas needing special management attention (such as ***Areas of Critical Environmental Concern***) are also identified in the planning process to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and ensure safety from natural hazards. Multiple-use management goals and objectives become more challenging as cumulative development and land-use changes encroach on open land in the Mina rail corridor region of influence.

The proposed Mina rail corridor would cross three BLM management areas including Las Vegas, Battle Mountain, and Carson City. Each BLM Field Office manages lands within its administrative boundaries according to one or more Management Framework Plan or Resource Management Plan. The Las Vegas, Tonopah, and Carson City plans would apply to the Mina rail corridor. These programs and resource management plans require a number of public and private partnerships and a collaborative approach to land management and planning.

Grazing operations are a major BLM land-management program in the Mina rail corridor region of influence. Grazing results in both direct and indirect cumulative impacts to vegetation, habitats, and wildlife in the Mina rail corridor region of influence. The environmental impacts associated with grazing operations are a function of the location, timing, intensity, duration, and frequency of grazing. Grazing animals directly affect plant communities through trampling and nutrient redistribution. The most noticeable impacts occur around waters, salt blocks, fencelines, and other areas where animals concentrate. With proper grazing management, these concentration areas are limited in extent and mitigated regularly through management procedures such as moving salt blocks and hauling water to the grazing animals. While grazing can stimulate growth of some plants and provide other benefits, it can also reduce plant abundance, density, and vigor, especially in sandy soils.

Ultimately, the BLM land-management efforts and content of the resource management plans will play a major role in the magnitude, location, and extent of direct, indirect, and cumulative impacts in the Mina rail corridor region of influence, and in the relative balance among multiple uses and resource values chosen for the public lands. DOE recognizes the importance of these land-management actions and encourages readers to review specific resource management plans for more detailed information. As discussed in Chapter 2 of this Nevada Rail Corridor SEIS, the proposed railroad would be subject to BLM decisions and approval, and the BLM would consider effects of the railroad on BLM resource management planning, land-management activities, and BLM-administered natural resources. The proposed railroad's contribution to cumulative impacts to BLM land-management planning and actions in the Mina corridor alignment region of influence would be small.

4.2.2.1.8 Urbanization and Economic Development Initiatives

In response to increased economic development goals, the urbanized areas in the Mina rail corridor region of influence have generally planned for and solicited ways to grow and develop. Concepts such as industrial-park development, airport expansion, increased retail opportunities, and housing are prominent goals of the public and private sectors in the Mina rail corridor region of influence. Several regional economic development initiatives are under way or planned in the northern portion of the Mina rail corridor cumulative impacts region of influence. This trend is likely to continue, with land-use and ownership changes and potential land-use conflicts becoming an increasing issue and challenge for the future. However, it is likely that the rural nature of the overall Mina rail corridor cumulative impacts region of influence will remain largely in tact. With or without the proposed railroad, urbanization and economic development activities, while increasing, would not generally change the overall undeveloped character of the Mina rail corridor region of influence.

With or without the proposed railroad, urbanization and economic development activities, while increasing, would not generally change the overall undeveloped character of the Mina rail corridor region of influence.

4.2.2.2 Air Quality and Climate

Emissions of concern in the Mina rail corridor region of influence include ***fugitive dust*** and emissions resulting from the operation of machinery and equipment. Construction activities such as surface disturbance and use of haul trucks in the Mina rail corridor region of influence would cause the generation of fugitive dust. Fugitive dust is a type of non-point source pollution – small airborne particles that do not originate from a specific point. These ***particulate matter*** emissions are regulated according to their size (less than or equal to 2.5 micrometers [$PM_{2.5}$] and less than or equal to 10 micrometers [PM_{10}]). Control of fugitive dust is generally provided by water suppression, or in some cases, application of a chemical compound designed to minimize dust emissions. Most of the projects and activities identified in this analysis would generate some level of fugitive dust. The plumes associated with the generation of fugitive dust are often localized to the area being disturbed and are temporary. In ***arid*** areas such as the Mina rail corridor cumulative impacts region of influence, generation and control of fugitive dust will always be a concern. Emissions resulting from the operation of machinery and equipment include ***sulfur dioxide***, ***oxides of nitrogen***, ***volatile organic compounds***, and ***carbon monoxide***.

There is a comprehensive air quality permitting system in Nevada to evaluate and approve only those projects that are allowable within quantitative ***air quality*** thresholds. The Nevada Division of Environmental Control, Bureau of Air Pollution Control, has established and implemented air pollution control requirements in Nevada Revised Statutes 445B.100 through 445B.825, inclusive, and Nevada Revised Statutes 486A.010 through 486A.180, inclusive. The Bureau of Air Pollution Control has jurisdiction over air quality programs in all counties in the state except Washoe and Clark. The Bureau of

Air Pollution Control also has jurisdiction over all fossil fuel-fired units in the state that generate steam for electrical production. The DOE Proposed Action in the Mina rail corridor would be subject to the permitting requirements noted above, and would occur in air basins that are classified as ***in attainment*** with air quality standards or are unclassifiable. The State of Nevada will not grant permits for activities that cannot show compliance with the applicable federal and state regulations.

Cumulative impacts to air quality would be small.

4.2.2.3 Hydrology

4.2.2.3.1 Surface-Water Resources

4.2.2.3.1.1 Changes in Drainage, Infiltration Rates, and Flood Control. Construction of major projects in previously undeveloped areas often results in changes to natural drainage. Construction could include regrading that would allow runoff from a number of minor drainage channels to collect in a single *culvert* or pass under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. This could cause some localized changes in drainage patterns, but this probably would occur only in areas where natural drainage channels are small. Compaction of soil during construction could reduce water infiltration rates and change natural runoff and drainage patterns. However, some activities would disturb and loosen the ground for some time, which could cause higher infiltration rates.

Construction in ***washes*** or other flood-prone areas could reduce the area through which floodwaters naturally flow. This could result in water building up, or ponding, on the upstream side of crossings during flood events, and then slowly draining through the culverts or bridges. These alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the impact of floods on human health and safety, or cause significant harm to the natural and beneficial values of ***floodplains***.

Insufficient inflow from the Walker River into Walker Lake would continue to jeopardize the future of Walker Lake as a viable fishery, with or without the proposed railroad. If developed, the proposed railroad would not result in further inflow reductions into Walker Lake. Mitigation measures that could be implemented by the U.S. Fish and Wildlife Service or other entities could improve the chances for a viable fishery in the lake in future years.

As a linear project up to 450 kilometers (280 miles) long, the proposed Mina rail corridor would pose new surface drainage challenges because of the existing characteristics of terrain, topography, soils, and physical features. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the rail roadbed (subgrade) and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and to allow movement of equipment to construction initiation points. However, project planning and best management practices would help avoid or reduce the scope of these changes, and impacts would be very localized.

Project planning and best management practices would help avoid or reduce potential impacts from the proposed railroad or other ongoing or reasonably foreseeable future actions. Potential cumulative impacts due to changes in drainage, infiltration rates, and flood control would be very small and localized.

4.2.2.3.1.2 Spill and Contamination Potential. Major construction activities and other projects in the region of influence would use materials including petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to operate construction equipment, and could include solvents used in cleaning or degreasing actions. A release or spill of contaminants to a stream or river would have the greatest potential for adverse environmental impacts; a release of contaminants to dry impermeable soil would have the least potential for adverse impacts. Other projects would face similar situations. Spill-control and -management plans (and standard operating procedures for the construction industry) would reduce the likelihood of spills. Construction and operation of a railroad in the proposed Mina rail corridor would be typical of major activities that use materials that could cause contamination through spills. While the risk of a spill and associated water contamination cannot be totally eliminated, risks can be managed so that the risk would be small.

While the risk of a spill and associated water contamination cannot be totally eliminated, risks can be managed through regulatory controls so that the resulting cumulative impacts would be small.

4.2.2.3.2 Groundwater Resources

Existing and proposed future development within the Mina corridor region of influence presents the challenge of matching water supply with water demand. Because water availability is a potential resource constraint in the region of influence over time, water demand can be both competitive among potential users and controversial among users and the general public. To allocate water uses, the State of Nevada uses a water permit application process coordinated by the State Engineer. Once granted, water rights in Nevada have the standing of both real and personal property. It is possible to buy or sell water rights and change the water's point of diversion, manner of use, and place of use by filing the appropriate application with the State Engineer. Overall, because the water permitting and allocation process considers the broad range of factors noted above, the process serves as a way to manage potential cumulative impacts of water demand and use within each basin.

Representative existing and reasonably foreseeable water users in the Mina rail corridor region of influence include:

- Public-supply/municipal, agricultural (stock watering), and mining uses collectively comprise approximately 87 percent of groundwater use within the Mina rail corridor region of influence.
- The Nevada Test Site uses approximately 830,000 cubic meters (673 acre-feet) of water per year.
- Yucca Mountain Repository demands would range from about 218,000 to 527,000 cubic meters (176 to 427 acre-feet) of water per year between calendar years 2010 and 2013, which represents the period of the highest water demand for the Mina rail corridor project. The Repository would use approximately 76,700 to 397,000 cubic meters (62 to 322 acre-feet) of water per year in calendar year 2014 through completion of operation.

It is estimated that a railroad in the proposed Mina rail corridor would use up to about 7.32 million cubic meters (5,950 acre-feet) of water during the construction phase, with about 80 percent of that water use occurring in the first 2 years of construction. About 23,000 cubic meters (17 acre-feet) of water would be needed annually during the operations phase. DOE would obtain water for railroad construction and operations from proposed new wells installed in various water basins along the rail corridor. Committed groundwater resources in the Mina rail corridor region of influence already exceed annual perennial yield values (a measure of available groundwater supply replenished each year through recharge) within some of the groundwater basins (hydrographic areas) that would be affected by the proposed railroad. While designated groundwater basins are not considered closed to additional appropriations, the State Engineer could impose additional restrictions and preferred uses of the water in these designated basins.

Overall, the needs of the proposed railroad would represent a small portion of current cumulative water usage within the Mina rail corridor region of influence, which in some locations would continue to exceed perennial yield values.

4.2.2.4 Biological Resources and Soils

4.2.2.4.1 Habitat Loss and Fragmentation

Past, present, and reasonably foreseeable future actions in the Mina rail corridor cumulative impacts region of influence would result in substantial cumulative land disturbance. Existing activities such as the Nevada Test and Training Range, the Nevada Test Site, Naval Air Station Fallon and the Hawthorne Army Depot have already resulted in land disturbance and substantial changes to existing biological resources, and projects such as the various proposed industrial parks and master-planned communities in the northern portion of the Mina rail corridor cumulative impacts region of influence would continue this trend. Such land disturbances result in altered natural biological and ecological conditions, and directly serve to reduce the amount of natural land available as habitat and open space.

The primary adverse construction-related impacts on vegetation communities from ground disturbance would be the physical destruction or removal of vegetation, and the permanent or temporary removal or compaction of topsoil or other growing medium for the plants. These effects would occur with any major activity resulting in ground disturbance, including the proposed railroad. As more activity occurs, the cumulative loss of vegetative communities and associated habitats would increase. Management of these effects would typically be considered in project planning and mitigation, including projects on BLM-administered land. Much of the emphasis in land management in the Mina rail corridor region of influence concerns the maintenance or reconstruction of healthy habitats.

Habitat destruction would lead to direct impacts such as wildlife injury and mortality, alteration of behavior and movement patterns, and the indirect impacts of reduced vegetative health, reduced biological diversity, and locally degraded ecological function. When there is extensive habitat fragmentation, the individuals or populations of particular species might have difficulty surviving. Habitat destruction arises from a number of sources, including projects that involve land disturbance, and land-management actions, including wild horse and burro management. Though any project that causes disturbance of vegetation contributes to habitat fragmentation, linear projects that impose any degree of impediment to movements, like the proposed railroad, amplify the potential effects.

Measures to avoid, minimize or otherwise reduce impacts are typically implemented by project proponents and encouraged by government agencies and generally include actions to reduce or avoid habitat fragmentation and loss. Such actions would include minimizing land disturbance, using existing roads, interim reclamation, combined roads/utility rights-of-way for pipelines and cables, noise reduction, centralization of facilities, and employee training and education.

An Integrated Natural Resources Management Plan was prepared for the Hawthorne Army Depot in 2004 (DIRS 182761-Bishop 2007, all). The plan is being used to ensure that natural resource conservation and Army mission activities are integrated and are consistent with federal stewardship requirements on mission lands. The plan describes an ecosystem management approach that provides guidance to avoid the impacts of habitat loss and fragmentation, conserve biodiversity, and improve and enhance natural resource integrity while supporting sustainable economies and communities.

In areas proposed for railroad operational purposes, the impacts to vegetation would typically be moderate in scope, and cumulatively add to habitat loss and fragmentation. However, in areas slated for short-term use during construction, revegetation and reclamation efforts would result in replacement of topsoil, reseeding of native species, monitoring for success, and eventual return of a native vegetation community somewhat comparable to pre-disturbance conditions.

Cumulative impacts due to habitat loss and fragmentation would be small to moderate through the construction and operations phases throughout the Mina rail corridor region of influence.

4.2.2.4.2 Invasive Species and Noxious Weeds

Invasive species and noxious weeds naturally move into new areas over time, but this occurrence has been accelerated in many areas through human activity, either intentionally or by accident. In many cases these plants have been moved into North America from another continent. They have been accidentally introduced through contaminated grain or hay, or sometimes intentionally introduced for erosion control or as ornamentals. In addition, livestock and vehicles can cause invasive species and noxious weeds to spread, birds could carry seed, or the species can be brought in with contaminated fill dirt. Regardless of how they were introduced, invasive species and noxious weeds possess characteristics that allow them to compete aggressively with native vegetation. Invasive species and noxious weeds impact native plants, animals, and natural ecosystems by:

- Reducing biodiversity
- Altering hydrologic conditions
- Altering soil characteristics
- Altering fire intensity and frequency
- Interfering with natural succession
- Competing for pollinators
- Displacing rare plant species
- Replacing complex communities with single-species monocultures

From a cumulative impacts perspective, any time land is disturbed and native vegetation is lost there is an opportunity for noxious weeds to replace the native vegetation. While the BLM and other land owners/ managers in the area have implemented programs to minimize this potential, invasion of noxious weeds cannot always be prevented. Therefore, coordinated multi-agency management actions and efforts are needed to mitigate the effects from cumulative land disturbance. Management of noxious and invasive weeds is essential for restoration of native plant community health and resiliency. If noxious and invasive weeds were not managed, they would continue to gradually replace more desirable native species throughout the Mina rail corridor region of influence.

Linear disturbances such as pipelines, roads, utility corridors, or rail lines that cross relatively undisturbed land have the potential to exacerbate the spread of invasive species and noxious weeds into areas not previously affected. As the invasive or noxious weeds become established along the linear features they spread to adjacent areas, affecting the plant and animal communities beyond the actual disturbance, and are able to out-compete native species by responding more rapidly to the infrequent availability of water.

These impacts could occur as a result of constructing and operating the proposed railroad in Mina rail corridor, but strict adherence to best management practices should reduce the potential for impacts. Cumulative impacts due to the introduction and spread of invasive species and noxious weeds would be small.

4.2.2.4.3 Special-Status Species

Habitat for several special status species would be disturbed and individuals of several species could be lost as a result of constructing and operating the proposed railroad in the Mina rail corridor. Through the NEPA and permitting processes, each proposed project and land-management planning effort in the Mina rail corridor region of influence will face challenges for the protection of various special status species. There are a number of special status species that could be affected by cumulative impacts in the Mina rail corridor region of influence. Recent attention has focused on several specific species, including the desert tortoise (*Gopherus agassizii*) and Lahontan cutthroat trout, as discussed below.

The Mojave population of the desert tortoise is listed as threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531 to 1544). It is found within the proposed Mina rail corridor region of influence in the southwestern-most 48 kilometers (30 miles), from the Beatty Wash area to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 55 to 72). The desert tortoise is found in southern California, parts of southern Utah, and in the southern portions of Nevada, with the tortoises potentially affected by the proposed Mina rail corridor at the extreme northern extent of their range. While relative abundance of the tortoise is low in much of the Mina rail corridor region of influence, every action that could disturb soil or vegetation within the tortoise's range has potential cumulative impacts of loss or fragmentation of the species' habitat or the direct mortality of individual desert tortoises, which in turn would affect the health and extent of the collective population of the species. In the area near the Yucca Mountain Site, construction activities would have similar impacts on the desert tortoise.

The threatened Lahontan cutthroat trout is stocked in Walker Lake and occurs upstream to Weber Reservoir. Weber Dam currently blocks movement further upstream, and prevents spawning by cutthroat trout; however, in the near future a fish ladder might be developed at that dam to allow fish movement. Reestablishment of a self-sustaining population of Lahontan cutthroat trout in the Walker River system is a prerequisite for recovery of this species. With mitigation, the Mina rail corridor activities would have minimal effects on the trout, but the existing problem with Weber Dam blocking movement of the trout further upstream would remain.

BLM resource management plans sometimes place restrictions on other activities (for example, grazing, wild horse and burro abundance, off-road vehicle use, mineral activities) so that desert tortoise or other special status species habitat can be protected. However, off-road vehicle use, shooting, and collecting of individuals continue to impact tortoise populations. Habitat protection efforts for the desert tortoise are coordinated among a number of federal, state, and local governmental agencies, with the cumulative impact perspective a major factor in determining allowable impacts to the tortoise. Restoration plans and habitat conservation plans also affect the required mitigation measures, best management practices, and standard operating procedures for the protection of the desert tortoise or other special status species.

Private landowners, corporations, state or local governments, or other non-federal landowners who wish to conduct activities on their land that might incidentally harm (or "take") wildlife listed as endangered or threatened must first obtain an incidental take permit from the U.S. Fish and Wildlife Service. To obtain a permit, the applicant must develop a Habitat Conservation Plan, designed to offset any harmful effects the proposed activity might have on the species. There is a single species (desert tortoise) Habitat Conservation Plan being developed in the Pahrump area of Nye County. Habitat Conservation Plans would support development of private lands while accounting for the potentially affected species.

No major effects on special status species are projected to result from construction and operation of the proposed railroad in the Mina rail corridor. DOE would conduct any required consultation with the U.S. Fish and Wildlife Service in accordance with the Endangered Species Act. There is a substantial regulatory framework, to which all projects are subject, that serves to evaluate and protect special status species. Therefore, cumulative impacts to special status species would be small.

4.2.2.4.4 Known or Potentially Contaminated Soils

The major sources of existing soil contamination problems in the Mina rail corridor region of influence are mining, the Nevada Test Site, and the Hawthorne Army Depot. There have been mining activities in the region for many years, and mining wastes from older operations (before the regulatory framework required waste management and clean-up) still remain.

The problems associated with the Nevada Test Site have been described in recent NEPA documentation (DIRS 101811-DOE 1996, all; DIRS 162638-DOE 2002, all). Historic contamination of soils resources on the Nevada Test Site is primarily from radioactive-waste management sites and past nuclear testing activities. Environmental restoration and remediation is occurring at contaminated Nevada Test Site locations in accordance with the facility's Environmental Restoration Program, but much of the contamination is long-term and the land and soil are not restorable to useful condition. For most of the contaminated soils within the Nevada Test Site boundary, DOE is planning only a characterization and long-term monitoring program. Contaminated areas on the Nevada Test Site are generally defined and access is restricted for reasons of safety and security.

The Hawthorne Army Depot has an Installation Restoration Program that outlines proposed future investigations and remedial actions at each Solid Waste Management Unit and other areas of concern at the installation. There are soil and groundwater contamination issues, with the primary contaminants of concern being compounds associated with explosives and heavy metals. Environmental restoration and remediation is ongoing at a number of sites. Other sites have achieved the status of no further remedial action planned. Contaminated areas on the Hawthorne Army Depot are generally defined and access is restricted for reasons of safety and security.

Contaminated soils or spills can impact other resources such as water resources, biological resources, and land use. Spills of hazardous materials are possible with regional activities, but the current regulatory framework to manage and control hazardous materials and wastes ensures that actions are in place to minimize impacts. While potential impacts associated with hazardous materials and wastes from current and future mining operations in the region are controlled through the existing regulatory framework, mining wastes from old mining extraction and processing activities, especially in the Goldfield area, remain a concern related to soil contamination.

The proposed railroad could result in very localized contamination of soils through occasional spills (such as fuel, oil, and solvents). However, such incidents would be minor in scope and quickly mitigated in accordance with plans and regulations. All existing and foreseeable projects would be subject to the same regulations. Cumulative impacts related to contamination of soils would likely be small.

4.2.2.5 Cultural Resources

Cultural resources include historic and archaeological sites, buildings, structures, landscapes, and objects. Most reasonably foreseeable projects in the Mina rail corridor region of influence will involve at least some ground disturbance. With that ground disturbance, cultural resources could be destroyed, damaged, or discovered for recovery or mitigation. As part of the evaluation of proposed projects on federal land, the existing regulatory framework requires that cultural resources be identified and protected. With information on the location of a proposed project and the estimated extent of ground disturbance, cultural resource specialists can be called on to perform appropriate surveys and inventories of cultural resources in the potentially disturbed area.

Because cultural resources are typically on or below the ground, they can be damaged by other activities, such as off-highway vehicle use. As the major land manager in the Mina rail corridor region of influence, the BLM has an extensive cultural resource management program and manages federal land with protection of cultural resources as a key management objective. Once ground is disturbed and facilities are constructed on the land, the opportunity for identification of cultural resources is usually lost. Therefore, the BLM and other land managers in the area (for example, DOE on the Nevada Test Site and the Air Force on the Nevada Test and Training Range) employ cultural resource specialists and involve tribal representatives, as appropriate. Mission activities on the Nevada Test Site, on the Nevada Test and Training Range, and at the Yucca Mountain Repository also could cause unintended adverse impacts to cultural resources. DOE, the BLM, and other federal agencies in the Mina rail corridor region of influence are committed to public education and employee training regarding the protection of cultural resources.

Based on the extent of cultural resource site finds within BLM-administered land and on the Nevada Test Site, and data collected to date on the proposed Mina corridor, other cultural resources in the Mina rail corridor region of influence are likely to be discovered as projects proceed. Also, it is likely that only a portion of currently undiscovered sites would ultimately be found eligible for the *National Register of Historic Places*.

Impacts to cultural resources in the Mina rail corridor region of influence would be small because the Department would conduct intensive field surveys and implement mitigation measures, including avoidance. Other project proponents would be subject to the same regulatory framework and BLM policies and procedures. Cumulative impacts to cultural resources in the Mina rail corridor region of influence would be small.

4.2.2.6 Occupational and Public Health and Safety

4.2.2.6.1 Nonradiological Health and Safety

Throughout the Mina rail corridor region of influence, continuing and reasonably foreseeable activities have the potential to result in occupational injuries or fatalities including, but not necessarily limited to sources such as tripping, being cut on equipment or material, dropping heavy objects, catching clothing in moving machine parts, and other types of accidents. Other occupational risks include biological hazards, dust and soils hazards, air quality hazards, transportation accidents, and noise hazards. Biological hazards include potential human health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human health effects from exposure to inhalable soils and dusts containing hazardous constituents, and potential occupational encounters with unexploded ordnance.

While occupational injuries or fatalities are unavoidable with human activity, public and private facilities within the Mina rail corridor cumulative activity area are highly regulated. There is a substantial regulatory framework for occupational health and safety, with the Occupational Safety and Health Administration programs and regulations forming the basis for protection of workers. Through DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, the Department has prescribed the Occupational Safety and Health Act Standards that contractors are to meet in their work at government-owned, contractor-operated facilities. The Department of Labor, Bureau of Labor Statistics, measures occupational incident rates, including total recordable cases, lost workday cases, and fatalities, associated with the work environment.

There are no data on injury/illness incident rates for the Mina rail corridor cumulative impacts region of influence. Injury/illness incidence rates in Nevada generally run higher than those in the United States as a whole. The economic segments with the highest injury/illness incidence rates in Nevada are construction and goods-producing industries.

Additional traffic is especially a concern with the construction phases of reasonably foreseeable projects. The construction phase of a project not only brings construction workers to the work sites, but also means an increase in slow-moving and bulky traffic involving the transportation of construction equipment. Use of trucks for hauling hazardous or other dangerous materials is also an increasing concern as traffic increases on the road network. To minimize traffic impacts at the entrance to the Yucca Mountain Site, a new interchange at the Site entrance with U.S. Highway 95 has been proposed for both traffic flow and safety reasons. Increased traffic would not necessarily mean an increase in the rate of traffic accidents, but the number of accidents would increase if the rate of traffic accidents stayed the same and traffic increased. Therefore, transportation safety concerns would increase and there could be an increased workload for traffic-accident responders in the Mina rail corridor region of influence with the cumulative growth in traffic.

From a transportation safety standpoint, rail cars loaded with live munitions currently travel between Wabuska, Nevada, and the Hawthorne Army Depot. Under the Proposed Action, health and safety risks associated with accidents involving these rail cars would be reduced as the trains would be routed away from the populated community of Schurz on the Walker River Paiute Reservation.

Nonradiological transportation impacts specifically associated with the proposed railroad would include vehicular fatalities and nonradiological rail accidents and fatalities associated with railroad operations. Vehicular fatalities would be the result of commute trips from workers responsible for railroad operations. The number of incidents would be proportional to the number of trains and casks moved by rail.

Other regional activities would also cumulatively add to the totals beyond the railroad-related impacts, but cumulative nonradiological health and safety in the Mina rail corridor region of influence would be small within the context of the overall region of influence.

4.2.2.6.2 Radiological Health and Safety

Existing and reasonably foreseeable future activity (such as the Nevada Test Site and Yucca Mountain Repository activity managed by DOE) in the Mina rail corridor region of influence involves the storage, handling, transportation, use, and disposal of radioactive materials and wastes. Staff at the Nevada Test Site and the Yucca Mountain Repository would be separate, and it is not anticipated that there would be any cumulative exposures to workers from both operations. The modes of transportation of radioactive wastes for the Nevada Test Site (shipment by truck) and the Yucca Mountain Repository (shipment by rail) would differ. Radiological impacts associated with railroad operations would be higher under Yucca Mountain Inventory Module 1 or 2 operations compared to the level of transportation under this Nevada Rail Corridor SEIS Proposed Action.

There is an extensive regulatory framework associated with transportation safety, and the proposed railroad would operate in compliance with these laws and regulations. The regulatory framework and implementation of appropriate standard operating procedures would reduce the potential for accidents. Coordination of plans for proposed railroad construction and operation with local emergency response providers would be important to limit the potential for accidents, and for an effective response to an accident should one occur.

Operation of the proposed railroad in the Mina rail corridor under the Proposed Action would result in a small contribution to cumulative radiological health and safety impacts. Cumulative radiological impacts in the Mina rail corridor region of influence would be small.

4.2.2.7 Socioeconomics

The economic roots of the Mina rail corridor cumulative impacts region of influence have traditionally been based on mineral development, military operations and support, and livestock grazing. These activities will continue to be the primary economic drivers in the Mina rail corridor cumulative impacts region of influence. Additionally, the expansion of the Reno and Carson City metropolitan areas in the northern reaches of the Mina rail corridor cumulative impacts region of influence will continue to occur, providing additional economic inputs. While the proposed railroad would be a major development in the Mina rail corridor region of influence, its long-term economic development potential would be limited and would primarily be related to construction activities.

Population growth in the Mina rail corridor cumulative impacts region of influence has generally been stagnant in much of the area. However, many in the region desire growth and development. It is uncertain if there is sufficient economic development growth potential in these areas to support the desired growth. It is possible that some areas would grow at the expense of other areas, or that recently developed plans for growth turn out to be unrealistic. Provision of housing to meet market demand is a private-sector activity, with the private-housing sector assumed to build to the needed level to meet housing demand at the appropriate locations. One of the factors that will affect how and where growth occurs is the availability of infrastructure to support the growth. Beyond the traditional infrastructure needs like roads, sewer, water, and public buildings, modern infrastructure such as the availability of fiber-optic lines might also affect growth patterns. For example, the availability of fiber-optic lines or other high-technology infrastructure is likely to be a substantial growth discriminator for both businesses and individuals. The locations of and extent to which factors such as fiber-optic lines would ultimately affect growth cannot be projected at this time.

The potential future land disposals identified in Section 4.2.2.1.4, if implemented by the BLM, could have the potential to provide land for private-sector projects such as housing, industrial or commercial facilities, or other developments.

The State of Nevada has developed population projections for the Mina rail corridor cumulative impacts region of influence (DIRS 178807-Hardcastle 2006, all) as follows:

- Esmeralda County is projected to experience a small decrease in population from 2005 to 2026.
- Nye County is projected to add more than 32,000 people from 2005 to 2026.
- Lyon County is projected to add more than 41,000 people from 2005 to 2026.
- Mineral County is projected to experience a small decrease in population from 2005 to 2026.

Population projections are always subject to change with new information, and the Nevada State Demographer incorporates foreseeable economic development into the population projections.

Nye County's projected growth continues a recent trend, with growth in Pahrump very evident over the past several years. Growth in Pahrump is being driven by low-cost land, proximity to the Las Vegas metropolitan area, and relocation of retirees to the area. Growth in Nye County is also directly linked to existing and future Yucca Mountain Site operations. Growth in Lyon County is due largely to its proximity to Carson City and Reno.

As discussed in Section 3.2.7, Socioeconomics, DOE used an economic model to estimate the potential socioeconomic impacts of the proposed railroad (DIRS 182251-REMI 2007, all). The model includes consideration of construction and operations employment and wages, project-related spending, and other parameters that could affect the socioeconomic environment. The model included a future baseline of socioeconomic parameters that would represent a cumulative impacts baseline without a railroad in the proposed Mina rail corridor.

Consistent with the methodology established in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 4-43), most of the construction workers for the proposed Mina rail corridor are assumed to be residents of Clark County. This assumption is made because the construction sectors in Nye, Esmeralda, Lyon and Mineral Counties are not large enough to provide enough workers for construction activities. Under this scenario, Clark County is projected to attain the largest levels of construction-related employment, income, and spending effects from the proposed project, followed by Mineral, Nye, Esmeralda, and Lyon Counties. Mineral County would experience the largest employment percentage increase during the construction phase, with an estimated increase of about 6 percent above baseline conditions. The socioeconomic analysis also considers a second scenario, which assumes that half of the construction workers for the Mina rail corridor reside in the combined Washoe County-Carson City area, and the other half reside in Clark County. This second scenario is considered because Washoe County and Carson City may be more likely than Clark County to supply construction workers for the northern portions of the Mina rail corridor. Under this second scenario, the beneficial economic effects on Clark County would be reduced, while the Washoe County-Carson City area would gain some of these beneficial aspects of the proposed railroad. In any case, the overall effects of the proposed Mina rail corridor project on the Clark County or Washoe County economies would still be relatively small.

Employee locations for the operations phase would follow the same general pattern and relative magnitude of the construction phase, but there would be fewer operations jobs than construction jobs. Gains in employment during the operations phase would be felt most strongly in Esmeralda County, where the peak percentage change in average annual employment is projected to be 6.3 percent above baseline conditions during full operations. Mineral County is the only other county in the region of influence projected to experience more than a 1-percent change in average annual employment at any point during the operations phase (2.6 percent).

Population changes that would result from construction and operation of the proposed railroad in the Mina rail corridor are also projected to generally follow this pattern. During the construction phase, the upper bound of increase to population would be about 3 percent or less of the future cumulative population baseline in all four counties. The operations-phase population change would have the largest percentage increase compared to the cumulative baseline in Esmeralda County (about 7 percent average annual increase over the baseline). There are no projected impacts to population on the Walker River Paiute Reservation.

Strains on housing infrastructure during the construction phase would not be anticipated because most construction workers could be housed in construction camps at strategic locations along the Mina rail corridor, rather than in nearby communities. Contractors might elect to use commercially available facilities to house construction personnel at locations such as Hawthorne, Tonopah, Goldfield, Beatty, and Pahrump.

Some infrastructure impacts would be expected where construction activities or operating facilities were near communities. For example, construction workers, including those from the proposed railroad, could strain the existing health care service capacity in the Mina rail corridor region of influence, particularly in Hawthorne, Goldfield, and Tonopah. Operations-related population gains could also result in identifiable effects on health and education-related services.

The road network in the Mina rail corridor region of influence consists generally of two-lane highways and unpaved roads. U.S. Highway 95 is the major north-south highway in the region of influence. In rural, less populated parts of the Mina rail corridor cumulative impacts region of influence, roads are adequate to handle existing and projected future traffic flow. However, the array of new and proposed activities throughout the Mina rail corridor region of influence would have the potential to strain parts of the existing roadway infrastructure. There could be some traffic delays at existing rail-highway grade crossings, and grade separation might be necessary at some crossings in Churchill, Lyon, and Mineral Counties. However, cumulative traffic levels in the region would likely continue to increase as overall regional growth and development occurs.

Any road improvement and maintenance responsibilities in the region of influence are handled by the Nevada Department of Transportation through a Statewide Transportation Plan and a Statewide Transportation Improvement Program. The Statewide Transportation Improvement Program includes a 3-year list of federally funded and regionally important non-federally funded transportation projects and programs consistent with the goals and strategies of the Statewide Transportation Plan. Routine highway improvements and maintenance projects for the period 2006 through 2015 have been identified for Nye, Esmeralda, Lyon, and Mineral Counties as part of the Nevada Department of Transportation planning processes. The level of cumulative traffic changes would generally not be sufficient for major upgrades of regional roads.

Overall, the proposed railroad project would have a small impact on economic development and growth, housing and community infrastructure, and traffic in the Mina rail corridor region of influence. While there is some limited potential for induced growth impacts, the specific locations and scope of these actions is unknown at this time, and any such actions are projected to be small. Cumulative impacts to socioeconomics in the Mina rail corridor region of influence would be small.

4.2.2.8 Noise and Vibration

4.2.2.8.1 Railroad Noise

In the Mina rail corridor cumulative impact region of influence, there is an existing branchline extending from Hazen, Nevada, to the Hawthorne Army Depot. The noise associated with railroad operations is part of the existing environment, specifically in the Schurz area where the railroad's presence is very evident. The sounds associated with the existing branchline include wayside noise (noise generated by the cars and locomotives), and horn sounding. The individual operating rules of each railroad require train engineers to sound horns when approaching most grade crossings. Horn sounding is generally not required at private crossings. Wayside noise and horn sounding are common in Schurz and along other portions of the existing branchline.

Hawthorne Army Depot is planning to construct a rail siding, known as the Wabuska Spur, which would increase the Depot's rail capacity. Increased rail capacity could cause increases in overall rail traffic on the existing branchline and could result in more wayside noise and horn sounding near Hawthorne.

Transportation of spent nuclear fuel and high-level radioactive waste casks would result in as many as eight one-way trips per week along the Mina rail corridor. Train activity associated with supply and maintenance of the Yucca Mountain Repository is also proposed along the completed rail line (as many as seven one-way trips per week), as is Mina rail corridor maintenance activity (about two one-way trips per week), for a total of about 17 one-way trips per week. During the construction phase, completed portions of the rail line could also be used to deliver ballast to construction areas.

Potential noise impacts from the proposed railroad in the Mina rail corridor would be expected to be small. However, the railroad would introduce or expand noise sources into areas of the Mina rail corridor region of influence that previously had very limited railroad noise. This could result in incremental annoyance effects for some persons.

While adverse noise effects could increase for some in the Mina rail corridor region of influence, selection of the Mina rail corridor would substantially reduce noise impacts in Schurz, because the existing rail line through Schurz would be eliminated and replaced by one of Schurz alternative corridor segments. This would provide a substantial reduction in annoyance effects for people in Schurz.

4.2.2.8.2 Urban Noise

Urban noise includes automobiles, construction activities, barking dogs, and other human activities generally within an identifiable community. At present, urban noise in the Mina rail corridor region of influence is limited because there are only a few cities and communities. However, with economic development and growth goals throughout the Mina rail corridor region of influence, the number and scope of urbanized areas is expected to increase. Urban noise is generally localized and is differentiated from aircraft and railroad noise sources, which move with the source from one location to another, while urban noise is within identifiable geographic borders associated with the locations of populations.

The proposed railroad would have a very small effect on urbanization in the area, and its effect on urban noise in the Mina rail corridor region of influence would be small. Cumulative impacts related to urban noise would be small.

4.2.2.8.3 Aircraft Noise

Aircraft-related noise from engines and sonic booms is common throughout the Mina rail corridor cumulative impacts region of influence, and can cause “startle” and annoyance effects. The noise associated with military aircraft is consistent with the “dominant use” of the area for military and defense-related activities on the Nevada Test and Training Range and at Naval Air Station Fallon. Noise effects associated with Nevada Test and Training Range or Naval Air Station Fallon missions would be considered necessary and unavoidable. Commercial air traffic also contributes to noise impacts in the region of influence.

The proposed railroad would not contribute to cumulative aircraft noise.

4.2.2.8.4 Vibration

Vibration can be perceived on land surfaces and within buildings with certain types of activities. Construction activity is one of the more common sources of vibration, but railroad construction vibration would be very localized and typically minor in scope and duration. In the Mina rail corridor cumulative impacts region of influence, other possible sources of vibration include occasional testing activities at the Nevada Test and Training Range and sonic booms from aircraft-related military activities in the airspace above the region of influence. These events would also tend to be short-term and localized.

Cumulative impacts from vibration would be small.

4.2.2.9 Aesthetic Resources

Cumulative impacts to aesthetic resources from the proposed railroad in the Mina rail corridor and other regional activities would primarily result from modifications to natural ***viewsheds***. The natural setting of the Mina rail corridor region of influence includes vast and expansive viewsheds typical of much of the western United States. The open spaces and wide vistas offer interesting cloud, weather, and landscape interactions. Human activity disturbs the natural viewsheds with views of land disturbances such as buildings, roads, removal of vegetation, power lines, equipment, and vehicles. Activity that disturbs substantial areas of land can result in impacts to visual resources from fugitive dust and ground scars that create a contrast with the surrounding environment and draw the viewer’s attention. Additionally, most man-made structures are designed and built for their functionality and safety, not for their visual appeal or compatibility with the visual character of the landscape. For example, projects with construction-related equipment, facilities, and activities can include the presence of workers, camps, vehicles, and machinery, laydown yards, and dust. The likely addition of explosive bunkers at the Hawthorne Army Depot and projected wind-energy development are examples of other long-term changes in the visual setting that are reasonably foreseeable. Each type of project has its unique visual features but generally, new projects would not be consolidated into any specific location within the region of influence.

While the area has a history of railroad use, the presence of a railroad and associated train traffic in the Mina rail corridor would be an identifiable change to the regional viewsheds from some observation points and provide a noticeable contrast with natural visual attributes. The passage of a train would attract the attention of an observer, both because of the noise associated with the train and the contrast with the landscape, especially if the train were to fall in the foreground or middle ground ***distance zones*** of the viewshed. Visual impacts of passing trains would be temporary, but visual impacts of the track would be long term.

Visual resources within the Mina rail corridor region of influence have been considered through application of the BLM Visual Resource Management System. The BLM uses this system to identify and classify the BLM-administered lands within established visual resource objectives, and evaluates proposed activities within the Visual Resource Management System framework to consider consistency with the visual resource objectives. Ground disturbances in the regional environment will last for long periods without restoration and reclamation efforts. The magnitude and extent of potential impacts to visual resources vary based on the number of viewers affected, distance and atmospheric conditions of viewing, degree of visual contrast compared to existing visual attributes, viewer sensitivity to the visual changes, and compatibility with existing land uses. The BLM generally requires ground disturbances to be restored and reclaimed as part of project approval.

There would be no known interactions of the proposed railroad with other reasonably foreseeable activities that would affect a Class I or Class II area in the Mina rail corridor region of influence.

4.2.2.10 Utilities, Energy, and Materials

4.2.2.10.1 Utilities

From a cumulative impacts perspective within the Mina rail corridor region of influence, utility crossings are and will continue to be commonplace with little impact other than minor ground disturbance. Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. The rail line would cross or encroach upon existing or proposed utility rights-of-way in a variety of locations. This situation would be typical for other rights-of-way in the region. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Many regional activities, including the proposed railroad, would increase demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and other utilities. However, regional service providers are projected to be able to adjust to increasing demand, and overall cumulative impacts to utilities would be small.

4.2.2.10.2 Energy and Materials Usage

Large projects such as pipelines, transmission lines, and power plants that could occur in the Mina rail corridor cumulative impacts region of influence require materials and energy to construct and operate. Energy and materials resources necessary for construction or operation of these projects are often obtained within regional or, in some cases, national markets.

Energy and materials (for example, steel and concrete) that would be needed for construction and operation of the proposed railroad in the Mina rail corridor are not constrained in regional markets, and proposed railroad needs would represent a small percentage of the cumulative annual materials use within the Mina rail corridor cumulative impacts region of influence. While the regional markets for various construction-related materials and energy sources will continue to grow as the region develops, there is no evidence of potential limits to growth from constrained material or energy supplies. Cumulative impacts from energy and materials usage in the Mina rail corridor region of influence would be small.

4.2.2.11 Waste Management

4.2.2.11.1 DOE Waste-Management Activities

DOE has had waste-management programs at the Nevada Test Site for several decades. While the Nevada Test Site missions have changed over time (with an emerging focus on national security, energy, and environmental issues), waste management and disposal at the Nevada Test Site has been one of the primary long-term land uses. There are two active waste management and disposal sites on the Nevada Test Site:

- Area 5 occupies 2.9 square kilometers (720 acres) and is in Frenchman Flat north of Mercury, Nevada.
- Area 3 occupies 0.52 square kilometer (130 acres) north of Mercury in Yucca Flat.

Environmental restoration efforts are underway at various locations throughout the Nevada Test Site. The Nevada Test Site waste-management program currently includes management and disposal operations for hazardous waste, mixed waste, and low-level radioactive waste. Transportation of the waste is accomplished by truck from both on-site and off-site sources. There are no plans for Nevada Test Site activities to include use of the proposed railroad for shipment of wastes.

The proposed railroad would not contribute to cumulative impacts associated with DOE waste-management activities on the Nevada Test Site.

At present, Yucca Mountain Repository-development efforts are focused on preparing an application to the U.S. Nuclear Regulatory Commission for authorization to construct the repository for spent nuclear fuel and high-level radioactive waste. The Yucca Mountain FEIS (DIRS 155970-DOE 2002, all) and the Repository SEIS (DOE/EIS-0250F-S1) describe operations at the Yucca Mountain Site in detail.

4.2.2.11.2 Sanitary and Construction Wastes

As the populated areas in the Mina rail corridor cumulative impacts region of influence expand and grow, the volume of ***sanitary waste*** generated will also expand. Project proponents are legally required to dispose of nonhazardous and nonradiological construction and other solid waste in appropriately permitted solid waste landfills. Nevada has 24 operating municipal landfills with a combined capacity to accept more than 11,000 metric tons (12,000 tons) of waste per day. However, the number of operating landfills has decreased substantially over the past 15 years, and while there is sufficient capacity to accept waste for the State of Nevada as a whole, there are some areas, such as Pahrump, that have limited capacity for future years.

Railroad construction- and operations-related waste would add only a fraction of a percent to the total waste stream in the state. If there were a constraint to landfill capacity at some future time, additional land would be needed to expand or open a new landfill. Because of the relative scarcity of private land in the Mina rail corridor region of influence, land used for this purpose might need to come from BLM-administered federal land. As an alternative to local government landfill provision, private companies can also be expected to seek business opportunities to provide solid- and hazardous-waste management, transportation, and disposal.

DOE would store and use hazardous materials (such as oil, gasoline and solvents) during the railroad construction phase, and would control and manage these materials in accordance with the extensive federal and state regulatory framework. Other major projects would have similar waste streams, and project plans and requirements would call for disposal of such wastes in permitted facilities and materials management according to accepted industry practices.

The proposed railroad's contribution to impacts from the generation and management of sanitary and construction wastes would be small. Cumulative impacts to waste disposal facilities in the Mina rail corridor region of influence would be small.

4.2.2.12 Environmental Justice

4.2.2.12.1 Potential Effects to Low-Income and/or Minority Populations

Environmental justice impacts result when high and adverse human health or environmental impacts fall disproportionately on low-income and minority populations. If high and adverse impacts are found to have disproportionate impacts on environmental justice populations as compared to the general population of the area, the impacts would be mitigated to the extent practical by the federal agencies involved in the proposed action.

Based on individual and group values, beliefs, and goals, there is a difference in perspective as to the potential effects of activities in the Mina rail corridor region of influence on low-income and/or minority populations among the different stakeholders and other interested parties. *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (DIRS 174205-Kane et al. 2005), prepared by the American Indian Writers Subgroup of the Consolidated Group of Tribes and Organizations, discusses cultural resources, American Indian values and their relationship to environmental justice, and broader American Indian values. DOE considers the American Indian Writers Subgroup conclusions to be responsible opposing viewpoints for purposes of its environmental justice responsibilities. DOE has concluded that there are no identifiable environmental or human health impacts associated with the proposed railroad in the Mina rail corridor that would disproportionately affect low-income or minority populations. Additionally, there are no identified effects to subsistence hunting and gathering traditions in the Mina rail corridor region of influence. Therefore, the DOE incremental contribution to cumulative environmental justice impacts to low-income and/or minority populations under the Proposed Action in the Mina rail corridor region of influence would be small.

The largest concentration of low-income or minority populations along the Mina rail corridor occurs in Mineral County and on the Walker River Paiute Reservation. The corridor would cross American Indian tribal lands, with the three Schurz bypass options almost entirely on the Walker River Paiute Reservation (DIRS 180222-BSC 2006, pp. 15 and 16). There are approximately 1.4 square kilometers (350 acres) of Reservation lands in the corridor (DIRS 180222-BSC 2006, p. 15). The population of the Reservation, estimated to be 853 persons in 2000, is low-income and consists mainly of American Indians, a minority population. The poverty rate in Mineral County is 15 percent, which exceeds the rate of poverty (11 percent) in the State of Nevada, while the poverty rate of Walker River Paiute Reservation residents is 32 percent, nearly three times the rate of poverty in the state. The only moderate or large impacts that were identified relate to noise impacts from construction. These impacts would not occur on the Walker River Paiute Reservation; therefore, there would be no large and adverse effects that would disproportionately affect a low income or minority community and there are no special pathways that would result in disproportionately large and adverse effects to low-income or minority communities.

Cumulative impacts to low-income or minority populations along the Mina rail corridor would be small, if any.

4.2.2.12.2 Economic Opportunity

Existing and reasonably foreseeable projects and activities in the Mina rail corridor region of influence would present economic opportunities for some people in the area. Economic opportunities include employment, wages, revenue from business operation, and other economic stimuli associated with growth and development. DOE and other project proponents in the Mina rail corridor region of influence have a legally mandated equal opportunity approach to these economic opportunities. Potential for economic gain would be distributed equally to persons or businesses in the area that seek employment or business opportunity. While not all people would gain economically from the cumulative group of projects and activities, the opportunity for gain does not favor one population group or another based on minority or income status.

Because there would be small changes in long-term population attributable to activities in the Mina rail corridor, impacts or stresses to the housing stock, infrastructure systems, or social services would be unlikely. Socioeconomic impacts from railroad construction and operation in the Mina rail corridor would be small overall and would be unlikely to adversely or disproportionately affect the low-income or minority populations in the corridor.

4.3 Unavoidable Adverse Impacts/Irretrievable Commitments of Resources

This section addresses unavoidable adverse impacts that could remain after the application of ***mitigation*** measures, the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity, and potentially irreversible or irretrievable commitments of resources for the Mina rail corridor.

4.3.1 UNAVOIDABLE ADVERSE IMPACTS

This section summarizes potential impacts associated with construction and operation of a railroad in the Mina rail corridor that could be unavoidable and adverse and that could remain after DOE implemented mitigation measures.

4.3.1.1 Land Use and Ownership

Railroad construction and operation in the Mina rail corridor could result in altered access to some private land holdings, land associated with the Walker River Paiute Reservation, the Hawthorne Army Depot, ***unpatented mining claims***, rights-of-way, and grazing allotments (through loss of forage and grazing footprint).

4.3.1.2 Air Quality

Railroad construction in the Mina rail corridor would result in temporary increases in ***criteria air pollutants***, mainly fugitive dust. Railroad operations would result in small increases in criteria air pollutants.

4.3.1.3 Hydrology

Railroad construction in the Mina rail corridor could alter natural surface-water drainage patterns. Impacts associated with the alteration of drainage patterns or changes to erosion and sedimentation rates or locations would be small and localized. In addition, construction could require the withdrawal and use of groundwater. In many areas the rail line could cross, other uses or commitments of groundwater resources would approach or exceed the perennial yields of the underlying groundwater basins. This would potentially be a small and adverse, although not permanent, impact.

4.3.1.4 Biological Resources and Soils

Railroad construction in the Mina rail corridor could cause habitat loss and the loss of small numbers of individual plants and animals. Disturbed soils could result in increased erosion during the construction phase, even with the implementation of best management practices.

4.3.1.5 Cultural Resources

Although DOE would implement best management practices and mitigation measures related to cultural resources, grading and other construction activities could degrade, cause the removal of, or alter the setting of archaeological sites or other cultural resources and cause the loss of archaeological information in the Mina rail corridor.

4.3.1.6 Socioeconomics

Population growth associated with railroad construction and operations in the Mina rail corridor could result in additional infrastructure and public services needs. This probably would occur in the communities with the largest labor pools and where the workers resided permanently – the Reno and Las Vegas areas.

4.3.1.7 Noise and Vibration

During the construction phase, noise levels at locations such as Goldfield would be noticeable, and could approach or potentially exceed Federal Transit Administration or Federal Housing Authority construction noise guidelines during events such as rock blasting. This unavoidable impact would be temporary. Railroad operations along the Mina rail corridor could lead to an unavoidable, but small increase in ambient noise from passing trains in residential areas near Silver Peak, Mina, and Goldfield. No unavoidable adverse impacts associated with vibration are expected for either the construction or operations phases.

4.3.2 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Railroad construction could lead to a long-term loss of productivity in disturbed areas along the Mina rail corridor. In the context of transportation, long-term refers to the period of environmental recovery after the end of the construction phase or the active use of a transportation route for purposes supporting the Yucca Mountain Repository.

The land-cover types along the Mina rail corridor are widely distributed in the region. A loss of vegetation and grazing forage from a disturbed area in the corridor would have little effect on the regional productivity of plants and animals.

Productivity loss for soils would be limited to areas affected by land clearing and construction. These areas would not be available for revegetation and habitat for some time. Disturbed areas would recover, however, and eventually would return to pre-disturbance conditions, although the process of recovery would be slow in the arid environment.

4.3.3 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENT OF RESOURCES

Railroad construction would result in some irretrievable or irreversible commitments of resources. Many resources could be retrievable at a later date through such actions as removing roadbeds, revegetating land, and recycling materials. Land uses could change in the rail corridor until railroad operations were complete, thereby limiting or eliminating other land uses for that period. However, at the end of the operations phase land along the corridor could revert to public or private ownership.

The loss of cultural resources would result in an irretrievable commitment of resources. Mitigation approaches involving the recovery of archaeological resources before construction activities degraded the sites would reduce the finite number of such resources in the Yucca Mountain region. However, the context of the sites would be destroyed.

DOE would use about 125 million liters (33 million gallons) of diesel fuel and 2.5 million liters (0.66 million gallons) of gasoline in Nevada during the construction phase (DIRS 180877-Nevada Rail Partners 2007, p. 2-7). This would be about 0.6 percent of the annual motor fuel consumption in the state. Construction use of diesel fuel would be about 2.2 percent of annual consumption. Operational use of motor fuel by locomotives would be a very small fraction of Nevada motor fuel use.

5. NEW INFORMATION REGARDING OTHER RAIL CORRIDORS

This chapter summarizes environmental information from the Yucca Mountain FEIS regarding the Carlin, Jean, and Valley Modified rail corridors, provides updated information on these corridors as appropriate, and considers the effect of any changes on the potential environmental impacts of the Carlin, Jean, and Valley Modified rail corridors. This chapter also describes present and reasonably foreseeable actions that would affect direct, indirect, and cumulative impacts in the regions of influence for these rail corridors.

Glossary terms are shown in ***bold italics***.

5.1 Introduction

In the Amended Notice of Intent dated October 13, 2006, the U.S. Department of Energy (DOE or the Department) announced that it would update as appropriate the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS; DIRS 155970-DOE 2002, all) information and analyses for the Carlin, Jean, and Valley Modified ***rail corridors*** to determine if there are significant new circumstances or information relevant to environmental concerns (71 *FR* 60484). The Department has eliminated the Caliente-Chalk Mountain rail corridor, which would intersect the Nevada Test and Training Range, from further review because of U.S. Air Force concerns that a rail line on the Range would interfere with the Air Force mission and objectives (DIRS 182772-MTS 2007, p. 9). For clarity, any options in the Carlin, Jean, and Valley Modified rail corridors that would cross onto the Nevada Test and Training Range are depicted in figures with dashed lines. Additionally, DOE has informed the Timbisha Shoshone Tribe that any corridor options that would cross Timbisha Shoshone Trust Lands have been eliminated from consideration (DIRS 174558-Sweeney 2004, all).

5.1.1 GENERAL METHODOLOGY

DOE reviewed and updated the ***affected environment*** information in the Yucca Mountain FEIS, as appropriate, using the same data sources to the extent possible. However, since DOE completed the Yucca Mountain FEIS, many data management systems, such as geographic information systems, and data sources, such as the BLM LR2000, have advanced and currently provide more data and specificity than was previously available.

Since DOE completed the Yucca Mountain FEIS, the design and plans for the construction of a rail line within the Caliente rail corridor have advanced (see Section 2.2.3). The advanced Caliente rail design and plans provide a basis for updating information about and estimating environmental impacts for the other corridors analyzed in the Yucca Mountain FEIS. The approach DOE used to estimate changes in environmental impacts for the Carlin, Jean, and Valley Modified rail corridors is based on primary impact indicators. A primary impact indicator is the most important contributor or parameter used to determine the impacts of a particular environmental resource area. To update the information on the Carlin, Jean, and Valley Modified rail corridors, parameters that describe corridor characteristics (such as length of corridor and earthwork quantities) derived from Caliente rail alignment analyses provided ratios to estimate the data at a corridor level.

In addition, DOE updated the baseline environmental conditions for each resource area through the collection of federal, state, and local data commensurate with the information in the Yucca Mountain FEIS for the Carlin, Jean, and Valley Modified rail corridors. Using updated affected environments as the new baselines, while considering the evolution of engineering and design changes, DOE evaluated how the magnitude and range of potential impacts might have changed from those reported in the Yucca Mountain FEIS. DOE also considered present and reasonably foreseeable actions that would affect direct, indirect, and cumulative impacts within the regions of influence for these rail corridors.

Sections 5.1.1.1 through 5.1.1.12 describe the general approach DOE used to update the environmental conditions for each resource area for the Carlin, Jean, and Valley Modified rail corridors.

5.1.1.1 Land Use and Ownership

In the Yucca Mountain FEIS, DOE determined that an evaluation of impacts to land use and ownership should identify the current ownership of the land that its activities could disturb, and the present and anticipated future uses of the land. The Yucca Mountain FEIS defined the ***region of influence*** for impacts to land-use and ownership as land areas that would be disturbed or whose ownership or use would change as a result of constructing and operating a railroad. In the Yucca Mountain FEIS, DOE evaluated land use and ownership within the 400-meter (0.25-mile)-wide corridor. The update in this Nevada Rail Corridor SEIS used the same region of influence. Based on these criteria, DOE evaluated the potential impacts to land use and ownership from the construction and operation of the railroad. The Bureau of Land Management (BLM) manages most of the public lands through which the Carlin, Jean, and Valley Modified rail corridors would pass. Traditional land uses in most of the areas that would be directly and indirectly affected include grazing, mining, energy development, general recreation, utility rights-of-way, and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing and mining.

Some BLM-administered lands have special designations that identify their uses or why they have be set aside. These include Wildlife Habitat Management Areas, Areas of Critical Environmental Concern, Wilderness Areas, and Wilderness Study Areas. Public lands in the Mina rail corridor region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as Special Recreation Management Areas.

Most of the land encompassing the Carlin, Jean, and Valley Modified rail corridors is BLM-administered public land. Each BLM Field Office manages lands within its administrative boundaries according to one or more Management Framework Plan or Resource Management Plan. In addition to BLM-administered land, the range of potentially affected land ownership includes private land holdings (including land designated for commercial development), other federal lands (DOE lands, U.S. Department of Defense lands), and American Indian trust lands and reservations.

To evaluate land use and ownership in the Carlin, Jean, and Valley Modified rail corridors, DOE obtained data from the latest editions of BLM Master Title Plats and online land record databases, such as BLM LR2000 (DIRS 182772-MTS 2007, p. 66). The Department also evaluated county and state land records and information from other federal agencies, universities, or commercial developments.

5.1.1.2 Air Quality

The update to air quality information includes changes in attainment status for the counties through which the Carlin, Jean, and Valley Modified rail corridors would pass. As in the Yucca Mountain FEIS, DOE defined the regions of influence for air quality as the air basins through which the corridors would pass. To update this air quality information, DOE obtained data from the Nevada Bureau of Air Quality to determine attainment status for counties that could be affected, and used the same qualitative methods as the Yucca Mountain FEIS. Areas in violation of one or more of the ***criteria pollutant*** standards are classified as ***nonattainment areas***. If there are not enough air quality data to determine the status of a remote or sparsely populated area, then the U.S. Environmental Protection Agency lists the area as unclassifiable. Unclassifiable areas are considered to be in attainment.

The region of influence includes the air basins in the vicinity of sources of criteria pollutant emissions that could be affected during railroad construction and operations. In particular, the air basins of the Las Vegas Valley (for ***particulate matter*** with aerodynamic diameters equal to or less than 10 micrometers [$\boldsymbol{PM_{10}}$] and ***carbon monoxide***) and the Pahrump Valley (for PM_{10}) where criteria pollutant concentrations are already an issue. If nonattainment or maintenance areas are not identified, detailed estimates of emission rates or comparisons to threshold levels for conformity were not made.

5.1.1.3 Hydrology

The Yucca Mountain FEIS analyzed surface-water resources within the 400-meter (0.25-mile)-wide corridor and within 1 kilometer (0.6 mile) of each side of the corridor. For this Nevada Rail Corridor SEIS, the region of influence for surface water, including springs, is the same as the Yucca Mountain FEIS. Information for this update was obtained from (1) the National Hydrography Dataset Waterbody geospatial data that the U.S. Geological Survey developed in cooperation with U.S. Environmental Protection Agency; (2) the Geographic Names Information System Nevada geospatial database developed by the U.S. Geological Survey and the BLM; and (3) the National Wetlands Inventory database managed by the U.S. Fish and Wildlife Service (DIRS 182772-MMTS 2007, p. 66).

In the Yucca Mountain FEIS, the Department used terrain types to estimate total water demand. Since DOE completed the Yucca Mountain FEIS, the Department has canvassed similar projects throughout Nevada and determined that the excavation type, not the terrain, would more accurately estimate total water demand associated with the rail line construction. DOE applied ratios based on earthwork to the corridors to estimate water demand in relation to the values for the Caliente rail alignment. DOE updated the water demand based on earthwork needs and reevaluated the water required for compaction. Earthwork needs would include excavation of common (alluvial) ripable rock, and drilling and blasting of solid bedrock.

5.1.1.4 Biological Resources and Soils

The update of information for biological resources and soils assessed changes in baseline biological resources and soils conditions for the Carlin, Jean, and Valley Modified rail corridors within the same region of influence as the Yucca Mountain FEIS. These changes in baseline conditions include vegetation cover, soil types, new or delisted special status species, critical habitat, and wildlife management areas. Consistent with the Yucca Mountain FEIS, this update considered the potential for impacts to vegetation communities; special status species (plants and animals), including their habitat; springs, wetlands, and riparian areas; big game habitat; and wild horse and burro herd management areas that in the 400-meter (0.25-mile)-wide corridor. This update also considered special status species and big game habitat within 5 kilometers (3 miles) of each side of the corridor that could be affected by rail line construction, and springs and riparian areas within this area that could be affected by permanent changes in surface-water flows.

DOE obtained location records for special status species from a statewide database managed by the Natural Heritage Program (DIRS 182772-MTS 2007, p. 67) that contains records of observations of rare or protected plants, fish, and wildlife species. Other information sources included (1) the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all); (2) the *Tonopah*

Resource Management Plan and Record of Decision (DIRS 173224-BLM 1997, all); (3) the *Biological Field Findings Report for Potential Rail Alignments along the Mina Route* (DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, all); and (4) the *Mina Rail Route Feasibility Study* (DIRS 180222-BSC 2006, all. Additional DOE obtained information from the National Hydrography Dataset Waterbody geospatial data that the U.S. Geological Survey developed in cooperation with the U.S. Environmental Protection Agency, the Geographic Names Information System Nevada geospatial database and the BLM Wild Horse and Burro Management Area Maps (DIRS 182772-MTS 2007, p. 67).

5.1.1.5 Cultural Resources

The update to cultural resources information assesses changes in the baseline cultural resources conditions since DOE completed the Yucca Mountain FEIS. These changes include a review of surveys completed since DOE completed the Yucca Mountain FEIS and the number of sites and their potential for listing on the *National Register of Historic Places*. The region of influence was a corridor width of 400 meters (0.25 miles), which was the same as the Yucca Mountain FEIS. This update used records from the Desert Research Institute, the Nevada Cultural Resources Information System, and archaeological information repositories at the Harry Reid Center at the University of Nevada-Las Vegas, and the Nevada State Museum in Carson City.

As part of this update, the Department completed cultural resources records searches for the Carlin, Jean and Valley Modified rail corridors. The records searches identified the presence of cultural resources, including historic and archaeological sites.

5.1.1.6 Occupational and Public Health and Safety

The update for occupational and public health and safety focuses on traffic, worker industrial safety, incident-free radiological and nonradiological impacts, and radiological impacts related to accidents. Since DOE completed the Yucca Mountain FEIS, there have been updates to the methods and data to estimate the radiation doses for workers and members of the public (DIRS 182757-MTS 2007, all). The impacts for the Carlin, Jean, and Valley Modified rail corridors reflect new information, as described in Section 3.2.6 of this Nevada Rail Corridor SEIS.

Based on the conceptual design and plans for the construction of a rail line in the Caliente rail corridor, DOE has determined that the estimated workforce has increased the Department completed the Yucca Mountain FEIS. To update occupational and public health and safety impacts, DOE used employment levels scaled from the Caliente rail corridor analysis.

The region of influence for each includes:

- Traffic impacts: The 400-meter (0.25-mile) width of the corridor and public highways used by workers and for shipments during construction and operations.
- Worker industrial safety impacts: The 400-meter-wide rail corridor.
- Incident-free radiological and nonradiological impacts: The 800-meter (0.5-mile) area on either side of the centerline of the rail corridor.
- Radiological impacts with respect to accidents: An area within an 80-kilometer (50-mile) radius from a potential occurrence location in the rail corridor.

DOE obtained information from the Bureau of Labor Statistics for 2005, and used the RADTRAN 5 computer program (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all) and the RISKIND computer program (DIRS 101483-Yuan et al. 1995, all) where applicable.

5.1.1.7 Socioeconomics

The update to information on socioeconomics includes changes to the employment and population baselines for the three corridors. The region of influence for this update is the Nevada counties through which the corridors would pass, and the two areas where most workers would be expected to reside (the Carson City/Washoe County area and Clark County).

DOE obtained data from the U.S. Census Bureau, the Nevada State Demographer, and other local and state sources. In addition, the Department utilized estimates and projections from the socio-demographic forecasting software program REMI, version 9, to develop baselines.

5.1.1.8 Noise and Vibration

To assess and update the baseline conditions for noise and vibration, DOE reviewed the input parameters used for the noise and vibration analysis in the Yucca Mountain FEIS. This included the population within the region of influence for noise and vibration, relevant noise standards, and the frequency and number of trains. DOE has updated the criteria to determine the level of potential impacts from noise and vibration. For noise impacts from construction activities, DOE used U.S. Department of Transportation, Federal Transit Administration, methods (DIRS 177297-Hanson, Towers, and Meister 2006, all) and construction noise guidelines. For operation of trains during the construction and operations phases, DOE analyzed noise impacts under established Surface Transportation Board (STB) criteria (49 CFR 1105.7e(6)). To evaluate potential vibration impacts from construction and operations activities, DOE used Federal Transit Administration building vibration damage and human-annoyance criteria (DIRS 177297-Hanson, Towers, and Meister 2006, all). This update assessed the distance of the rail line from communities along the rail line and estimated the noise impacts from railroad construction and operation to these communities. For the update to impacts from vibration, DOE considered typical background levels of ground vibration, the number of trains, and the distance of the rail line from historic structures or sites of cultural significance. The updated criteria for noise and vibration do not affect the level of impacts presented in the Yucca Mountain FEIS.

5.1.1.9 Aesthetics

Consistent with the Yucca Mountain FEIS, the region of influence for aesthetics in this Nevada Rail Corridor SEIS is based on a 400-meter (0.25 mile)-wide corridor and its ***viewshed***. This update considered changes to the visual sensitivity ratings of viewsheds in Nevada and the BLM Visual Resource Management System objectives as described BLM Handbook H-8431-1, Visual Resource Contrast Rating (DIRS 173053-BLM 1986, all). DOE reviewed BLM plans, including the Elko Resource Management Plan, the Las Vegas Resource Management Plan, and the Tonopah/Battle Mountain Resource Management Plan. The analysis of potential impacts on aesthetic resources considered BLM ratings for both federal and non-federal land areas. Non-federal lands were granted the rating of surrounding BLM lands or else assigned the BLM rating of Class III. The regions of influence included the landscapes along the rail corridor with aesthetic quality that construction and operations of a railroad could affect.

5.1.1.10 Utilities, Energy, and Materials

The Yucca Mountain FEIS evaluated utilities, energy, and materials impacts common to all corridors and noted that these impacts would include the use of motor fuel, steel, and concrete. Since DOE completed the Yucca Mountain FEIS, information on the baseline supply of utilities, energy, and construction materials has been updated. For example, annual motor fuel use in Nevada was updated from the Federal Highway Administration database. DOE applied the engineering methods used during recent work on the Caliente rail alignment to estimate the amount of earthwork for the Carlin, Jean, and Valley Modified rail corridors. The Department used the estimated amount of earthwork to determine fuel use because fuel use is proportional to the quantity of earthwork needed. In addition, applying the engineering methods used for the Caliente alignment, DOE developed material requirement estimates based on the length of rail line for steel (main track rail) and concrete (main track ties).

5.1.1.11 Waste Management

Waste management impacts are based on the estimated generation of solid municipal waste from rail line construction in each of the three corridors. The Yucca Mountain FEIS evaluated common waste management impacts for all corridors rather than for individual corridors. Information to allow differentiation between corridor waste management impacts is now much more readily available. Consistent with the Yucca Mountain FEIS, this update estimated the peak annual generation of sanitary solid waste. However, based on advanced databases, this update was then able to estimate the impact that the waste generated would have on the individual landfills serving the respective corridor, rather than on landfills on a state-wide basis as the Yucca Mountain FEIS did. DOE obtained information on landfills from the Nevada Division of Environmental Protection database (DIRS 174041-NDEP 2007, all).

5.1.1.12 Environmental Justice

Consistent with the Yucca Mountain FEIS, DOE evaluated the potential impacts to two specific populations, those defined as low income and those defined as minority. For the Yucca Mountain FEIS, the region of influence for the environmental justice analysis was defined as the Nevada counties the corridors would cross. DOE identified low income and minority populations by examining 1990 and 2000 U.S. Census Bureau block group data in the region of influence.

Census data for the year 2000 concerning minority communities in Nevada was available at the block group level for the Yucca Mountain FEIS analysis; however, 2000 Census data on low-income communities were not. Therefore, the information on low-income communities was from the 1990 Census. As a consistent criterion for identifying minority and low-income blocks and block groups, DOE employed a 10-percent threshold, meaning that the environmental analysis focused on blocks and block groups in Nevada having a 10-percent or greater minority population or low-income population than the state averages. DOE adopted the 10-percent threshold for the Yucca Mountain FEIS from a 1995 Nuclear Regulatory Commission document, *Interim NRC Procedure for Environmental Justice Reviews* (DIRS 103426-NRC 1995, all). This threshold is consistent with the recent revision of Nuclear Regulatory Commission guidance on environmental justice (DIRS 157276-NRC 1999, all).

For determining minority populations for the update in this Nevada Rail Corridor SEIS, DOE followed the Council on Environmental Quality guidance (DIRS 103162-CEQ 1997, all) and the approach used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13). DOE considered that a minority population exists where either: (a) the minority population of the affected area exceeds 50 percent; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. (DOE used both the United States and the State of Nevada minority populations.)

The Department used the Council on Environmental Quality definition of low-income and the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is meaningfully greater than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE applied the U.S. Nuclear Regulatory Commission guidance of a 20-percent threshold above the state average of 11 percent (that is, 31 percent) for low-income populations (69 *FR* 52040, August 24, 2004).

For this update, DOE used 2000 Census Bureau information block group data to determine both low-income and minority populations for this update.

5.2 Carlin Rail Corridor

Table 5-1 summarizes the results of the update to the primary impact indicators for the Carlin rail corridor and compares them with the corridor information reported in the Yucca Mountain FEIS. The information reflects the total for rail road construction and operations, unless otherwise noted.

The Carlin rail corridor would originate at the Union Pacific Railroad Mainline near Beowawe in north-central Nevada. The corridor would travel south through Crescent, Grass, and Big Smoky Valleys, passing west of Tonopah and east of Goldfield. It would then travel south following and periodically crossing the western boundary of the Nevada Test and Training Range, passing through Oasis Valley and across Beatty Wash. It would travel across Crater Flats and along Fortymile Wash to Yucca Mountain. Depending on the option, the Carlin rail corridor would be approximately 530 kilometers (330 miles) long from its link with the Union Pacific Railroad Mainline to Yucca Mountain.

Options to the Carlin rail corridor range from 510 kilometers to 540 kilometers (320 to 340 miles). The two main corridor options are the Big Smoky Valley option and the Monitor Valley option. The Yucca Mountain FEIS contains detailed descriptions of the Carlin rail corridor and its options, which are shown in Figure 5-1.

5.2.1 LAND USE AND OWNERSHIP

In the Yucca Mountain FEIS, DOE determined that an evaluation of impacts to land use and ownership should identify the current ownership of the land that its activities could disturb, and the present and anticipated future uses of the land. In the Yucca Mountain FEIS, DOE evaluated land use and ownership in the 400-meter (0.25-mile)-wide corridor. The region of influence for land-use and ownership impacts was defined as land areas that would be disturbed or whose ownership or use would change as a result of the construction and operation of a rail line within this corridor. The purpose of the 400-meter width was to provide sufficient space for final alignment to route the rail line around sensitive land features or engineering obstacles. The region of influence for this Nevada Rail Corridor SEIS is the same as the Yucca Mountain FEIS.

Traditional land uses in most of the Carlin rail corridor region of influence that would be directly and indirectly affected include grazing, mining, energy development, general recreation, utility rights-of-way, and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing and mining.

Some BLM-administered lands have special designations which denote their use or what they have been set aside for. These include Wildlife Habitat and Management Areas, Areas of Critical Environmental Concern, Wilderness Areas, and Wilderness Study Areas. Public lands in the Carlin rail corridor region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as Special Recreation Management Areas.

Table 5-1. Updated environmental information for the Carlin rail corridor (page 1 of 2).

Resource	Changes from Yucca Mountain FEIS to this analysis
Corridor length	No change
Land ownership	
BLM-administered land	Yucca Mountain FEIS: 44,000 to 49,000 acres (180 to 200 square kilometers) (approximately 86 percent) Updated analysis: 44,000 to 52,000 acres (180 to 210 square kilometers) (88 to 94 percent)
Private land	Yucca Mountain FEIS: 1,00 to 3,700 acres (7.3 to 15 square kilometers) (approximately 6.7 percent) Updated analysis: 1,600 to 2,300 acres (6.4 to 9.4 square kilometers) (3.27 to 4.02 percent)
Nevada Test and Training Range land	Yucca Mountain FEIS: 0 to 2,700 acres (0 to 10.9 square kilometers) (approximately 5.2 percent) Updated analysis: 0 to 11.4 square kilometers (0 to 2,800 acres) (0 to 4.9 percent)
Nevada Test Site land	No change
American Indian trust lands and reservations	No change
Air quality	
National Ambient Air Quality Standards attainment status	No change
Hydrology	
Surface water	No change
Groundwater use (construction phase)	Yucca Mountain FEIS: 660 acre-feet (810,000 cubic meters) Updated analysis: 5,800 acre-feet (7.13 million cubic meters
Biological resources and soils	Six additional sensitive species recorded
Cultural resources (records search)	Yucca Mountain FEIS: 110 recorded sites Updated analysis: 120 recorded sites
Occupational and public health and safety	
Industrial hazards (construction and operations)	
Total recordable cases	Yucca Mountain FEIS: 210 Updated analysis: 391
Lost workday cases	Yucca Mountain FEIS: 105 Updated analysis: 224
Fatalities	Yucca Mountain FEIS: 0.41 Updated analysis: 1
Transportation hazards (construction only)	
Traffic fatalities	Yucca Mountain FEIS: 1.1 Updated analysis: 4
Cancer fatalities	Yucca Mountain FEIS: 0.14 Updated analysis: 0.6

Table 5-1. Updated environmental information for the Carlin rail corridor (page 2 of 2).

Resource	Changes from Yucca Mountain FEIS to this analysis
Occupational and public health and safety (continued)	
Incident-free radiological impacts (latent cancer fatalities) (operations only)	
Public	Yucca Mountain FEIS: 0.0012 Updated analysis: 0.00008
Workers	Yucca Mountain FEIS: 0.31 Updated analysis: 0.33
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	Yucca Mountain FEIS: 0.000000037 Updated analysis: 0.000001
Cancer fatalities from vehicle emissions	Yucca Mountain FEIS: 0.09 Updated analysis: 0.4
Nonradiological transportation accident fatalities	
Spent nuclear fuel and high-level radioactive waste transportation	Yucca Mountain FEIS: 0.54 Updated analysis: 0.31
Construction and operations workforce	Yucca Mountain FEIS: 0.7 Updated analysis: 3.3
Socioeconomics	
Estimated construction workforce	Yucca Mountain FEIS: 1,230 worker-years Updated analysis: 6,600 worker-years
Estimated operations workforce	Yucca Mountain FEIS: 47 workers per year Updated analysis: 42 workers per year
Noise and vibration	No change
Aesthetics	No change
Utilities, energy, and materials (amount used)	
Diesel	Yucca Mountain FEIS: 10.6 million gallons (40 million liters) Updated analysis: 29 million gallons (110 million liters)
Gasoline	Yucca Mountain FEIS: 0.22 million gallons (0.82 million liters) Updated analysis: 0.63 million gallons (2.4 million liters)
Steel	Yucca Mountain FEIS: 82,000 tons (76,000 metric tons) Updated analysis: 95,000 tons (86,000 metric tons)
Concrete	Yucca Mountain FEIS: 456,000 tons (414,000 metric tons) Updated analysis: 364,000 tons (330,000 metric tons)
Waste management	
Sanitary solid waste	Updated analysis: 1.7 tons (1.6 metric tons) per day
Environmental justice (disproportionately high and adverse impacts)	No change, none identified

To obtain current land use and ownership data, DOE consulted the latest edition of the BLM Master Title Plats and online land record databases, such as BLM LR2000. The Department also evaluated county and state land records, along with information managed by other federal agencies, universities, or commercial developments.

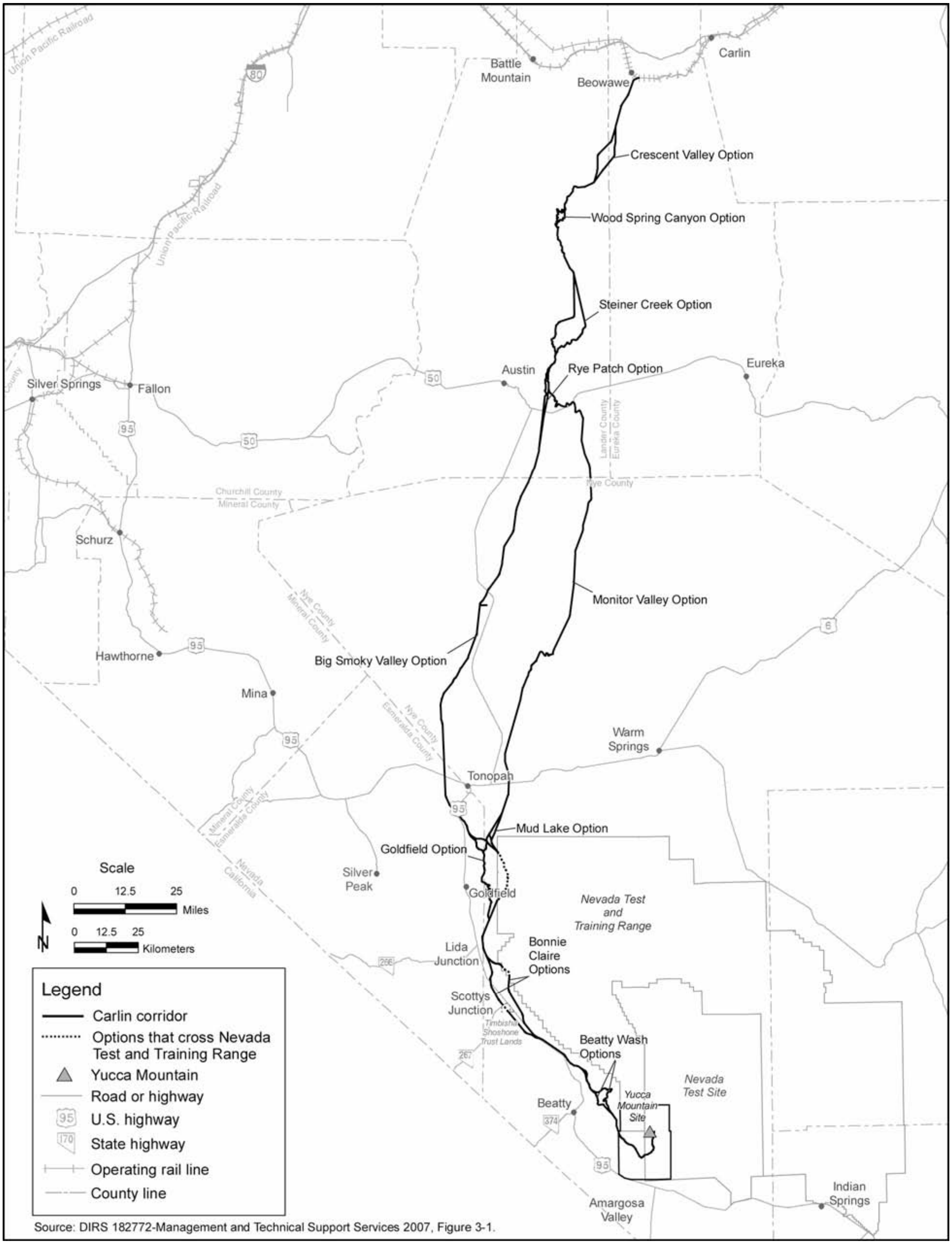


Figure 5-1. Carlin rail corridor and options (2002).

Potential impacts from construction and operation of a railroad in the Carlin rail corridor would be consistent with those that DOE reported in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 6.3.2.1.1). The following paragraphs discuss information gathered in relation to land use in the Carlin rail corridor since DOE completed the Yucca Mountain FEIS.

The Yucca Mountain FEIS reported that the BLM administered approximately 86 percent of the land in the corridor (180 to 200 square kilometers [44,000 to 49,000 acres]), the Department of Defense managed 5.2 percent (0 to 10.9 square kilometers), DOE managed 2.2 percent (4.6 square kilometers [1,100 acres]), and less than 1 percent (0 to 1.6 square kilometers) was held in trust by the Timbisha Shoshone Tribe. The Department of Defense lands were on the Nevada Test and Training Range.

Current land holdings for the Carlin rail corridor are as follows: BLM-administered land, approximately 88 to 94 percent (180 to 210 square kilometers [44,000 to 52,000 acres]); Department of Defense land, about 0 to 4.9 percent (0 to 11.4 square kilometers [2,800 acres]); DOE land, approximately 2 percent (unchanged); and Timbisha Shoshone trust lands less than 1 percent (unchanged) (DIRS 182772-MTS 2007, p. 73). The change in estimates of amount of BLM-administered land and private property within this corridor are, in part, the result of using databases whose land ownership data have been refined and enhanced since completion of the Yucca Mountain FEIS.

The Yucca Mountain FEIS reported that about 6.7 percent (7.3 to 15 square kilometers [1,800 to 3,700 acres]) of the land within the Carlin rail corridor was private property. Currently, DOE estimates that private property occupies about 3.3 to 4 percent (6.4 to 9.4 square kilometers [1,600 to 2,300 acres]) of the land in the corridor (DIRS 182772-MTS 2007, p. 73). Similar to changes in BLM administered land, the change in the amount of private land reflects, in part, the use of more recent databases whose land ownership data have been enhanced since the Yucca Mountain FEIS. The highest density of private land occurs within the first 30 kilometers (19 miles) of the corridor (near Beowawe), although other concentrations of private property occur near Crescent Valley. In the Crescent Valley area, for instance, much of the private property lies in single sections (2.6 square kilometers [1 square mile]) of land that are separated by BLM-administered sections (as shown in Figure 5-3 for the area south of Crescent Valley). As a general criterion, DOE minimized crossing private property when it identified the Carlin rail corridor; however, as a result the corridor tends to cross private parcels of land owned by many individuals, which creates a correspondingly complex ownership pattern.

The Bonnie Claire option in the Carlin rail corridor would cross and divide an 11-square-kilometer (2,800-acre) portion of the Timbisha Shoshone trust lands near Scottys Junction, Nevada.

Since DOE completed the Yucca Mountain FEIS, the BLM has found that a 0.43-square-kilometer (100-acre) parcel of public land near Hadley, Nevada, is suitable for direct (noncompetitive) sale to Round Mountain Gold Corporation for expansion of the existing Hadley Airport (*Notice of Realty Action: Direct (Non-Competitive) Sale of Public Lands, Nye County, NV*; 72 *FR* 4290, January 30, 2007); Figure 5-2 shows the location of the airport in relation to the Carlin rail corridor. This land, which is approximately 2.6 kilometers (1.6 miles) from the center of the Carlin rail corridor, was purchased by the Round Mountain Gold Corporation on May 11, 2007.

The Carlin rail corridor would pass near historic and currently established mining districts. At the time DOE completed the Yucca Mountain FEIS, the number of unpatented claims staked in Nevada had been steadily dropping since the BLM instituted a requirement in 1991 for an annual fee for each claim. Since the DOE completed the Yucca Mountain FEIS, the prices of gold and other metallic resources have been steadily rising, which has caused a resurgence in the number of mining claims. Unpatented mining claims have been, and continue to be, staked along the corridor, with sections containing the greatest number of claims located near the Crescent Valley and Goldfield areas (see Figure 5-3). According to a mineral assessment prepared for Lander County, exploration and development activity is increasing in and around the Crescent Valley area for gold, silver, barite and geothermal resources (DIRS 182772-MTS 2007, p. 73).

The Cortez Gold Mines are near the northern end of the Carlin rail corridor, in the vicinity of Crescent Valley, and have been expanding their mining operations since DOE completed the Yucca Mountain FEIS. The Cortez Gold Mines, also called the Cortez Joint Venture, is the oldest continuously operating gold mining operation in Nevada; Figure 5-3 shows the location of the mine in relation to the Carlin rail corridor. The Cortez Gold Mines are among the largest annual producers of gold in the state of Nevada, and considered one of Nevada's major mines (DIRS 182772-MTS 2007, p. 74). Since DOE completed the Yucca Mountain FEIS, the Cortez Gold Mine has proposed an expansion of its Pipeline/South Pipeline Project, which is an open-pit gold mining and processing operation (*Notice of Intent To Prepare an Environmental Impact Statement To Analyze the Proposed Amendment to the Pipeline/South Pipeline Plan of Operations (NVN–067575) for the Cortez Hills Expansion Project*; 70 *FR* 72308, December 2, 2005). The BLM has granted authorization to Cortez Gold Mine to disturb approximately 37 square kilometers (9,000 acres) associated with the Pipeline/South Pipeline Project, which was under BLM consideration when DOE completed the Yucca Mountain FEIS. The proposed expansion would include an additional 25 square kilometers (6,100 acres). The proposed expansion is less than 1.6 kilometers (1 mile) from the outer boundary of the Carlin rail corridor. The EIS for the proposed expansion project is in preparation, so it is unknown what impacts it could have; in addition, the project could undergo modifications and boundary adjustments.

DOE reviewed information in the Mineral Resources Data System and the Abandoned Mine database (DIRS 182772-MTS 2007, p. 74) to determine if additional mines, active or abandoned, have been located and documented since DOE completed the Yucca Mountain FEIS. Updates to these data systems revealed that the Carlin rail corridor would cross Mammoth, Diamondfield Property, Aloha, Tognoni Spring, Goldfield Bullion, Future Group, and Wright Prospect mines. The Monitor Valley option would cross Nevada State Pit, and there is an abandoned mine on the Steiner Creek option. Of these, Nevada State Pit, Tognoni Spring, and Diamondfield Property are "past producers," meaning that mining activities occurred in the past but no mining operations are currently underway.

The classification for Wright Prospect and Future Group is "occurrence," meaning that discovery of an outcrop has occurred and there could be some land disturbance, but there is currently no mining operation underway. Aloha, Goldfield Bullion, and Mammoth are "prospect sites," meaning there has been discovery of a mineral resource but no mining (DIRS 182772-MTS 2007, p. 74).

During the Goldfield mining history, several patents were issued for mining claims along the Carlin rail corridor, as reported in the Yucca Mountain FEIS. With a patented mining claim, the claimholder owns the land and the minerals. Effective October 1, 1994, Congress imposed a moratorium on spending appropriated funds for the acceptance or processing of mineral patent applications that had not yet received First Half Final Certificates (the required first step for patent issuance) or were not in Washington, D.C., for Secretary of Interior review of First Half Final Certificates on or before September 30, 1994. Until the moratorium is lifted, the BLM will not accept applications for mining claim patents. Therefore, the numbers and locations of patented mining claims remain unchanged from those reported in the Yucca Mountain FEIS.

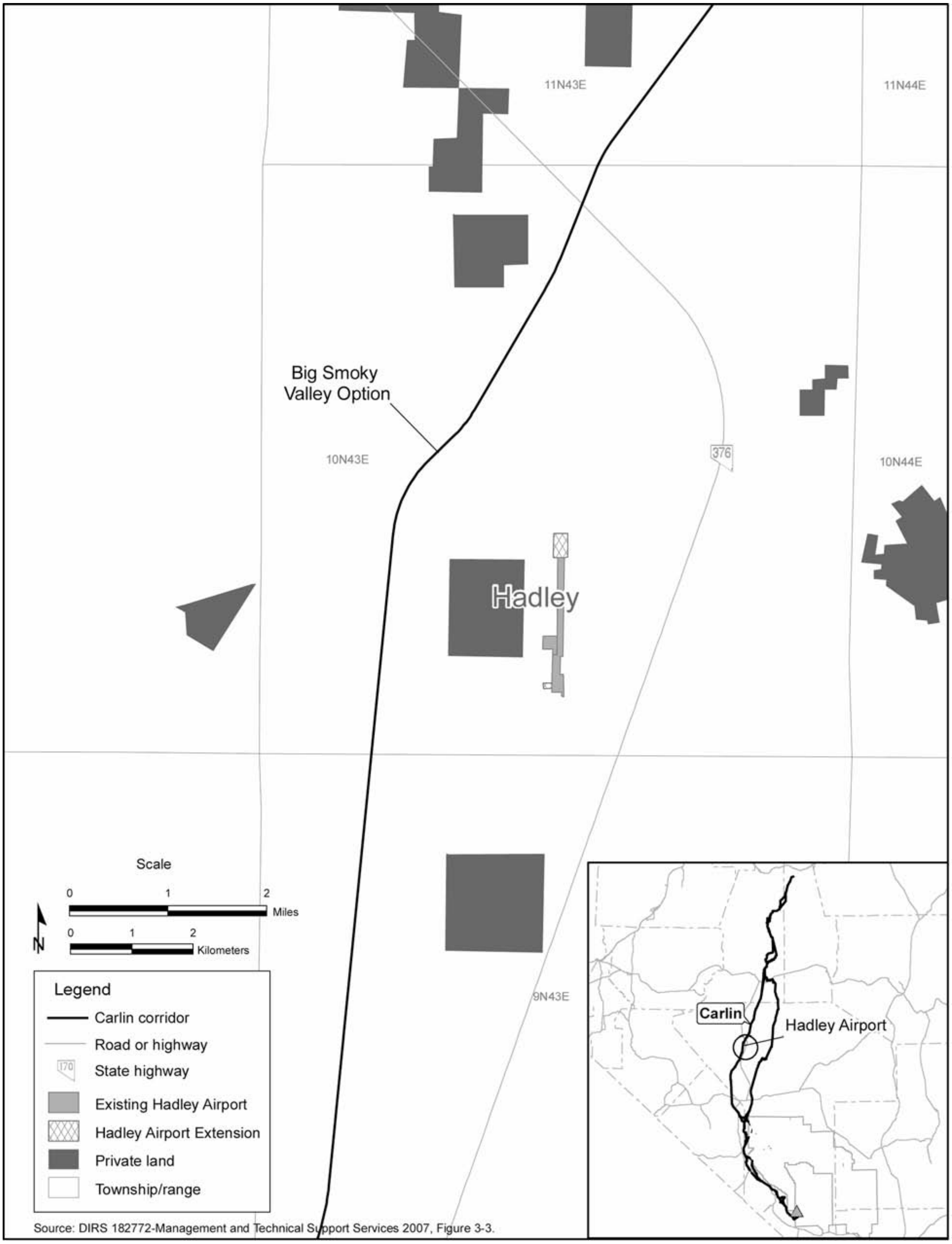


Figure 5-2. Hadley Airport location.

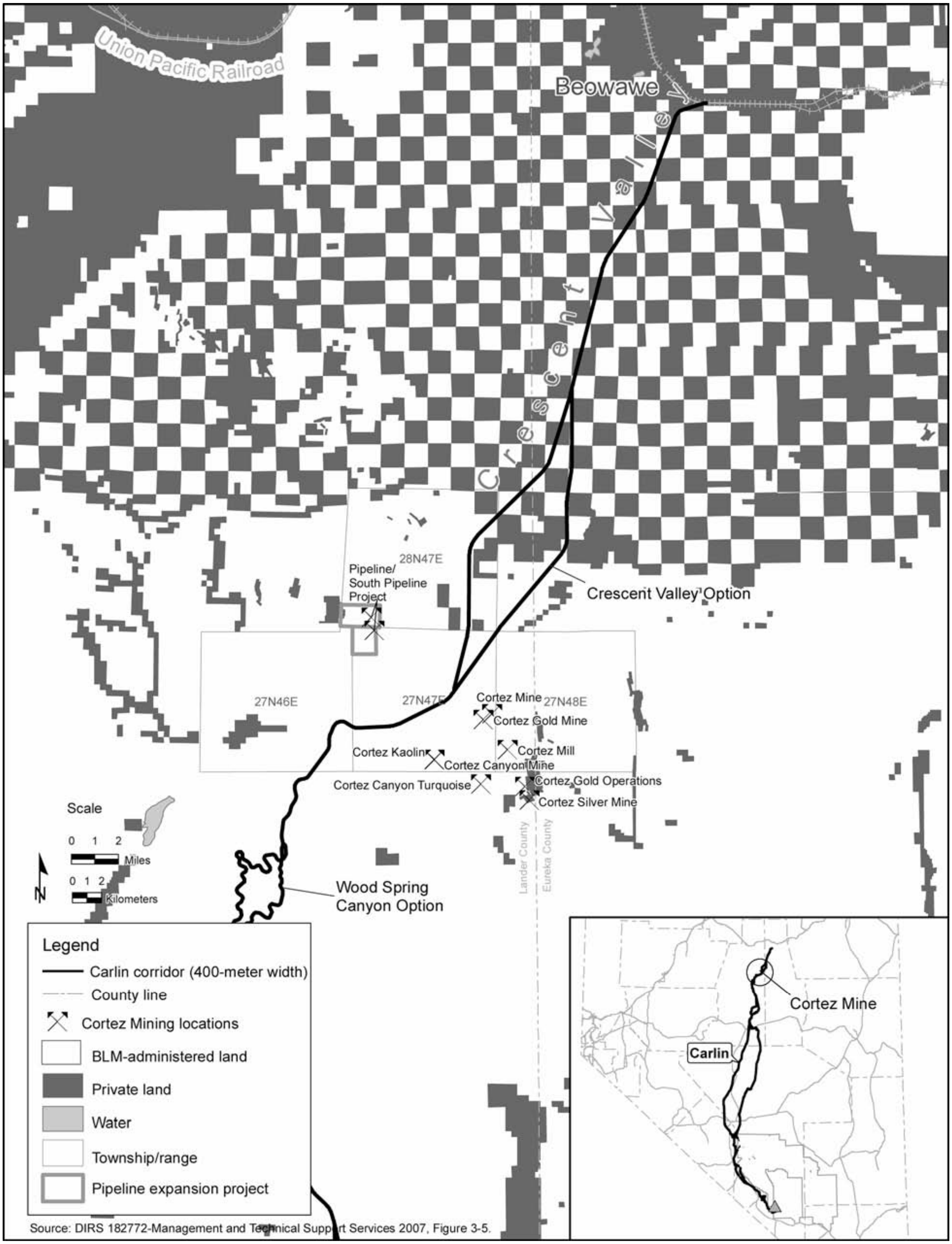


Figure 5-3. Cortez Mine location.

During an evaluation of Wilderness Areas and Wilderness Study Areas potentially affected by the Carlin rail corridor, the Yucca Mountain FEIS determined that only the Steiner Creek option would encroach on the Simpson Park Wilderness Study Area. The status of this Wilderness Study Area has not changed; therefore, this constitutes a land-use conflict. The Yucca Mountain FEIS reported that the Carlin rail corridor and its options would cross 12 BLM grazing allotments. The BLM has since updated their grazing allotment information, which indicates Carlin and its options would now cross the Geyser, South Buckhorn, Carico Lake, Grass Valley, Simpson Park, Potts, Monitor, Hunts Canyon, Kingston, Wildcat Canyon, Smoky, Francisco, San Antone, Montezuma and Razorback grazing allotments, along with an allotment the BLM has designated as being unused. According to this data source, the Carlin rail corridor also crosses the Ralston and Silver King grazing allotments; however, the BLM Battle Mountain District Office reports this same area as just the Ralston grazing allotment.

As reported in the Yucca Mountain FEIS, the corridor would cross six wild horse and burro herd management areas, the Bates Mountain pronghorn antelope release area, three riparian habitats, and the Simpson Park habitat management area (see Section 5.2.4). According to the Yucca Mountain FEIS, the Carlin rail corridor would cross a Desert Land Entry Withdrawal. Since DOE completed the Yucca Mountain FEIS, the BLM has authorized or received proposals for additional Desert Land Entry Withdrawals within or adjacent to the Carlin rail corridor (DIRS 182772-MTS 2007, p. 74). For example, the Monitor Valley Option crosses or is adjacent to six Desert Land Entries. Of these, three have been issued patents, one has been authorized by BLM and is awaiting patent, and two others have applications in process with the BLM. The BLM grants Desert Land Entry Withdrawals to individuals to reclaim, irrigate, and cultivate arid and semiarid public lands of the western United States. The Yucca Mountain FEIS reported that the Carlin rail corridor would cross linear land features such as rights-of-way for utilities and roads. A review of BLM land records, including Master Title Plats, indicated the authorization of additional rights-of-way since DOE completed the Yucca Mountain FEIS (DIRS 182772-MTS 2007, p. 75).

5.2.2 AIR QUALITY

The Yucca Mountain FEIS evaluated air quality impacts common to all of the proposed corridors and noted that these impacts would include temporary increases in ***criteria air pollutant*** concentrations from construction of a rail line. The Yucca Mountain FEIS did not identify any air quality impacts unique to the Carlin rail corridor. The update did not find any indication that the air quality status of the counties and areas along the Carlin rail corridor has changed since DOE completed the Yucca Mountain FEIS (DIRS 182772-MTS 2007, p. 82).

Areas in violation of one or more of the criteria pollutant standards are classified as nonattainment areas. If there is not enough air quality data to determine the status of a remote or sparsely populated area, then the Environmental Protection Agency lists the area as unclassifiable and the area is considered to be in attainment. The Carlin rail corridor would pass through rural parts of Nye, Esmeralda, Lander, and Eureka Counties in Nevada that are either in attainment or unclassifiable for criteria air pollutants under the Environmental Protection Agency (DIRS 182772-MTS 2007, p. 82). Since no nonattainment or maintenance areas were identified, no detailed estimates of emission rates or comparisons to threshold levels for conformity were made.

Fuel use by construction equipment would emit ***carbon monoxide, nitrogen dioxide, sulfur dioxide***, and particulate matter with diameters of 10 micrometers or less (***PM_{10}***) and 2.5 micrometers or less (***$PM_{2.5}$***) Construction activities would also emit PM_{10} in the form of ***fugitive dust*** from excavation, truck traffic, and operation of concrete batch plants (DIRS 180877-Nevada Rail Partners 2007, p. 2-6). The emissions would be temporary and would cover a sizeable area as construction progressed along the length of the corridor.

Air quality impacts common to all corridors during railroad operations would result from diesel locomotives, which would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10} and $PM_{2.5}$. The number of locomotive engines in use and the associated operational characteristics would not differ appreciably from those in the Yucca Mountain FEIS. Therefore, there should be no measurable differences in potential impacts from those in the Yucca Mountain FEIS.

5.2.3 HYDROLOGY

This section describes surface-water and groundwater resources and impacts to those resources. The Yucca Mountain FEIS analyzed surface water and groundwater resources within the 400-meter (0.25-mile)-wide corridor and within 1 kilometer (0.6 mile) of each side of the corridor. For this Nevada Rail Corridor SEIS, the region of influence for hydrology, was the same as for the Yucca Mountain FEIS.

5.2.3.1 Surface Water

The Yucca Mountain FEIS identified potential surface-water resources, which include springs, streams, ***riparian areas***, and reservoirs within the region of influence along the corridor (DIRS 155970-DOE 2002, Table 6-37). As noted in the Yucca Mountain FEIS, the spread of construction-related materials by precipitation or intermittent runoff events, releases to surface waters, and the alteration of natural drainage patterns or runoff rates that could affect downgradient resources would be unlikely. Based on the information collected for this update, impacts to surface-water resources from construction of a rail line in the Carlin rail corridor would be the same as those reported in the Yucca Mountain FEIS.

The Carlin rail corridor, including all of its options, would cross 11 different mapped ***100-year flood*** zones or flood zone groups (DIRS 182772-MTS 2007, p. 82). These remain unchanged since DOE completed the Yucca Mountain FEIS. Although unlikely, the spread of construction-related materials by precipitation or intermittent runoff events could occur during the construction of a rail line. Impacts associated with changes in drainage patterns or to erosion and sedimentation rates or locations would be small and localized.

5.2.3.2 Groundwater

In the Yucca Mountain FEIS, the Department used terrain types to estimate total water demand. Since DOE completed the Yucca Mountain FEIS, DOE has canvassed similar projects throughout Nevada and determined that the amount and type of earthwork, not the terrain, would more accurately estimate total water demand associated with the construction of a rail line. Therefore, DOE updated the water demand based on earthwork needs. This resulted in an estimated water demand for the Carlin rail corridor of approximately 7.1 million cubic meters (5,800 acre feet) (DIRS 180877-Nevada Rail Partners 2007, p. 2-7) compared to the estimate based on terrain types reported in the Yucca Mountain FEIS of 810,000 cubic meters (660 acre-feet). To accommodate this increase in estimated water demand, DOE would need to draw more water than originally estimated in the Yucca Mountain FEIS from the underlying hydrographic basins and pump from additional wells. Groundwater withdrawal could temporarily affect discharge from nearby wells or springs. DOE would conduct detailed analyses if new wells required for construction of the rail line were to be located near other water sources.

Construction of a rail line would require water for soil compaction, dust control, and workforce use. Water use during construction would come primarily from groundwater resources, specifically hydrographic basins. If the hydrographic basin is designated, permitted groundwater rights approach or exceed the estimated perennial yield, water resources are being depleted or require additional administration, and the Nevada State Engineer has declared preferred uses of water. Table 5-2 updates the designation status of the hydrographic basins and the percentage of the Carlin rail corridor that would

Table 5-2. Hydrographic basins associated with the Carlin rail corridor.[a,b]

Hydrographic basin (and subbasin where applicable)	Length (kilometers)[c]	Percentage of total[d]	Designated
Alkali Spring Valley	21	4	No
Big Smoky Valley/Northern Part	110	21	Yes
Big Smoky Valley/Tonopah Flat	76	14	Yes
Carico Lake Valley	4.4	0.82	No
Crater Flat	29	5.5	No
Crescent Valley	80	15	Yes
Fortymile Canyon/Jackass Flats	13	2.4	No
Grass Valley	55	10	No
Lida Valley	24	4.4	No
Oasis Valley	23	4.4	Yes
Ralston Valley	27	5.1	Yes
Sarcobatus Flat	48	9	Yes
Stonewall Flat	21	3.9	No

a. Source: DIRS 182772-MTS 2007, p. 83.
b. To calculate water demand for each basin, multiply the total water demand for a given corridor by the percentage of total.
c. To convert kilometers to miles, multiply by 0.62137.
d. Based on primary option in Yucca Mountain FEIS.

be in the respective basin. The total percentage of the Carlin rail corridor that would be in designated basins is about 68 percent. The Yucca Mountain FEIS estimated that about 70 percent of the Carlin rail corridor would be in designated basins.

Railroad operations in the Carlin rail corridor would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

5.2.4 BIOLOGICAL RESOURCES AND SOILS

Potential impacts to biological resources and soils from the construction and operation of a railroad in the Carlin rail corridor would be consistent with those reported in the Yucca Mountain FEIS. Maximum land disturbance for the construction of a rail line in the Carlin rail corridor would not differ from the estimates in the Yucca Mountain FEIS; therefore, the potential impacts would not change.

Consistent with the Yucca Mountain FEIS, this update considered the potential for impacts to vegetation communities; special status species (plants and animals), including their habitat; springs, wetlands, and riparian areas; big game habitat; and wild horse and burro herd management areas that may occur within the 400-meter (0.25-mile)-wide corridor. The analysis considered special status species and big game habitat within 5 kilometers (3 miles) of the corridor that may be affected by construction of the rail line. DOE also analyzed springs and riparian areas that could be affected by permanent changes in surface-water flows.

5.2.4.1 Biological Resources

The Carlin rail corridor would start in the Great Basin. The predominant land-cover types in this area are salt desert scrub and sagebrush. There are areas of pinon-juniper forests near the corridor. The corridor would pass through the Mojave Desert, which has predominant land-cover types of creosote-bursage, Mojave mixed scrub, and salt desert scrub.

Table 5-3 lists the special status species, big game habitat, and herd management areas identified in the Yucca Mountain FEIS and identifies additional information resulting from this update. The updated version of the Nevada Natural Heritage Program database examined for Nevada Rail Corridor SEIS included observations of six additional sensitive species not included in the Yucca Mountain FEIS. They are:

- Lahontan cutthroat trout (*Oncorhynchus clarkii henshawi*)
- Southwestern willow flycatcher (*Empidonax traillii extimus*)
- Crescent Dunes serican scarab (*Serica ammomenisco*)
- Eastwood milkweed (*Asclepias eastwoodiana*)
- Ripley's springparsley/Sanicle biscuitroot (*Cymopterus ripleyi var. saniculoides*)
- Toquima milkvetch (*Astragalus toquimanus*)

There are no other known changes to game habitat, sensitive species, or springs and riparian areas within the corridor or within 5 kilometers (3 miles) of the corridor than reported in the Yucca Mountain FEIS.

5.2.4.2 Soils

The Yucca Mountain FEIS classified soils in the rail corridor with four attributes: shrink swell, erodes easily, unstable fill, and blowing soil. As noted in the Yucca Mountain FEIS, the shrink swell and erodes easily attributes are common in the Carlin rail corridor. The Yucca Mountain FEIS also reported that there were no soils classified as prime farmlands within the Carlin rail corridor. For the update, no new information was identified on the attributes of the soils surveyed in the corridor (DIRS 182772-MTS 2007, p. 86).

The Yucca Mountain FEIS reported construction activities would temporarily disturb soils in and adjacent to about 19 square kilometers (4,700 acres) of land. Disturbance of erodible soils could lead to increased silt loads in water courses or increased soil transport by wind. Erosion control during construction, and revegetation or other means of soil stabilization after construction, would minimize these concerns.

Table 5-3. Special status species, big game habitat, and herd management areas associated with the Carlin rail corridor[a] (page 1 of 3).

Resource	Type	Yucca Mountain FEIS		Nevada Rail Corridor SEIS	
		In corridor	Within 5 kilometers	In corridor	Within 5 kilometers
Threatened or endangered species (categorized by type)					
Southwestern willow flycatcher (*Empidonax traillii extimus*)	B				•
Desert tortoise (*Gopherus agasizii*)	A/R	•		•	
Lahontan cutthroat trout[b] (*Oncorhynchus clarkii henshawi*)	F			•	

Table 5-3. Special status species, big game habitat, and herd management areas associated with the Carlin rail corridor[a] (page 2 of 3).

		Yucca Mountain FEIS		Nevada Rail Corridor SEIS	
Resource	Type	In corridor	Within 5 kilometers	Resource	Type
Sensitive species					
Pygmy rabbit (*Brachylagus idahoensis*)	M		●		●
Fringed myotis (*Myotis thysanodes*)	M		●		●
San Antonio pocket gopher (*Thomomys bottae curtatus*)	M	●		●	
Ferruginous hawk (nesting area) (*Buteo regalis*)	B	●	●	●	●
Amargosa toad (*Bufo nelsoni*)	A/R		●		●
Oasis Valley speckled dace (*Rhinichthys osculus*)	F		●		●
Big Smoky Valley speckled dace (*Rhinichthys osculus lariversi*)	F		●		●
Oasis Valley springsnail (*Pyrgulopsis micrococcus*)	MO		●		●
Crescent Dune aegialian scarab (*Aegialia crescenta*)	I		●		
Crescent Dunes serican scarab (*Serica ammomenisco*)	I				●
Eastwood milkweed (*Asclepias eastwoodiana*)	P				●
Funeral Mountain milkvetch (*Astragalus funereus*)	P		●		●
Nevada Sanddune beardtongue (*Penstemon arenarius*)	P	●	●	●	●
Ripley's springparsley/Sanicle biscuitroot (*Cymopterus ripleyi var. saniculoides*)	P				●
Toquima milkvetch (*Astragalus toquimanus*)	P				●
Game Habitat					
Elk *(Cervus canadensis)*	M	●		●	
Mule deer (*Odocoileus hemionus*)	M	●		●	
Pronghorn antelope (*Antilocapra americana*)	M	●		●	
Sage grouse (*Centrocercus urophasianus*)[c]	B	●		●[c]	

Table 5-3. Special status species, big game habitat, and herd management areas associated with the Carlin rail corridor[a] (page 3 of 3).

		Yucca Mountain FEIS		Nevada Rail Corridor SEIS	
Resource	Type	In corridor	Within 5 kilometers	Resource	Type
Wild horse and burro herd management areas					
Bald Mountain		●		●	
Callaghan		●		●	
Hickison		●		●	
Saulsbury		●		●	
Goldfield		●		●	
Gold Mountain					●
Nevada Wild Horse Range				●	
Stonewall		●		●	
Bullfrog		●		●	

Species Type Key: *M = Mammal; B = Bird; A/R = Amphibian or Reptile; F = Fish; MO = Mollusk; I = Insect; P = Plant*

a. Sources: Data collected from DIRS 182772-MTS 2007, pp. 105 to 106; DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, all).

b. Habitat for the Lahontan cutthroat trout, a threatened species under the Endangered Species Act, crosses the Big Smoky Valley and Monitor Valley options of the Carlin rail corridor north and northeast of Round Mountain in Nye County.

c. Portions of the Carlin rail corridor pass through winter habitat, brood rearing habitat, and nesting habitat of the sage grouse (Centrocercus urophasianus). Conservation of the greater sage grouse has become an important concern due to a decline in population and habitat. Since DOE completed the Yucca Mountain FEIS, the State of Nevada has developed a Greater Sage-Grouse Conservation Plan. This plan involves a number of state and federal agencies, including the Nevada Department of Wildlife, the California Department of Fish and Game, the Nevada and California BLM State Offices, and the U.S. Fish and Wildlife Service, among others. The Plan's highest priorities focus on maintaining sage-grouse habitats that are currently intact and highly productive. In addition, it emphasizes the enhancement of degraded seasonal habitats that have the greatest potential for recovery (DIRS 182772-Management and Technical Support Services 2007, all).

According to the Yucca Mountain FEIS, the impacts to soils would be transitory and small. The soils within the Carlin rail corridor and the potential impacts to these soils remain unchanged since DOE completed the Yucca Mountain FEIS.

5.2.5 CULTURAL RESOURCES

The effects of rail line construction in the Carlin rail corridor on cultural resources would be essentially the same as those DOE reported in the Yucca Mountain FEIS. Impacts to cultural resources from railroad operations in the Carlin rail corridor would be unlikely.

Cultural resources include any prehistoric or historic archaeological sites, buildings, structures, landscapes, or objects resulting from or modified by human activity and can include mining, ranching, and linear features such as roads and trails. Cultural resources designated as historic properties warrant consideration with regard to potential adverse impacts resulting from proposed federal actions.

For this update, DOE conducted an archaeological site file search using records from the Desert Research Institute, the Nevada Cultural Resources Information System, and archaeological information repositories at the Harry Reid Center at the University of Nevada-Las Vegas, and the Nevada State Museum in Carson City.

The records search revealed the presence of 120 known archaeological sites within the 400 meters (0.25 mile) width of the Carlin rail corridor. The difference between the 110 sites reported in the Yucca Mountain FEIS and the 120 identified in the new survey reflects the addition of sites recorded in the past decade, particularly in the vicinity of Yucca Mountain, where cultural resources inventories have been ongoing. Of the 120 known sites, 11 are eligible or potentially eligible for inclusion on the *National Register of Historic Places* (DIRS 182772-MTS 2007, p. 87).

The types of sites found in the new survey records are the same as those reported in the Yucca Mountain FEIS. The total amount of archaeological inventories conducted is approximately 3 percent of the total area for the Carlin rail corridor. Prior to construction of a rail line, field surveys and potentially mitigation of cultural resources would be required.

5.2.6 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

5.2.6.1 Industrial Safety

The categories of worker impacts include total recordable incidents, lost workdays, and fatalities. Recordable incidents or cases are occupational injuries or occupation-related illnesses that result in (1) a fatality, regardless of the time between the injury or the onset of the illness and death, (2) lost workday cases (nonfatal), and (3) incidents that result in the transfer of a worker to another job, termination of employment, medical treatment, loss of consciousness, or restriction of motion during work activities.

Revised estimates of the number of workers needed to construct the rail line resulted in 6,600 worker-years in comparison to the 1,230 worker-years estimated in the Yucca Mountain FEIS (2,000 hours per worker-year). Estimates of industrial safety impacts incorporate Bureau of Labor Statistics data for 2005 (DIRS 179131-BLS 2006, all; DIRS 179129-BLS 2007, all). The Yucca Mountain FEIS used 1998 data from the same source. Industrial safety impacts from operations in the Carlin rail corridor would be lower than those reported in the Yucca Mountain FEIS because of differences in the labor statistics used. Operation of the railroad would require about 60 workers each year an increase from 47 workers estimated in the Yucca Mountain FEIS. Table 5-4 lists estimated industrial safety impacts reported in the Yucca Mountain FEIS as well as the updated information.

5.2.6.2 Transportation

Since DOE completed the Yucca Mountain FEIS, there have been updates to the methods and data used to estimate the radiation doses for workers and members of the public. Section 2.2.3 of this Nevada Rail Corridor SEIS describes updates to the methods and data used to estimate impacts for the rail corridors. The impacts for the Carlin rail corridor reflect new information resulting from these changes.

Updates for transportation estimated impacts during construction from the transportation of construction materials to the construction sites and impacts from commuting workers. Operation of the railroad could result in incident-free radiological impacts, risks from radiological accidents, impacts from vehicle emissions from waste transportation and commuting workers, and traffic fatalities associated with waste transport and commuting workers.

The Yucca Mountain FEIS evaluated traffic fatality and vehicle emission impacts from the movement of equipment and delivery of materials for construction, worker commutes to and from construction sites, and transport of water to construction sites. Table 5-5 lists the impacts of transportation during the construction period. Due to the increased number of construction workers from the estimate in the Yucca Mountain FEIS, estimated traffic fatalities could increase from 1.1 to 4, and fatalities from exposure to

Table 5-4. Impacts to workers from industrial hazards during railroad construction and operations in the Carlin rail corridor.[a]

Group and industrial hazard category	Construction: Yucca Mountain FEIS[b]	Construction: Update[c]	Operations: Yucca Mountain FEIS[d]	Operations: Update[e]	Total: Yucca Mountain FEIS	Total: Update
Involved worker						
Total recordable cases[f]	99	300	95	50	194	350
Lost workday cases	49	170	52	38	101	208
Fatalities	0.14	0.59	0.26	0.35	0.4	0.94
Noninvolved worker						
Total recordable cases	5.9	30	5.4	12	11.3	42
Lost workday cases	2.2	16	2.0	6.4	4.2	22.4
Fatalities	0.006	0.04	0.006	0.02	.012	.06
Totals[g]						
Total recordable cases	110	330	100	61	210	391
Lost workday cases	51	180	54	44	105	224
Fatalities	0.14	0.6	0.27	0.4	0.41	1.0

a. Estimates of worker-years multiplied by accident rate (DIRS 179131-BLS 2006, all; DIRS 179129-BLS 2007, all).
b. Estimated workforce to construct the rail line would be 1,230 worker-years.
c. Estimated workforce to construct the rail line would be 6,600 worker-years.
d. Totals for 24 years for operations.
e. Totals for operations up to a 50-year period.
f. Total recordable cases include injuries, illnesses, and fatalities.
g. Totals might differ from sums of values due to rounding.

Table 5-5. Transportation impacts during railroad construction for the Carlin rail corridor.[a]

Transportation impact category	Traffic fatalities: Yucca Mountain FEIS	Traffic fatalities: Update	Number of cancers: Yucca Mountain FEIS	Number of cancers: Update	Total: Yucca Mountain FEIS	Total: Update
Vehicle emission impacts (cancer fatalities)						
Material delivery vehicles	–	–	0.04	0.04	0.04	0.04
Worker commuting	–	–	0.10	0.5	0.10	0.5
Transportation accidents (fatalities)						
Material delivery vehicles	0.3	0.3	–	–	0.3	0.3
Worker commuting	0.8	3.7	–	–	0.8	3.7
Totals[b]	1.1	4.0	0.14	0.6	1.54	4.6

a. Source: DIRS 182772-MTS 2007, p. 88.
b. Totals might differ from sums of values due to rounding.

vehicle emissions could increase from 0.14 to 0.6. Total transportation impacts from construction could be about 5 fatalities.

The transportation of spent nuclear fuel and high-level radioactive waste in the Carlin rail corridor could result in radiological and nonradiological impacts to workers and the public. Radiological impacts could result from radiation that the rail casks emitted during incident-free transportation, from radionuclides released from the rail cask during transportation accidents, or from radiation that the rail cask emitted because of a loss of shielding during a transportation accident. Nonradiological impacts (vehicle emission-related fatalities) would result from diesel locomotives and fugitive dust. Nonradiological impacts could also result from traffic accidents that involved workers and members of the public.

Table 5-6 lists the impacts of using the Carlin rail corridor to ship spent nuclear fuel and high-level radioactive waste calculated using updated methods and data. The impacts presented reflect those from the mainline to the repository. This is in contrast to the Yucca Mountain FEIS, where the Nevada impacts started where the mainline intersects the Nevada border.

Table 5-6. Operations impacts of transportation for the Carlin rail corridor.[a]

Transportation impact category	Traffic fatalities		Number of cancers		Total	
	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
Incident-free radiological impacts (LCFs)[b]						
Public (LCFs)	–	–	0.0012	0.000088		
Workers (LCFs)	–	–	0.31	0.33		
Radiological accident risks (LCFs)			0.000000037	0.000001		
Vehicle emission impacts (cancer fatalities)						
Waste transportation	–	–	0.0008	0.00038		
Worker commuting	–	–	0.09	0.4		
Transportation accidents (fatalities)						
Waste transportation	0.054	0.31	–	–		
Worker commuting	0.7	3.3	–	–		
Totals[c]	0.7	3.6	0.4	0.7	1.1	4.3

a. Source: DIRS 182772-MTS 2007, p. 90.
b. LCF = latent cancer fatality.
c. Totals might differ from sums of values due to rounding.

For members of the public, estimated radiological impacts from incident-free (routine) transportation decreased from those in the Yucca Mountain FEIS, from 0.0012 to 0.000088 latent cancer fatality. This would be due primarily to the change in analysis for the Nevada rail line to model dedicated trains for shipments to the repository (DIRS 182772-MTS 2007, p. 89), which would be partially offset by the increase in the latent cancer fatality conversion factor.

For workers, estimated radiological impacts from incident-free transportation would increase from 0.31 to 0.33 latent cancer fatality. The increase would be due primarily to the increase in the latent cancer fatality conversion factor, the use of additional escorts in all areas, and the estimation of impacts for uninvolved workers at the staging yard, which would be partially offset by the decrease in the exposure time at the staging yard.

Estimated radiological accident risks would increase from 0.000000037 to 0.000001 latent cancer fatality. This would be due primarily to the use of the combined Track Class 3 transportation accident rate (DIRS 182772-MTS 2007, p. 89) based on train kilometers and railcar kilometers and the increase in the latent cancer fatality conversion factor. Although this is an increase, radiological accident risk would still be a negligible contributor to the overall transportation risk.

Estimated impacts from waste transportation vehicle emissions would decrease from 0.0008 to 0.00038 fatality. This would be due primarily to decreases in populations along the Carlin rail corridor. Vehicle emission impacts from commuting workers could increase from those reported in the Yucca Mountain FEIS because of the longer operations phase.

Estimated impacts from nonradiological transportation accidents would increase from 0.054 to 0.31 fatality. This is the most notable change to accident risk and would be due primarily to the use of the updated rail fatality rate (DIRS 178016-DOT 2005, all) and from accounting for the presence of locomotives and buffer cars in the estimation of the number of nonradiological transportation accident fatalities. Due to the increase in the number of workers, traffic fatalities associated with commuting workers could also increase.

Overall, the estimated total number of transportation-related fatalities from operation of a railroad in the Carlin rail corridor has increased from 1.0 fatality reported in the Yucca Mountain FEIS to 4.3 fatalities in the current assessment. This change is due primarily to the increase in the number of fatalities from traffic accidents.

5.2.7 SOCIOECONOMICS

In the Yucca Mountain FEIS, DOE used construction costs, workforce estimates, and state and regional economic data to identify potential direct and indirect changes in state and regional economic activity. The Department noted that construction activities would cause short-term, temporary increases in employment and population.

Revised estimates of the number of workers needed to construct the rail line in the Carlin rail corridor resulted in 6,600 worker-years in comparison to the 1,230 worker-years estimated in the Yucca Mountain FEIS. Operation of the railroad would require about 42 workers each year in comparison to the 47 workers estimated in the Yucca Mountain FEIS.

The Yucca Mountain FEIS estimated population baselines for Clark, Nye, and Lincoln Counties and the Rest of Nevada on projections by state and local agencies including the Nevada State Demographer, Nye County, and Clark County, which was prepared by the University of Nevada Las Vegas. The rest of Nevada included Eureka, Lander, and Esmeralda Counties. The original baseline estimate was that the 2006 population in the region of influence would be approximately 1.73 million. The updated baseline, which incorporates the Nevada State Demographer's more current data, indicates that the estimated 2006 population in the region was approximately 1.94 million (DIRS 182772-MTS 2007, p. 90).

Clark County, which includes Las Vegas, dominates the region of influence with a 2006 estimated population of 1.89 million, which is approximately 7 percent more than the population that DOE reported in the Yucca Mountain FEIS. Population growth in the unincorporated town of Pahrump dominates Nye County's growing popularity as a residential destination. Since DOE completed the Yucca Mountain FEIS, Pahrump, the largest population center in Nye County, has experienced double-digit growth. The estimated population of Pahrump increased from 23,000 in July 1999 to 33,000 by July 2005, an increase of about 45 percent. In the same period, the State Demographer estimates that Nye County as a whole grew from a population of about 31,000 to about 41,000. The Carlin rail corridor would pass near the towns of Beatty and Tonopah. The State Demographer estimated the 2005 population of Beatty to be slightly over 1,000 and the 2005 population of Tonopah to be about 2,600 (DIRS 182772-MTS 2007, p. 91). The average annual impact from the construction and operation of a railroad to the baselines population in Clark, Nye, and Lincoln Counties and the rest of Nevada would be small.

Because the construction workforce is expected to come largely from Clark County and the Carson City/Washoe County area, any changes to the regional employment and population baselines would be small. Changes in employment and population in Nye and Lincoln Counties, including the communities within those counties, is unlikely because workers would lives near the rail line and would be unlikely to return to Nye or Lincoln Counties as permanent residents once construction ends. Current population growth in these counties would mask socioeconomic impacts due to the short-term growth in the workforce or the associated impact on population growth.

5.2.8 NOISE AND VIBRATION

The Yucca Mountain FEIS analysis for noise considered typical day-night sound levels, the distance of the rail line from communities along the rail line, and estimated the impacts from the construction and operation of a railroad to these communities. The Yucca Mountain FEIS analysis for vibration considered typical background level of ground vibration, the number of trains, and the distance of the rail line to historic structures or sites of cultural significance, and estimated the impacts from the operation of a railroad. There are no significant new circumstances or information that would cause the affected environment or the estimated impacts from noise or vibration to change from what was reported in the Yucca Mountain FEIS.

5.2.9 AESTHETICS

Based on a corridor-level analysis and an evaluation of current BLM resource management plans, there have been no changes to Visual Resource Management classifications for the Carlin rail corridor since DOE completed the Yucca Mountain FEIS. Under the current BLM plans, the Carlin rail corridor would pass through Visual Resource Management Class IV lands. Therefore, impacts would be the same as those discussed in the Yucca Mountain FEIS.

5.2.10 UTILITIES, ENERGY, AND MATERIALS

The Yucca Mountain FEIS evaluated utilities, energy, and materials impacts common to all corridors and noted that these impacts would include the use of motor fuel, steel, and concrete. The estimated impacts from these resources associated with the construction and operation of a railroad in Nevada would be small, similar to those in the Yucca Mountain FEIS.

The Carlin rail corridor would pass through rural parts of Nye, Esmeralda, Lander, and Eureka Counties in Nevada that have little access to support services. Electric power for construction would be initially supplied by portable generators. New power lines would be installed to provide power for construction services and would be extended, via underground distribution along the rail roadbed to meet all other construction and operational needs. Construction equipment would consume motor fuel (diesel and gasoline). The total motor fuel use in Nevada in 2005 was about 5.8 billion liters (1.5 billion gallons) (DIRS 182772-MTS 2007, p. 91). Highway motor fuel use in the state in 2005 increased 6.2 percent over that in 2004, the largest percentage increase for any state and attributable to Nevada's growing population. Table 5-7 lists the estimated amounts of diesel fuel and gasoline for construction for the Carlin rail corridor, which are higher than the estimates in the Yucca Mountain FEIS. The annual average use of motor fuel would be about 0.52 percent of that consumed annually in Nevada. Unlike overall state use, construction activities would use primarily diesel fuel, which would be about 2.1 percent of all special fuel (mainly diesel) used annually in Nevada.

Steel for rails, concrete (principally for rail ties, bridges, and drainage structures), and rock for ballast would be the primary materials that the construction of a rail line would consume. Table 5-7 lists estimates of steel and concrete consumption, which have changed from those in the Yucca Mountain FEIS.

Table 5-7. Construction fuel and materials impacts for the Carlin rail corridor.[a]

	Diesel fuel use (million liters)[d]		Gasoline use (million liters)		Steel (thousand metric tons)[e]		Concrete (thousand metric tons)	
Length (kilometers)[b,c]	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
530	40	110	0.82	2.4	74	86	414	330

a. Source of Update: DIRS 180877-Nevada Rail Partners 2007, p. 2-7, Table 2-1; DIRS 182772-MTS 2007, p. 92.
b. Corridor length used for comparative evaluation.
c. To convert kilometers to miles, multiply by 0.623.
d. To convert liters to gallons, multiply by 0.264.
e. To convert metric tons to tons, multiply by 1.102.

The estimated impacts to utilities, energy, and materials from the operation of a railroad in Nevada would be small, similar to those in the Yucca Mountain FEIS. The use of motor fuel by locomotives would increase over that in the Yucca Mountain FEIS due to more weekly train trips.

5.2.11 WASTE MANAGEMENT

The Yucca Mountain FEIS evaluated common waste management impacts for all corridors rather than for individual corridors. Information to allow differentiation between corridor waste management impacts is now much more readily available. Therefore, DOE has included this information at a level of analysis that was similar to the Yucca Mountain FEIS.

Waste generation and management impacts common to all corridors would result from construction and operation a railroad in the Carlin rail corridor. There would be relatively minor quantities of industrial, hazardous, and sanitary waste.

The Yucca Mountain FEIS estimated the peak annual generation of sanitary solid waste would be 910 metric tons (1,000 tons). DOE now estimates that solid municipal waste from construction facilities would be 750 metric tons (830 tons) during the peak year of construction. An assumed 25 percent of the waste would be recyclable, which would result in 570 metric tons (620 tons) for disposal at municipal landfills. The estimated total mass of waste that would be generated during rail line construction is about 2,000 metric tons (2,200 tons). This mass of sanitary solid waste would occupy about 5,100 cubic meters (6,600 cubic yards) of landfill volume at a waste density of 410 kilograms per cubic meter (700 pounds per cubic yard) (DIRS 182772-MTS 2007, p. 92). The estimated average daily disposal mass would be about 1.6 metric tons (1.7 tons) per day.

For the landfills in rural counties, this would represent a potential increase in volume of waste requiring processing. The Goldfield landfill, which serves a population of fewer than 1,500 people in Esmeralda County, received about 3.6 metric tons (4 tons) of solid waste per day in 2003 (DIRS 182772-MTS 2007, p. 92). Disposal of solid waste generated during the construction phase would represent nearly a 50-percent increase in daily waste volume for the Goldfield landfill and could hasten its estimated closure date of 2023. Nye County disposed of about 250 metric tons (280 tons) of waste during 2003 at three different landfills (DIRS 182772-MTS 2007, p. 92), but the county plans to close two of these landfills by 2011, which would represent 96 percent of the county's current waste disposal capacity. The Austin and Battle Mountain landfills in Lander County disposed of about 2.7 and 12 metric tons (3 and 13 tons) per day, respectively, in 2003; their estimated closure dates are 2041 and 2069. For comparison, the Apex Landfill in Clark County, which serves the Las Vegas Valley, receives 8,000 metric tons (8,800 tons) each day (DIRS 174041-State of Nevada 2004, pp. 6 and 7). Waste generated during construction could be trucked to larger landfills with small impact on waste disposal capacity.

Railroad operations would periodically generate waste during maintenance activities. Locomotive and railcar maintenance could generate used oil and solvents that DOE would recycle or dispose of as regulated waste.

5.2.12 ENVIRONMENTAL JUSTICE

The Yucca Mountain FEIS environmental justice analysis considered the potential for disproportionately high and adverse impacts on two segments of the overall population—minority communities and low-income communities. In the Yucca Mountain FEIS, DOE employed a criterion for identifying minority and low-income communities by applying a 10-percent threshold, meaning that the environmental analyses for environmental justice purposes focused on Census blocks and Census block groups having minority or low-income populations at least 10 percent higher than state averages.

For Nevada Rail Corridor SEIS, DOE adopted new criteria based upon revised NRC guidance. The new criteria are Census blocks having a 50 percent or higher minority population (10 percent higher than the State average), and Census block groups having a 30.5 percent low-income population (20 percent higher than the State average).

Updates for the 2000 U.S. Census Bureau block group data used in the Yucca Mountain FEIS to examine the location and concentration of low income populations were not available at the time DOE completed the Yucca Mountain FEIS. Instead, the Yucca Mountain FEIS used 1990 U.S. Census Bureau block group data to identify low income populations. For Nevada Rail Corridor SEIS, DOE used the more current 2000 U.S. Census Bureau block group data to identify both low income and minority populations. The next set of comprehensive Census Bureau data will not be released until the 2010 Census, thus, the 2000 data is still considered the most current data set. The region of influence identified in the Yucca Mountain FEIS for the Carlin rail corridor has remained the same. Furthermore, county level U.S. Census Bureau data estimates for 2006 suggest that while the population in southern Nevada is growing rapidly, the location of concentrations of minority and low income populations have remained relatively constant and static since 2000 (DIRS 182772-MTS 2007, p. 93).

DOE concluded in the Yucca Mountain FEIS that there would not be any high and adverse impacts from transportation of spent nuclear fuel and high-level radioactive waste in Nevada on any populations, and that disproportionately high and adverse effects would be unlikely for any specific segment of the population, including minorities and low-income communities. DOE further concluded that there were no special pathways (unique practices and activities creating opportunities for increased impacts) that could not be mitigated. Therefore, the Yucca Mountain FEIS concluded that there were no environmental justice impacts associated with any proposed rail corridor.

Since the DOE completed the Yucca Mountain FEIS, DOE has not identified any new large and adverse impacts to any population. DOE has also not identified any new minority or low income populations in the Carlin rail corridor region of influence, and has not identified any special pathways that could increase impacts to these populations. Therefore, DOE maintains that there would be no environmental justice impacts associated with the Carlin rail corridor.

5.3 Jean Rail Corridor

Table 5-8 summarizes the results of the update to the primary impact indicators for the Jean rail corridor and compares them with the corridor information published in the Yucca Mountain FEIS. The information reflects the total for the construction and operation of the rail corridor unless otherwise noted.

Table 5-8. Updated environmental information for the Jean rail corridor (page 1 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Corridor length	No change
Land ownership	
BLM-administered land	Yucca Mountain FEIS: 15,000 to 17,000 acres (60 to 69 square kilometers (about 83 percent)
	Updated analysis: 15,000 to 18,000 acres (61 to 73 square kilometers) (85.5 to 87.2)
Private land	No change
Nevada Test Site land	No change
Air quality	
National Ambient Air Quality Standards attainment Status	The Pahrump area in Nye County is now subject to a Memorandum of Understanding with regulatory agencies to better control fugitive emissions of PM_{10} and thereby avoid being designated a nonattainment area.
Hydrology	
Surface water	No change
Groundwater use (construction)	Yucca Mountain FEIS: 405 acre-feet (500,000 cubic meters)
	Updated analysis: 3,380 acre-feet (4.17 million cubic meters)
Biological resources and soils	Two additional sensitive species recorded
Cultural resources (records search)	Yucca Mountain FEIS: 6 recorded sites
	Updated analysis: 45 recorded sites
Occupational and public health and safety	
Industrial hazards (construction and operations)	
Total recordable cases	Yucca Mountain FEIS: 148
	Updated analysis: 246
Lost workday cases	Yucca Mountain FEIS: 76
	Updated analysis: 143
Fatalities	Yucca Mountain FEIS: 0.3
	Updated analysis: 0.9
Transportation hazards (construction only)	
Traffic fatalities	Yucca Mountain FEIS: 0.7
	Updated analysis: 2.5
Cancer fatalities	Yucca Mountain FEIS: 0.09
	Updated analysis: 0.3
Incident-free radiological impacts (latent cancer fatalities) (operations only)	
Public	Yucca Mountain FEIS: 0.00085
	Updated analysis: 0.00019
Workers	Yucca Mountain FEIS: 0.22
	Updated analysis: 0.21
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	Yucca Mountain FEIS: 0.000000015
	Updated analysis: 0.0000018
Cancer fatalities from vehicle emissions	Yucca Mountain FEIS: 0.07
	Updated analysis: 0.3

Table 5-8. Updated environmental information for the Jean rail corridor (page 2 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Nonradiological transportation accident fatalities	
Spent nuclear fuel and high-level radioactive waste transportation	Yucca Mountain FEIS: 0.019 Updated analysis: 0.11
Construction and operations workforce	Yucca Mountain FEIS: 0.5 Updated analysis: 2
Socioeconomics	
Estimated construction workforce	Yucca Mountain FEIS: 855 worker-years Updated analysis: 4,100 worker-years
Estimated operations workforce	Yucca Mountain FEIS: 36 workers per year Updated analysis: 32 workers per year
Noise and vibration	No changes
Aesthetics	No changes
Utilities, energy, and materials (amount used)	
Diesel	Yucca Mountain FEIS: 6.9 million gallons (26 million liters) Updated analysis: 22.7 million gallons (86 million liters)
Gasoline	Yucca Mountain FEIS: 1.3 million gallons (0.5 million liters) Updated analysis: 4.2 million gallons (1.6 million liters)
Steel	Yucca Mountain FEIS: 28,000 tons (26,000 metric tons) Updated analysis: 33,000 tons (30,000 metric tons)
Concrete	Yucca Mountain FEIS: 165,000 tons (150,000 metric tons) Updated analysis: 132,000 tons (120,000 metric tons)
Waste management	
Sanitary Solid Waste	Updated analysis: 1 ton (0.91 metric ton) per day
Environmental justice (disproportionately high and adverse impacts)	No changes, none identified

The Jean rail corridor would originate at the existing Union Pacific Railroad Mainline near Jean, Nevada. It would travel northwest near Pahrump, Town of Amargosa Valley, Jean, Goodsprings, Sand Spring, and Lathrop Wells before it reached Yucca Mountain. The State Line option would pass near Primm, Nevada.

Jean rail corridor options would range from 180 to 200 kilometers (110 to 130 miles) long. Figure 5-4 shows the corridor and its options. The Yucca Mountain FEIS contains detailed corridor and option descriptions.

5.3.1 LAND USE AND OWNERSHIP

The following paragraphs discuss information gathered in relation to land use in the Jean rail corridor since DOE completed the Yucca Mountain FEIS. The change in the estimates of the amount of BLM-administered land and private property within this corridor are in part the result of using more accurate databases of land ownership for this Nevada Rail Corridor SEIS. Land use and ownership conflicts with commercial growth have increased since those reported in the Yucca Mountain FEIS.

The Yucca Mountain FEIS reported that the BLM administered approximately 83 percent of the land in the corridor (60 to 69 square kilometers [15,000 to 17,000 acres]), DOE managed 12 percent (8.5 square kilometers [2,100 acres), and approximately 5 percent was private land (0.1 to 3.5 square kilometers [25 to 865 acres]).

Current land holdings for the Jean rail corridor are as follows: BLM-administered land, approximately 85 to 87 percent (61 to 73 square kilometers [15,000 to 18,000 acres); DOE land, approximately 10 to 13 percent (8.8 square kilometers [2,200 acres]); and private land, about 0.19 to 4.2 percent (0.1 to 3.5 square kilometers [25 to 870 acres]). The Jean rail corridor has two options, Wilson Pass and Stateline Pass, off the Union Pacific Railroad mainline. The Wilson Pass option would cross private property at the Bluejay, Snowstorm, and Pilgrim mines and run south of the Toiyabe National Forest in the Spring Mountains (Figure 5-4). The western option of the Jean rail corridor in Pahrump Valley also would intersect private property. The eastern option in that area would avoid those private parcels.

The Yucca Mountain FEIS reported that the Wilson Pass option would cross the Old Spanish Trail/Mormon Road special recreation management area, and four areas that the BLM has designated as available for sale or transfer. The option would be within approximately 1.6 kilometer (1 mile) of the Toiyabe National Forest. There have been no changes to the status of these areas since DOE completed the Yucca Mountain FEIS. The Yucca Mountain FEIS also reported that the Jean rail corridor would cross two wild horse and burro herd management areas and a BLM Class II Visual Resource Area (see Sections 5.3.4 and 5.3.9, of this Nevada Rail Corridor SEIS, respectively).

The Stateline Pass option would begin in Ivanpah Valley and cross through the proposed Ivanpah Valley Airport in the area between Interstate Highway 15 and the Union Pacific Railroad rail line. Clark County was considering the construction of the airport when DOE completed the Yucca Mountain FEIS. On October 27, 2000, President Clinton signed the Ivanpah Valley Airport Public Land Transfer Act, which permitted the Secretary of the Interior to convey public lands for sale to the Clark County Department of Aviation (Public Law 106-362, 114 Stat. 1404). Since DOE completed the Yucca Mountain FEIS, the Clark County Department of Aviation has purchased the property and is preparing an EIS (*Notice of Intent To Prepare an Environmental Impact Statement for the Southern Nevada Supplemental Airport, Clark County, NV, and To Conduct Public Scoping Meetings*, 71 *FR* 52367, September 5, 2006). If constructed, the Ivanpah Valley Airport, which is now called the Southern Nevada Supplemental Airport, would be a major public air carrier serving the greater Las Vegas metropolitan area, second to McCarran International Airport; Figure 5-5 shows the location of the proposed airport in relation to the Jean rail corridor.

The Stateline Pass option would cross the California-Nevada boundary and would cross into the Stateline Wilderness Area established by the California Desert Conservation Act. This wilderness area designation remains unchanged since DOE completed the Yucca Mountain FEIS.

DOE evaluated information in the Mineral Resources Data System and the Abandoned Mine database (DIRS 182772-MTS 2007, p. 96) to determine if there are any newly located mines, active or abandoned, since DOE completed the Yucca Mountain FEIS. In addition to the mines reported in the Yucca Mountain FEIS, the primary alignment for Jean would cross an abandoned mine and Purple Sage Claims. The Wilson Pass option would cross the Red Cloud Mine. Of these, Purple Sage Claims is an occurrence mine site, which means there has been discovery of an outcrop and there might be some land disturbance, but there is no mining operation underway at present. Red Cloud Mine is a past producer, which means mining occurred in the past but no mining operation is underway at present (DIRS 182772-MTS 2007, p. 96).

According to the Yucca Mountain FEIS, the Jean rail corridor would cross as many as eight BLM grazing allotments, depending on the option. The BLM has since updated their grazing allotment information. Updated information indicates that the Jean rail corridor and its options would cross up to 10 allotments: Mount Sterling, Wheeler Wash, Younts Spring, Stump Spring, Black Butte, Table Mountain, Spring

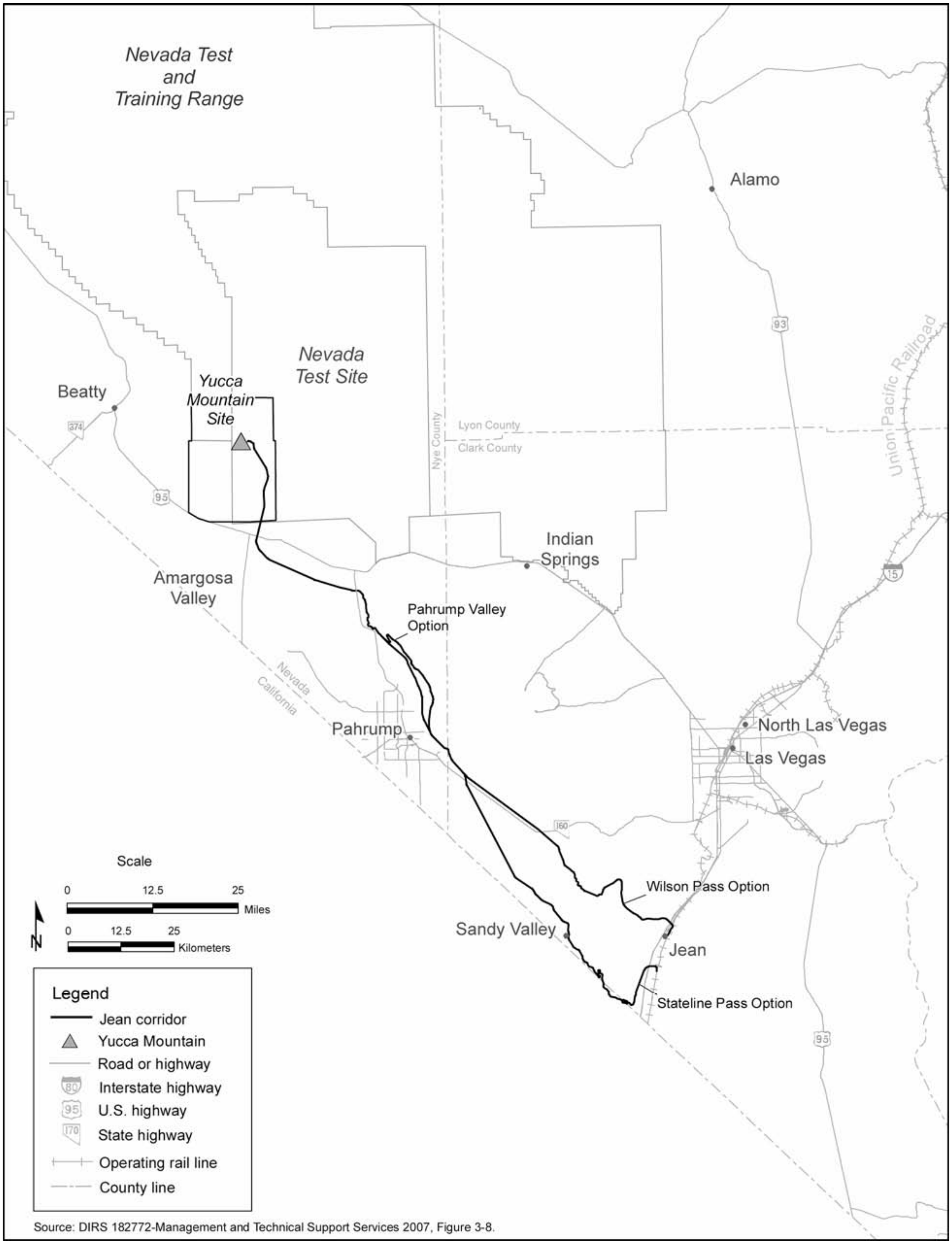


Figure 5-4. Jean rail corridor and options (2002).

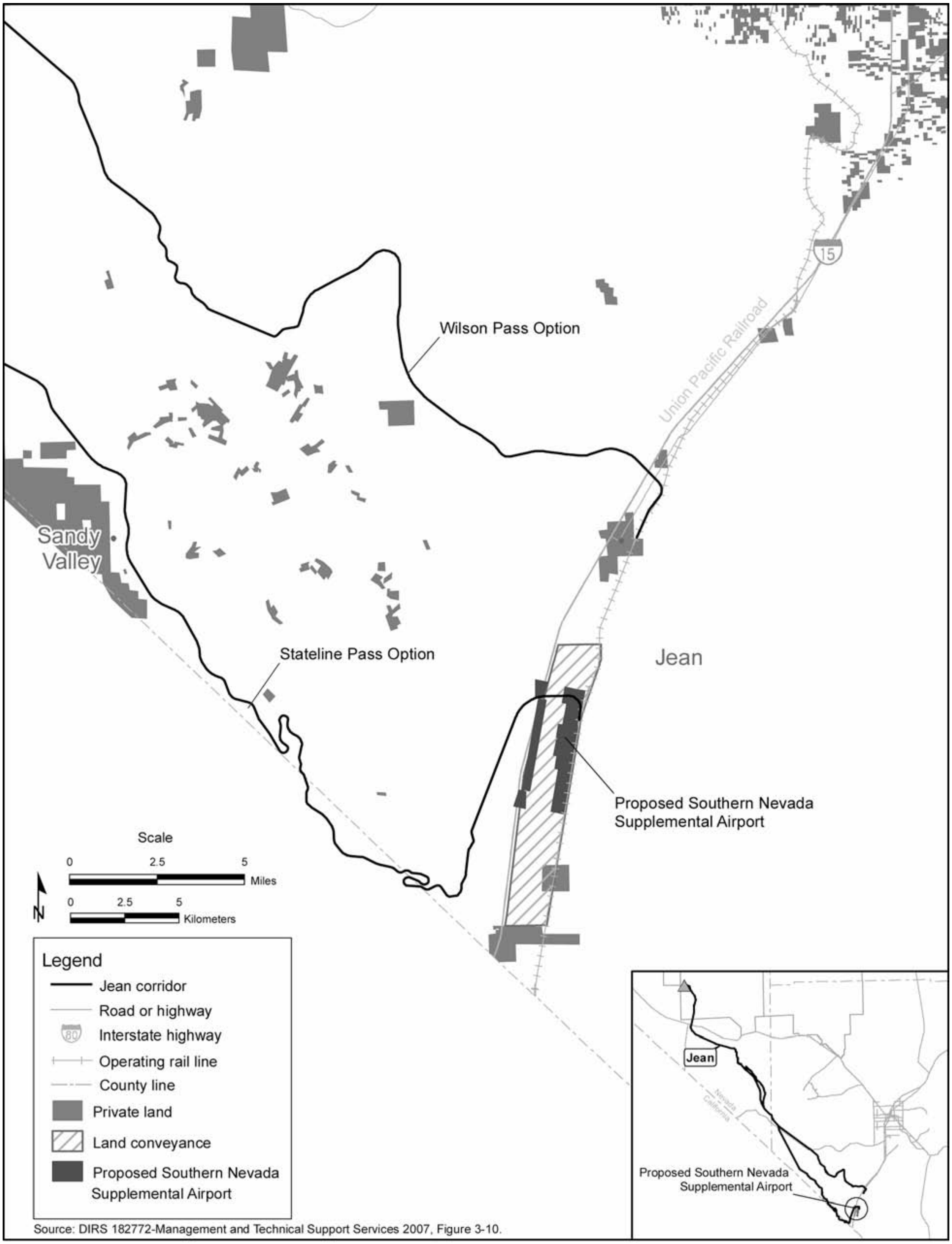


Figure 5-5. Location of proposed Southern Nevada Supplemental Airport.

Mountain, Roach Lake, two allotments BLM has designated as unused, and one designated as private (DIRS 182772-MTS 2007, p. 96).

The Yucca Mountain FEIS reported the Jean rail corridor would cross linear land features such as rights-of-way for utilities and roads. A review of BLM land records, including Master Title Plats, indicated the authorization of additional rights-of-way since DOE completed the Yucca Mountain FEIS (DIRS 182772-MTS 2007, p. 96).

5.3.2 AIR QUALITY

The Yucca Mountain FEIS evaluated air quality impacts common to all proposed rail corridors and noted that the impacts would include temporary increases in criteria pollutant concentrations from construction of the rail line. Construction equipment would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$. Construction activities would emit PM_{10} and $PM_{2.5}$ in the form of fugitive dust from land clearing and filling, equipment traffic, activity of a quarry, and operation of concrete batch plants. The emissions would be temporary and would cover a large area as construction progressed along the length of the corridor.

Areas in violation of one or more of the criteria pollutant standards are classified as nonattainment areas. If there is not enough air quality data to determine the status of a remote or sparsely populated area, then the Environmental Protection Agency lists the area as unclassifiable and are considered to be in attainment. The Jean rail corridor would pass through rural parts of Clark and Nye Counties in Nevada and one option would pass through a portion of rural San Bernardino County in California. A portion of the corridor would be in the Pahrump Valley in Nye County. At the time DOE completed the Yucca Mountain FEIS, these rural areas were all either unclassifiable or in attainment for criteria pollutants.

Since that time, however, the town of Pahrump and the nearby surrounding area have experienced double-digit growth and resultant development (DIRS 182772-MTS 2007, p. 102). The development has led to areas of cleared land, which has increased fugitive dust emissions. The Nevada Bureau of Air Quality Planning began monitoring the ambient air quality in Pahrump in January 2001. During 2001, 2002, and 2003 the 24-hour ambient air standard for PM_{10} was exceeded 27 times. Under the Clean Air Act, this means that Pahrump is no longer attaining the 24-hour standard of 150 micrograms per cubic meter (DIRS 182772-MTS 2007, p. 102). However, the U.S. Environmental Protection Agency has revoked, effective December 17, 2006 (71 *FR* 61144), the annual standard for PM_{10} from the National Ambient Air Quality Standards, citing a lack of evidence that links health problems to long-term exposure to coarse particle pollution.

In September 2003, the Environmental Protection Agency Region IX Administrator, the Nevada Division of Environmental Protection Administrator, the Nye County Board of Commissioners, and the Pahrump Town Board signed the Memorandum of Understanding and implement a Clean Air Action Plan for the Pahrump Valley and defines the limits of the plan as Nevada Hydrographic Area 162. It sets measurable and enforceable milestones for the development and implementation of a Clean Air Action Plan, which will serve as the area's official air quality improvement plan, with quantified emission reduction measures. If a Plan milestone is not achieved, the area will receive a traditional nonattainment area designation and be subject to federal requirements to meet air quality standards.

Under the conditions of the Memorandum of Understanding, Nye County will have until 2009 to bring the area into attainment. Control strategies were to have been in place by 2006 and are to remain in place to ensure that the Pahrump Valley continues to attain the air quality standards in the future.

During preparation of the Yucca Mountain FEIS, DOE conducted an air quality conformity review for the Jean rail corridor and determined that a conformity determination was not necessary because the entire corridor area was either in attainment or unclassifiable for criteria pollutants (DIRS 182772-MTS 2007, p. 102). Since the original air quality conformity review, the State of Nevada has monitored the town of Pahrump for ambient concentrations of PM_{10} and has signed the Memorandum of Understanding to improve air quality in the vicinity of Pahrump.

Because of the effective change in PM_{10} attainment status for the Pahrump Valley portion of the Jean rail corridor, this update used the air quality conformity review conducted for the Jean rail corridor in support of the Yucca Mountain FEIS to estimate potential PM_{10} emissions for comparison to the air quality General Conformity threshold level. A portion of the Jean rail corridor would cross the Las Vegas Valley, which was and remains a nonattainment area for PM_{10} and carbon monoxide (DIRS 182772-MTS 2007, p. 103).

The PM_{10} emissions for Jean rail route construction activities could exceed the General Conformity threshold level of 63 metric tons (70 tons) per year. Reviews of updated and more detailed information and methods (DIRS 180921-Nevada Rail Partners 2007, all; DIRS 180877-Nevada Rail Partners 2007, all) considered rail line construction and additional contributions from access roads, unpaved roads, storage piles, a batch plant, coarse stockpiles, and a quarry. The reviews indicated potential construction fugitive dust and PM_{10} emissions would increase above those originally estimated for the Yucca Mountain FEIS. Before any construction activities in the Jean rail corridor and Pahrump Valley, DOE would need to perform more detailed air quality calculations to evaluate the impacts of construction activities.

The State of Nevada has prepared a 2001 base-year emissions inventory for the Pahrump Valley area of 110,000 metric tons (120,000 tons) per year (DIRS 182772-MTS 2007, p. 103). The estimated emissions for rail line construction in the Jean rail corridor would be about 0.78 percent of this base-year inventory. A comparison for future years is not possible until finalization of the Clean Air Action Plan or State Implementation Plan.

Potential air quality impacts during rail line operation would result from diesel locomotives, which would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, $PM_{10,}$ and $PM_{2.5}$. Because the earthwork is complete, the extent of these impacts would be smaller during operations than during construction activities but would last longer. The number of locomotive engines in use and the associated operational characteristics would not differ appreciably from those in the Yucca Mountain FEIS. Therefore, there should be no measurable differences in potential impacts from those in the Yucca Mountain FEIS.

5.3.3 HYDROLOGY

This section describes surface-water and groundwater resources and impacts to those resources. The Yucca Mountain FEIS analyzed surface-water resources within the 400-meter (0.25-mile)-wide corridor and within 1 kilometer (0.6 mile) of each side of the corridor. For this Nevada Rail Corridor SEIS, the region of influence for hydrology was the same as for the Yucca Mountain FEIS.

5.3.3.1 Surface Water

There are no lakes, streams, or other perennial surface-water features along the Jean rail corridor or its options. The corridor and its options would cross seven mapped 100-year flood zones or flood zone groups (DIRS 155970-DOE 2002, Table 6-61). These remain unchanged since DOE completed the Yucca Mountain FEIS.

Impacts to surface-water resources from construction and operation of a railroad in the Jean rail corridor would be the same as those in the Yucca Mountain FEIS for all three options. Although unlikely, the spread of construction-related materials by precipitation or intermittent runoff events could occur during rail line construction. Impacts associated with changes in drainage patterns or to erosion and sedimentation rates or locations would be small and localized.

5.3.3.2 Groundwater

In the Yucca Mountain FEIS, the Department used terrain types to estimate total water demand. Since DOE completed the Yucca Mountain FEIS, DOE has canvassed similar projects throughout Nevada and determined that the amount and type of earthwork, not the terrain, would more accurately estimate total water demand associated with the construction of a rail line. Therefore, DOE updated the water demand based on earthwork needs. This resulted in an estimated water demand for the Jean rail corridor of approximately 4.17 million cubic meters (3,400 acre-feet) (DIRS 180877-Nevada Rail Partners 2007, p. 2-7) compared to the estimate based on terrain types reported in the Yucca Mountain FEIS of 500,000 cubic meters (410 acre-feet). To accommodate this increase in estimated water demand, DOE would need to draw more water than originally estimated in the Yucca Mountain FEIS from the underlying hydrographic basins and pump from additional wells. Groundwater withdrawal could temporarily affect discharge from nearby wells or springs. DOE would conduct detailed analyses if new wells required for construction of the rail line were to be located near other water sources.

Construction of a rail line would require water for soil compaction, dust control, and workforce use. Water use during construction would come primarily from groundwater resources, specifically from hydrographic basins. If the hydrographic basin is designated, permitted groundwater rights approach or exceed the estimated perennial yield, water resources are being depleted or require additional administration, and the Nevada State Engineer has declared preferred uses of the water. Table 5-9 updates the designation status of the hydrographic basins and the percentage of the Jean rail corridor that is in the respective basins. The total percentage of the Jean rail corridor in designated basins is about 87 percent. The Yucca Mountain FEIS estimated that about 90 percent of the length of the Jean rail corridor would be in designated basins.

Table 5-9. Hydrographic basins associated with the Jean rail corridor.[a,b]

Hydrographic basin (and subbasin where applicable)	Length (kilometers)[c]	Percentage of total[d]	Designated
Amargosa Desert	42	23	Yes
Fortymile Canyon/Jackass Flats	21	12	No
Ivanpah Valley/Southern Part	31	17	Yes
Mesquite Valley	20	11	Yes
Pahrump Valley	64	35	Yes
Rock Valley	3.3	1.8	No

a. Source: DIRS 182772-MTS 2007, p. 104.
b. To calculate water demand for each basin, multiply the total water demand for a given corridor by the percentage of total.
c. km = kilometer; to convert kilometers to miles, multiply by 0.62137.
d. Based on primary option in Yucca Mountain FEIS.

Operations along the completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

5.3.4 BIOLOGICAL RESOURCES AND SOILS

Potential impacts to biological resources and soils from the construction and operation of a railroad in the Jean rail corridor would be consistent with those reported in the Yucca Mountain FEIS. Maximum land disturbance for the construction of a rail line in the Jean rail corridor would not differ from the estimates in the Yucca Mountain FEIS and therefore the potential impacts would not change.

Consistent with the Yucca Mountain FEIS, this update considered the potential for impacts to vegetation communities; special status species (plants and animals), including their habitat; springs, wetlands, and riparian areas; big game habitat; and wild horse and burro herd management areas that may occur within the 400-meter (0.25-mile)-wide corridor. The analysis considered special status species and big game habitat within 5 kilometers (3 miles) of the corridor that may be affected by construction of the rail line. DOE also analyzed springs and riparian areas that could be affected by permanent changes in surface-water flows.

5.3.4.1 Biological Resources

The area encompassing the Jean rail corridor is in the Mojave Desert; the predominant land-cover types are creosote-bursage, Mojave mixed scrub, and blackbrush.

Table 5-10 presents the special status species, big game habitat, and herd management areas identified in the Yucca Mountain FEIS and identifies additional information resulting from this update. The updated version of the NNHP database examined for Nevada Rail Corridor SEIS included observations of two additional sensitive species not included in the Yucca Mountain FEIS. They are the Half-ring milkvetch/ Mojave milkvetch (*Astragalus mohavensis* var. *hemygurus*) and the Spring Mountains pyrg (*Pyrgulopsis deaconi*).

DOE evaluated surface-water resources, which include springs, streams, riparian areas, and reservoirs for all options. No springs, perennial streams, or riparian areas occur within the Jean rail corridor. These remain unchanged since DOE completed the Yucca Mountain FEIS. Eleven springs or groups of springs are outside the corridor, but are within 5 kilometers (3 miles) of the corridor.

There are no other known changes to the existence of game habitat, sensitive species, or springs in or within 5 kilometers (3 miles) of the Jean rail corridor in comparison to information in the Yucca Mountain FEIS. The Ash Meadows National Wildlife Refuge is 9 kilometers (about 6 miles) outside the Jean rail corridor.

5.3.4.2 Soils

The Yucca Mountain FEIS classified soils in the rail corridor locations with four attributes: shrink swell, erodes easily, unstable fill, and blowing soil. As noted in the Yucca Mountain FEIS, the shrink swell and blowing soils attributes are common in the Jean rail corridor, although a portion of the corridor would pass through areas that consist of soils with erodes easily and unstable fill attributes. The Yucca Mountain FEIS also reported that there were no soils classified as prime farmlands within the Jean rail corridor. No significant new information was identified on the attributes of the soils surveyed in the Jean rail corridor.

The Yucca Mountain FEIS reported the construction of the Jean rail corridor would temporarily disturb soils in and adjacent to 9.3 square kilometers (2,300 acres) of land. Disturbance of erodible soils could lead to increased silt loads in water courses or increased soil transport by wind. Erosion control during construction, and revegetation or other means of soil stabilization after construction, would minimize

Table 5-10. Special status species, big game habitat, and herd management areas associated with the Jean rail corridor[a] (page 1 of 2).

Resource	Type	Yucca Mountain FEIS		Nevada Rail Corridor SEIS	
		In corridor	Within 5 kilometers	In corridor	Within 5 kilometers
Threatened or endangered species (separated by type)					
Desert tortoise (*Gopherus agasizii*)	A/R	●		●	
Pahrump poolfish (*Empertrichthys latos*)	F				●
Sensitive Species					
Allen's big-eared bat (*Idionycteris phyllotis*)	M		●		●
Fringed myotis (*Myotis thysanodes*)	M		●		●
Long-legged myotis (*Myotis volans*)	M		●		●
Townsend's big-eared bat (*Corynorhinus townsendii*)	M	●		●	
Yuma myotis (*Myotis yumanensis*)	M	●		●	
Gila monster (*Heloderma suspectum cinctum*)	A/R		●		●
Oasis Valley springsnail (*Pyrgulopsis micrococcus*)	MO		●		●
Spring Mountains pyrg (*Pyrgulopsis deaconi*)	MO				●
Redheaded sphecid wasp (*Eucerceris ruficeps*)	I		●		●
Death Valley beardtongue (*Penstemon fruticiformis ssp. amargosae*)	P		●		●
Desert bearpoppy (*Arctomecon merriamii*)	P		●		●
Half-ring milkvetch/ Mojave milkvetch (*Astragalus mohavensis* var. *hemygurus*)	P				●
Pinto beardtongue (*Penstemon bicolor spp.*)	P	●	●	●	●
Pahrump Valley buckwheat (*Eriogonum bifurcatum*)	P		●		●
Rusby's globemallow (*Sphaeralcea rusbyi*)	P		●		●
Sheep fleabane (*Erigeron ovinus*)	P		●		●
Spring Mountain milketch (*Astragalus remotus*)	P		●		●
White-Margined beardtongue (*Penstemon albomarginatus*)	P	●		●	
Wolly sage (*Salvia funerea*)	P	●		●	

Table 5-10. Special status species, big game habitat, and herd management areas associated with the Jean rail corridor[a] (page 2 of 2).

Resource	Type	Yucca Mountain FEIS		Nevada Rail Corridor SEIS	
		In corridor	Within 5 kilometers	In corridor	Within 5 kilometers
Game Habitat					
Bighorn sheep *(Ovis canadensis)*	M	●		●	
Mule deer *(Odocoileus hemionus)*	M	●		●	
Chukar *(Alectoris chukar)*	B	●		●	
Quail *(Callipepla gambelii)*	B	●		●	
Wild horse and burro herd management areas					
Ash Meadows					●
Johnnie		●		●	
Wheeler Pass		●		●	
Red Rock		●		●	
Species Type Key:	*M = Mammal* *B = Bird* *A/R = Amphibian or Reptile* *F = Fish*			*MO = Mollusk* *I = Insect* *P = Plant*	

a. Sources: Data collected from DIRS 182772-MTS 2007, pp. 105 to 106; DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, all).

these concerns. Impacts to soils in the corridor, including its options, would be small, but could occur throughout construction. The soils within the Jean rail corridor and the potential impacts to these soils remain unchanged DOE completed the Yucca Mountain FEIS.

5.3.5 CULTURAL RESOURCES

The effects of rail line construction in the Jean rail corridor on cultural resources would be essentially the same as those DOE reported in the Yucca Mountain FEIS. Impacts to cultural resources from operation of a rail line in the Jean rail corridor would be unlikely.

Cultural resources include any prehistoric or historic archaeological sites, buildings, structures, landscapes, or objects resulting from or modified by human activity and include mining, ranching, and linear features such as roads and trails. Cultural resources designated as historic properties warrant consideration with regard to potential adverse impacts resulting from proposed federal actions.

For this update, DOE conducted an archaeological site file search using records from the Desert Research Institute, the Nevada Cultural Resources Information System, and archaeological information repositories at the Harry Reid Center at the University of Nevada-Las Vegas, and the Nevada State Museum in Carson City.

The records search revealed the presence of 45 known archaeological sites within the 400 meters (0.25 mile) width of the Jean rail corridor. The difference between the six sites reported in the Yucca Mountain FEIS and the 45 identified in the new survey reflects the addition of sites recorded in the past decade, particularly in the vicinity of Yucca Mountain, where cultural resources inventories have been ongoing. Of the 45 known sites, 11 are eligible or potentially eligible for inclusion on the *National Register of Historic Places* (DIRS 182772-MTS 2007, p. 107).

The types of sites found in the new survey records are the same as those reported in the Yucca Mountain FEIS. The total amount of archaeological inventories conducted is approximately less than 1 percent of the total area for the Jean rail corridor. Prior to construction of a rail line, field surveys and potentially mitigation of cultural resources would be required.

5.3.6 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

5.3.6.1 Industrial Safety

The categories of worker impacts include total recordable incidents, lost workdays, and fatalities. Recordable incidents or cases are occupational injuries or occupation-related illnesses that result in (1) a fatality, regardless of the time between the injury or the onset of the illness and death, (2) lost workday cases (nonfatal), and (3) incidents that result in the transfer of a worker to another job, termination of employment, medical treatment, loss of consciousness, or restriction of motion during work activities.

Revised estimates of the number of workers needed to construct the rail line resulted in 4,100 worker-years in comparison to the 855 worker-years estimated in the Yucca Mountain FEIS (2,000 hours per worker-year). Estimates of industrial safety impacts incorporate updated Bureau of Labor Statistics data for 2005 (DIRS 179131-BLS 2006, all; DIRS 179129-BLS 2007, all). The Yucca Mountain FEIS used 1998 data from the same source. Industrial safety impacts from operations in the Jean rail corridor would be lower than those in the Yucca Mountain FEIS because of differences in the labor statistics used. Operation of the railroad would require about 32 workers each year. Table 5-11 lists estimated industrial safety impacts reported in the Yucca Mountain FEIS as well as the updated information.

Table 5-11. Impacts to workers from industrial hazards during railroad construction and operations for the Jean rail corridor.[a]

Group and industrial hazard category	Construction		Operations		Total	
	Yucca Mountain FEIS[b]	Update[c]	Yucca Mountain FEIS[d]	Update[e]	Yucca Mountain FEIS	Update
Involved worker						
Total recordable cases[f]	67	180	73	37	140	217
Lost workday cases	33	100	40	28	73	128
Fatalities	0.09	0.36	0.20	0.26	0.29	0.62
Noninvolved worker						
Total recordable cases	4.0	19	4.1	8.9	8.1	27.9
Lost workday cases	1.5	10	1.5	4.8	3.0	14.8
Fatalities	0.004	0.03	0.004	0.01	.008	.04
Totals[e]						
Total recordable cases	71	200	77	46	148	246
Lost workday cases	35	110	41	33	76	143
Fatalities	0.10	0.6	0.20	0.3	0.3	0.9

a. Estimates of worker-years multiplied by accident rate (DIRS 179131-BLS 2006, all; DIRS 179129-BLS 2007, all).
b. Estimated workforce to construct the railroad would be 855 worker-years.
c. Estimated workforce to construct the railroad would be 4,100 worker-years.
d. Totals for 24 years for operations.
e. Totals for 33 years of operations within a 50-year period.
f. Total recordable cases include injuries, illnesses, and fatalities.

5.3.6.2 Transportation

Since DOE completed the Yucca Mountain FEIS, there have been updates to the methods and data to estimate the radiation doses for workers and members of the public. Section 3.2.6 of this Nevada Rail Corridor SEIS describes updates to the methods and data used to estimate impacts for the rail corridors. The impacts for the Jean rail corridor reflects new information resulting from these changes.

Updates for transportation estimated impacts during construction from the transportation of construction materials to the construction sites and impacts from commuting workers. Operation of the railroad could result in incident-free radiological impacts, risks from radiological accidents, impacts from vehicle emissions from waste transportation and commuting workers, and traffic fatalities associated with waste transport and commuting workers.

The Yucca Mountain FEIS evaluated traffic fatality and vehicle emission impacts from the movement of equipment and delivery of materials for construction, worker commutes to and from construction sites, and transport of water to construction sites. Table 5-12 lists the impacts of transportation during the construction period. Due to the increased number of construction workers from the estimate in the Yucca Mountain FEIS, estimated traffic fatalities could increase from 0.7 to 2.5, and fatalities from exposure to vehicle emissions could increase from 0.09 to 0.3. Total transportation impacts from construction could be about 2.8 fatalities.

Table 5-12. Transportation impacts during railroad construction for the Jean rail corridor.[a]

	Traffic fatalities		Number of cancers		Total	
Transportation impact category	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
Vehicle emission impacts (cancer fatalities)						
Material delivery vehicles	–	–	0.02	0.02	0.02	0.02
Worker commuting	–	–	0.07	0.3	0.07	0.3
Transportation accidents (fatalities)						
Material delivery vehicles	0.2	0.2	–	–	0.2	0.2
Worker commuting	0.5	2.3	–	–	0.5	2.3
Totals[b]	0.7	2.5	0.09	0.3	0.79	2.8

a. Source: DIRS 182772-MTS 2007, p. 109.
b. Totals might differ from sums of values due to rounding.

The transportation of spent nuclear fuel and high-level radioactive waste in the Jean rail corridor would result in radiological and nonradiological impacts to workers and the public. Radiological impacts would result from radiation that the rail casks emitted during incident-free transportation, from radionuclides released from the rail cask during transportation accidents, or from radiation that the rail cask emitted because of a loss of shielding during a transportation accident. Nonradiological impacts (vehicle emission-related fatalities) could result from diesel locomotives and fugitive dust. Nonradiological impacts could also result from traffic accidents that involved workers and members of the public.

Table 5-13 lists the impacts of using the Jean rail corridor to ship spent nuclear fuel and high-level radioactive waste calculated using updated methods and data. The impacts presented reflect those from the mainline to the repository. This is in contrast to the Yucca Mountain FEIS, where the Nevada impacts started where the mainline intersects the Nevada border.

For members of the public, estimated radiological impacts from incident-free (routine) transportation decreased from those in the Yucca Mountain FEIS, from 0.00085 to 0.00019 latent cancer fatality. This would be due primarily to the change in analysis for the Nevada rail line to model dedicated trains for shipments to the repository (DIRS 182772-MTS 2007, p. 110), which would be partially offset by the increase in the latent cancer fatality conversion factor.

For workers, estimated radiological impacts from incident-free transportation would decrease from 0.22 to 0.21 latent cancer fatality. The decrease would be due primarily to the decrease in the exposure time at the staging yard, which would partially offset by the increase in the latent cancer fatality conversion factor, the use of escorts in all areas, and the estimation of impacts for non involved workers at the staging yard.

Estimated radiological accident risks increased from 0.000000015 to 0.0000018 latent cancer fatality. This would be due primarily to the use of the combined Track Class 3 transportation accident rate (DIRS 182772-MTS 2007, p. 110) based on train kilometers and railcar kilometers and the increase in the latent cancer fatality conversion factor, and the increase in the population along the Jean rail corridor. Although this is an increase, radiological accident risk would still be a negligible contributor to the overall transportation risk.

Table 5-13. Operations impacts of transportation for the Jean rail corridor.[a]

Transportation impact category	Traffic fatalities		Number of cancers	
	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
Incident-free radiological impacts (LCFs)[b]				
Public (LCFs)	–	–	0.00085	0.00019
Workers (LCFs)	–	–	0.22	0.21
Radiological accident risks (LCFs)	-	-	0.000000015	0.0000018
Vehicle emission impacts (cancer fatalities)				
Waste transportation	–	–	0.00032	0.00083
Worker commuting	–	–	0.07	0.3
Transportation accidents (fatalities)				
Waste transportation	0.019	0.11	–	–
Worker commuting	0.5	2.0	–	–
Totals[c]	0.52	2.1	0.3	0.5

a. Source: DIRS 182772-MTS 2007, pp. 109 to 110.
b. LCF = latent cancer fatality.
c. Totals might differ from sums of values due to rounding.

Estimated impacts from waste transportation vehicle emissions would increase from 0.00032 to 0.00083 fatality. This would be due primarily to the increase in populations along the Jean rail corridor. Vehicle emission impacts from commuting workers could increase from those reported in the Yucca Mountain FEIS because of the longer operations phase.

Estimated impacts from nonradiological transportation accidents would increase from 0.019 to 0.11 fatality. This is the most notable change to accident risk and would be due primarily to the use of the updated rail fatality rate (DIRS 178016-DOT 2005, all) and from accounting for the presence of locomotives and buffer cars in the estimation of the number of nonradiological transportation accident fatalities. Traffic fatalities associated with commuting workers could also increase due to the increase in the numbers or workers.

Overall, the estimated total number of transportation-related fatalities from operation of a rail line in the Jean rail corridor has increased from 0.82 fatality reported in the Yucca Mountain FEIS to 2.6 fatalities in the current assessment. This change is due primarily to the increase in the number of fatalities from traffic accidents.

5.3.7 SOCIOECONOMICS

In the Yucca Mountain FEIS, DOE used construction costs, workforce estimates, and state and regional economic data to identify potential direct and indirect changes in state and regional economic activity. The Department noted that construction activities would cause short-term, temporary increases in employment and population.

Revised estimates of the number of workers needed to construct the rail line in the Jean rail corridor resulted in 4,100 worker-years in comparison to the 855 worker-years estimated in the Yucca Mountain FEIS. Operation of the railroad would require about 32 workers each year in comparison to the 36 workers estimated in the Yucca Mountain FEIS.

Clark County, which includes Las Vegas, dominates the region of influence with a 2006 estimated population of 1.89 million, which is approximately 7 percent more than the population that DOE reported in the Yucca Mountain FEIS. Population growth in the unincorporated town of Pahrump dominates Nye County's growing popularity as a residential destination. Since DOE completed the Yucca Mountain FEIS, Pahrump, the largest population center in Nye County, has experienced double-digit growth. The estimated population of Pahrump increased from 23,000 in July 1999 to 33,000 by July 2005, an increase of about 45 percent (DIRS 182772-MTS 2007, p. 111). In the same period, the State Demographer estimates that Nye County as a whole grew from about 31,000 to about 41,000. The average annual impact from the construction and operation of a railroad to the baselines population in Clark and Nye Counties would be small.

Because the construction workforce is expected to come largely from Clark County and the Carson City area, any changes to the regional employment and population baselines would be small. Changes in employment and population in Nye County, including the communities within that county, is unlikely because workers would live near the rail line and would be unlikely to return to Nye County as permanent residents once construction ends. Current population growth in these counties would mask socioeconomic impacts due to the short-term growth in the workforce or the associated impact on population growth.

5.3.8 NOISE AND VIBRATION

The Yucca Mountain FEIS analysis for noise considered typical day-night sound levels, the distance of the rail line from communities along the rail line, and estimated the impacts from the construction and operation of a railroad to these communities. The Yucca Mountain FEIS analysis for vibration considered typical background level of ground vibration, the number of trains, and the distance of the rail line from to historic structures or sites of cultural significance, and estimated the impacts from the operation of a railroad. There are no significant new circumstances or information that would cause the affected environment or the estimated impacts from noise or vibration to change from what was reported in the Yucca Mountain FEIS.

5.3.9 AESTHETICS

Based on a corridor-level analysis and an evaluation of current BLM resource management plans, there have been no changes to Visual Resource Management classifications for the Jean rail corridor since

DOE completed the Yucca Mountain FEIS. As discussed in the Yucca Mountain FEIS, the Wilson Pass Option of the Jean rail corridor would pass through Visual Resource Management Class II areas. The BLM established objective for Class II areas, in order to retain the existing character of the landscape, is that the level of change to the characteristic landscape should be low. Therefore, impacts from the construction and operation of the railroad would continue to be a conflict with the visual resource classification.

5.3.10 UTILITIES, ENERGY, AND MATERIALS

The Yucca Mountain FEIS evaluated utilities, energy, and materials impacts common to all corridors and noted that these impacts would include use of motor fuel, steel, and concrete. The estimated impacts from these resources associated with the construction and operation of a railroad in Nevada would be small, similar to those in the Yucca Mountain FEIS.

The Jean rail corridor would pass through rural parts of Clark and Nye Counties in Nevada, and one of the options would cross a portion of rural San Bernardino County in California, that have little access to support services for much of the corridor. Electric power for construction would be initially supplied by portable generators. New power lines would be installed to provide power for construction services and would be extended, via underground distribution along the rail roadbed to meet all other construction and operational needs. Construction equipment would consume motor fuel (diesel and gasoline). The total motor fuel use in Nevada in 2005 was about 5.8 billion liters (1.5 billion gallons) (DIRS 182772-MTS 2007, p. 111). Highway motor fuel use in the State in 2005 increased 6.2 percent over that in 2004, the largest percentage increase for any state and attributable to Nevada's growing population. Table 5-14 lists the estimated amounts of diesel fuel and gasoline for rail line construction in the Jean rail corridor, which are higher than the estimates in the Yucca Mountain FEIS. Based on a construction period of 43 months, the annual average use of motor fuel would be about 0.42 percent of that consumed annually in Nevada. Unlike overall state use, construction activities would use primarily diesel fuel, which would be about 1.6 percent of all special fuel (mainly diesel) used annually in Nevada.

Steel for rails, concrete (principally for rail ties, bridges, and drainage structures), and rock for ballast would be the primary materials that the construction of a rail line would consume. Table 5-14 lists estimates of steel and concrete consumption, which have increased over those reported in the Yucca Mountain FEIS.

The estimated impacts to utilities, energy, and materials from the operation of a railroad in Nevada would be small and similar to those in the Yucca Mountain FEIS. The use of motor fuel by locomotives would increase over that in the Yucca Mountain FEIS due to more weekly train trips, but the overall use would still be small.

5.3.11 WASTE MANAGEMENT

The Yucca Mountain FEIS evaluated common waste management impacts for all corridors rather than for individual corridors. Information to allow differentiation between corridor waste management impacts is now much more readily available. Therefore, this information has been included at a level of analysis that was similar to the Yucca Mountain FEIS.

Table 5-14. Construction energy and materials impacts for the Jean rail corridor.[a]

Length (kilometers)[b,c]	Diesel fuel use (million liters)[d]		Gasoline use (million liters)		Steel (thousand metric tons)[e]		Concrete (thousand metric tons)	
	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
180	26	86	0.5	1.6	26	30	150	120

a. Update source: DIRS 180877-Nevada Rail Partners 2007, p. 2-7, Table 2-1; DIRS 182772-MTS 2007, p. 112.
b. Corridor length used for comparative evaluation.
c. To convert kilometers to miles, multiply by 0.623.
d. To convert liters to gallons, multiply by 0.264.
e. To convert metric tons to tons, multiply by 1.102.

Waste generation and management impacts common to all corridors would result from construction and operation a railroad in the Jean rail corridor. There would be relatively minor quantities of construction debris and sanitary waste.

The Yucca Mountain FEIS estimated the peak annual generation of sanitary solid waste would be 910 metric tons (1,000 tons). DOE now estimates that solid municipal waste from construction facilities would be 500 metric tons (550 tons) during the peak year of construction. An assumed 25 percent of the waste would be recyclable, which would result in about 380 metric tons (410 tons) of waste to be disposed of at municipal landfills. The estimated total mass of waste that would be generated during construction of the rail line is about 1,200 metric tons (1,300 tons). This mass of sanitary solid waste would occupy about 2,900 cubic meters (3,800 cubic yards) of landfill volume at a waste density of 410 kilograms per cubic meter (700 pounds per cubic yard) (DIRS 182772-MTS 2007, p. 112). Heavier equipment used at large facilities such as the Apex Landfill in Clark County would result in greater waste compaction and less waste volume. The estimated average daily disposal mass would be about 1 metric ton (1.1 tons) per day.

A rail line in the Jean rail corridor would represent an increase in waste volume requiring processing for rural counties. Nye County disposed of about 250 metric tons (280 tons) of waste during 2003 at three different landfills (DIRS 182772-MTS 2007, p. 112), but the county plans to close two of these landfills by 2011, which represent 96 percent of the county's current waste disposal capacity. The Apex Landfill in Clark County serves the Las Vegas Valley and receives 8,000 metric tons (8,800 tons) each day (DIRS 174041-State of Nevada 2004, pp. 6 and 7). The estimated closure for this landfill is in 2047. Waste generated during construction could be trucked to the larger landfill with negligible impact on waste disposal capacity.

Operations would generate waste during periodic maintenance activities. Locomotive and railcar maintenance could generate used oil and solvents that DOE would recycle or dispose of as regulated waste.

5.3.12 ENVIRONMENTAL JUSTICE

The Yucca Mountain FEIS environmental justice analysis considered the potential for disproportionately high and adverse impacts on two segments of the overall population – minority communities and low-income communities. In the Yucca Mountain FEIS, DOE employed a criterion for identifying minority and low-income communities by applying a 10-percent threshold, meaning that the environmental analyses for environmental justice purposes focused on Census blocks and Census block groups having minority or low-income populations at least 10-percent higher than state averages.

For this Nevada Rail Corridor SEIS, DOE adopted new criteria based upon revised U.S. Nuclear Regulatory Commission guidance. The new criteria are Census blocks having a 50 percent or higher minority population (for example, 10 percent higher than the state average), and Census block groups having a 30.5 percent low-income population (for example 20 percent higher than the state average).

Updates for the 2000 U.S. Census Bureau block group data used in the Yucca Mountain FEIS to examine the location and concentration of low income populations were not available at the time DOE completed the Yucca Mountain FEIS. Instead, the Yucca Mountain FEIS used 1990 U.S. Census Bureau block group data to identify low income populations. For Nevada Rail Corridor SEIS, DOE used the more current 2000 U.S. Census Bureau block group data to identify both low income and minority populations. The next set of comprehensive Census Bureau data will not be released until the 2010 Census, thus, the 2000 data is still considered the most current data set. The region of influence identified in the Yucca Mountain FEIS for the Jean rail corridor has remained the same. Furthermore, county level U.S. Census Bureau data estimates for 2006 suggest that while the population in southern Nevada is growing rapidly, the location of concentrations of minority and low-income populations have remained relatively constant and static since 2000 (DIRS 182772-MTS 2007, p. 113).

DOE concluded in the Yucca Mountain FEIS that there would not be any high and adverse impacts from transportation of spent nuclear fuel and high-level radioactive waste in Nevada on any populations, and that disproportionately high and adverse effects would be unlikely for any specific segment of the population, including minorities and low-income communities. DOE further concluded that there were no special pathways (unique practices and activities creating opportunities for increased impacts) that could not be mitigated. Therefore, the Yucca Mountain FEIS concluded that there were no environmental justice impacts associated with any proposed rail corridor.

Since DOE completed the Yucca Mountain FEIS, DOE has not identified any new large and adverse impacts to any population. DOE has also not identified any new minority or low income populations in the Jean rail corridor region of influence, and has not identified any special pathways that could increase impacts to these populations. Therefore, DOE maintains that there would be no environmental justice impacts associated with the Jean rail corridor.

5.4 Valley Modified Rail Corridor

Table 5-15 summarizes the results of the update to the primary impact indicators for the Valley Modified rail corridor and compares them with the corridor information published in the Yucca Mountain FEIS. The information reflects the total for the construction and operation of the rail corridor unless otherwise noted.

The Valley Modified rail corridor would originate near the existing Apex rail siding off the Union Pacific Railroad Mainline. It would travel northwest and pass north of the City of North Las Vegas, and Las Vegas and near the Town of Indian Springs and parallel to U.S. Highway 95 before it entered the southwest corner of the Nevada Test Site and reached Yucca Mountain (see Figure 5-6).

Valley Modified rail corridor options would range from 157 to 163 kilometers (98 to 101 miles) long. Figure 5-6 shows the corridor and its options. The corridor has two possible starting locations and two possible options until they merge north of the City of Las Vegas in the Apex area. The Valley Modified rail corridor has three options – Valley Connection, Sheep Mountain, and Indian Hills. The Yucca Mountain FEIS contains detailed descriptions of the corridor and its options.

5.4.1 LAND USE AND OWNERSHIP

Much has changed in relation to the land-use and ownership in the Valley Modified rail corridor since DOE issued the Yucca Mountain FEIS. The change in the estimates of the amount of BLM-administered land and private property within this corridor are in part the result of using more accurate databases of land ownership for Nevada Rail Corridor SEIS. Notable changes include potential land use conflicts with Creech Air Force Base and Apex Industrial Park. In addition, Congress has since released the Quail Springs and Nellis A, B, and C Wilderness Study Areas from Wilderness Study Area status, which expanded the land disposal boundary for the Las Vegas area.

The Yucca Mountain FEIS reported that the BLM administered approximately 53 percent (30 to 37 square kilometers [7,400 to 9,000 acres]) of the land in the corridor, the Department of Defense managed 11 percent (3.6 to 7.5 square kilometers [900 to 1,900 acres]), DOE managed 32 percent (20.6 square kilometers [5,100 acres]), the Fish and Wildlife Service controlled 3 percent (1.7 to 4.1 square kilometers [420 to 1,000 acres]), and less than 1 percent was private land (DIRS 182772-MTS 2007, p. 115).

Current land holdings for the Valley Modified rail corridor are as follows, the BLM administers about 51 to 54 percent (31 to 36 square kilometers [7,700 to 8,900 acres]), the Department of Defense manages 7.5 to 13 percent (4.3 to 9.4 square kilometers [1,100 to 2,300 acres]), DOE manages 32 percent (unchanged), the U.S. Fish and Wildlife Service controls about 3 percent (unchanged), and less than 1 percent is private land (unchanged) (DIRS 182772-MTS 2007, p. 115).

In 2005, the U.S. Air Force designated the Indian Springs Air Force Auxiliary Airfield to Creech Air Force Base and expanded its mission and infrastructure (GlobalSecurity.org 2005). The base is home to two key military operations: the MQ-1 Predator unmanned aerial vehicle and the Unmanned Aerial Vehicle Battle laboratory. The Yucca Mountain FEIS reported the Valley Modified rail corridor would pass through this area, which at the time was predominantly vacant land under Air Force management. At present, the corridor would cross infrastructure the Air Force constructed to support the mission of Creech Air Force Base. The Indian Hills option would bypass this land-use conflict.

The Apex Industrial Park is an 85-square-kilometer (21,000-acre) area privately held by the VesCor real estate development company. It is approximately 21 kilometers (13 miles) northeast of downtown Las Vegas and about 6 kilometers (4 miles) from the Las Vegas metropolitan area. It is one of the few large contiguous industrial properties in Southern Nevada. Since DOE issued the Yucca Mountain FEIS, this industrial park has gone beyond a proposed activity to one in which 24 square kilometers (6,000 acres) is available for immediate sale and development, with nearly half already sold (DIRS 182772-MTS 2007, p. 116). The Valley Modified rail corridor would cross approximately 0.5 square kilometers (110 acres) of the Apex Industrial Park.

The BLM is currently preparing an EIS and initiating public scoping for UNEV, LLC, proposal to construct and operate a liquid petroleum products pipeline from Woods Cross, Utah, to the Apex Industrial Park in Nevada. This proposed activity is approximately 13 kilometers (8 miles) north of the Valley Modified rail corridor.

Table 5-15. Updated environmental information for the Valley Modified rail corridor (page 1 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Corridor length	No change
Land ownership	
BLM-administered land	Yucca Mountain FEIS: 7,400 to 9,100 acres (29.9 to 36.7 square kilometers (approximately 53 percent) Updated analysis: 7,700 to 8,900 acres (31 to 36 square kilometers) (51 to 53.7 percent)
Private land	Yucca Mountain FEIS: 49 acres (0.18 square kilometer) (about 3 percent) Updated analysis: 49 to 99 acres (0.2 to 0.4 square kilometer) (about 0.3 to 0.6 percent)
Nevada Test and Training Range land	Yucca Mountain FEIS: 900 to 1,900 acres (3.6 to 7.5 square kilometers) (about 11 percent) Updated analysis: 900 to 1,900 acres (4.3 to 9.4 square kilometers) (about 7.5 to 13.3 percent)
Nevada Test Site land	No change
U.S. Fish and Wildlife Service	No change
Air quality	
National Ambient Air Quality Standards attainment status	No change (potential for construction air quality impacts from PM_{10} and carbon monoxide)
Hydrology	
Surface water	No change
Groundwater use (construction)	Yucca Mountain FEIS: 395 acre-feet (395,000 cubic meters) Updated analysis: 320 acre-feet (3.44 million cubic meters)
Biological resources and soils	Six additional sensitive species recorded
Cultural resources (records search)	Yucca Mountain FEIS: 19 recorded sites Updated analysis: 45 recorded sites
Occupational and public health and safety	
Industrial hazards (construction and operations)	
Total recordable cases	Yucca Mountain FEIS: 111 Updated analysis: 176
Lost workday cases	Yucca Mountain FEIS: 57 Updated analysis: 103
Fatalities	Yucca Mountain FEIS: 0.25 Updated analysis: 0.5
Transportation hazards (construction only)	
Traffic fatalities	Yucca Mountain FEIS: 0.4 Updated analysis: 1.5
Cancer fatalities	Yucca Mountain FEIS: 0.05 Updated analysis: 0.2

Table 5-15. Updated environmental information for the Valley Modified rail corridor (page 2 of 2).

Resource	Changes from the Yucca Mountain FEIS to this analysis
Occupational and Public Health and Safety (continued)	
Incident-free radiological impacts (latent cancer fatalities) (operations only)	
Public	Yucca Mountain FEIS: 0.00065 Updated analysis: 0.00014
Workers	Yucca Mountain FEIS: 0.22 Updated analysis: 0.21
Radiological transportation accident fatalities	
Radiological accident risk (latent cancer fatalities)	Yucca Mountain FEIS: 0.0000000029 Updated analysis: 0.0000013
Cancer fatalities from vehicle emissions	Yucca Mountain FEIS: 0.07 Updated analysis: 0.2
Nonradiological transportation accident fatalities	
Spent nuclear fuel and high-level radioactive waste transportation	Yucca Mountain FEIS: 0.016 Updated analysis: 0.095
Construction and operations workforce	Yucca Mountain FEIS: 0.5 Updated analysis: 1.3
Socioeconomics	
Estimated construction workforce	Yucca Mountain FEIS: 405 worker-years Updated analysis: 2,500 worker-years
Estimated operations workforce	Yucca Mountain FEIS: 36 workers per year Updated analysis: 32 workers per year
Noise and vibration	No changes
Aesthetics	No changes
Utilities, energy, and materials (amount used)	
Diesel	Yucca Mountain FEIS: 3.4 million gallons (13 million liters) Updated analysis: 13 million gallons (49 million liters)
Gasoline	Yucca Mountain FEIS: 0.07 million gallons (0.27 million liters) Updated analysis: 0.26 million gallons (1 million liters
Steel	Yucca Mountain FEIS: 24,000 tons (22,000 metric tons) Updated analysis: 29,000 tons (26,000 metric tons)
Concrete	Yucca Mountain FES: 143,000 tons (130,000 metric tons) Updated analysis: 110,000 tons (100,000 metric tons)
Waste management	
Sanitary solid waste	Updated analysis: 0.7 tons (0.6 metric tons)per day
Environmental justice (disproportionately high and adverse impacts)	No changes, none identified

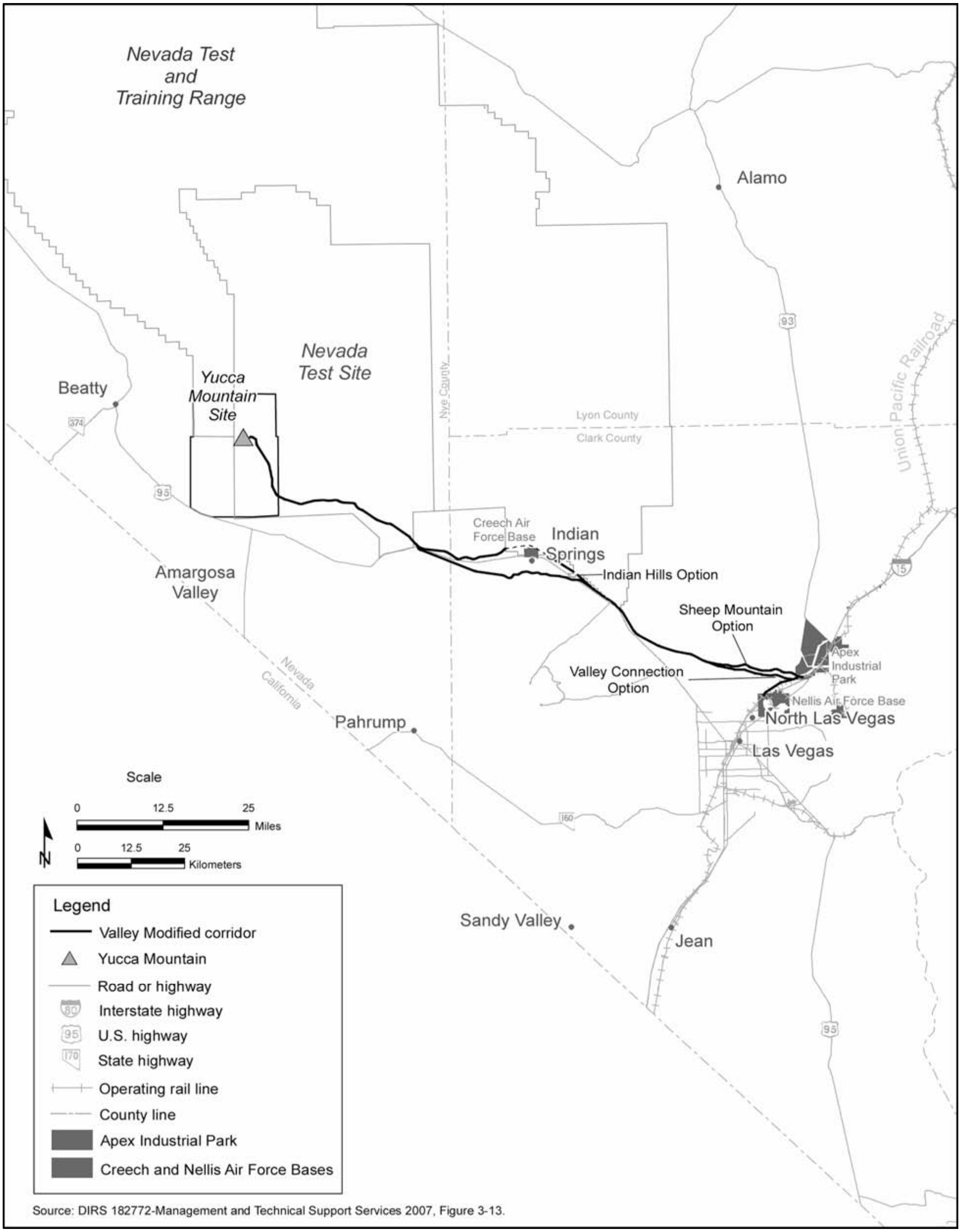


Figure 5-6. Valley Modified rail corridor and options.

The Yucca Mountain FEIS reported the corridor would cross the Quail Springs and Nellis A, B, and C Wilderness Study Areas, and one area designated as available for sale or transfer. In particular, the Indian Hills option would cross U.S. Fish and Wildlife Service lands, would pass almost entirely within a BLM utility corridor, and would cross a BLM Withdrawal Area for a power project. The Sheep Mountain option would pass through Quail Springs and Nellis A, B, and C Wilderness Study Areas, and the Nellis Small Arms Range. Of these land uses, the only changes have been to Quail Springs and Nellis A, B, and C. The Clark County Conservation of Public Land and Natural Resources Act (Public Law 107-282, 116 Stat. 1994) released these areas from the designation of Wilderness Study Areas in 2002 thus expanding the land disposal boundary for the Las Vegas area. The land formerly containing the Quail Springs Wilderness Study Area was sold to Clark County in 2002. The land formerly containing Nellis A, B, and C's have not yet been sold. These areas are under consideration for conservation areas to protect rare plant species, and will undergo NEPA analysis before the BLM offers these for sale or transfer.

The Yucca Mountain FEIS reported the Sheep Mountain option would pass through the Desert National Wildlife Refuge. Upon further evaluation, the Sheep Mountain and Valley Connection Options, and a portion of the common corridor segment just north of these options would pass through the Desert National Wildlife Refuge. The Desert National Wildlife Refuge established in 1936 includes a 610-square-kilometer (1.5-million-acre) area to protect the desert bighorn sheep and its habitat. In 1979, approximately 580 square kilometers (1.4 million acres) of this land were found to be suitable for further consideration as wilderness and were proposed for designation as a unit of the National Wilderness Preservation System. This means the area remains in proposed wilderness status and is managed as wilderness in accordance with National Wildlife Refuge System policy; public use is limited to wildlife observation, primitive camping, and picniking. This current land status would present a land conflict. According to the U.S. Fish and Wildlife Service, the Comprehensive Conservation Plan Environmental Impact Statement process, currently underway, is evaluating the wilderness status of this area (DIRS 182772-MTS 2007, p. 116).

The Yucca Mountain FEIS reported the corridor would cross three BLM grazing allotments (Wheeler Slope, Indian Springs, and Las Vegas Valley). The BLM has since updated their grazing allotment information. The Valley Modified rail corridor now crosses the Mount Sterling, Indian Springs, Wheeler Wash (formerly Wheeler Slope), Lucky Stripe, and the Las Vegas Valley grazing allotments, depending on the option.

DOE evaluated information in the Mineral Resources Data System and the Abandoned Mine database to determine if the addition of active or abandoned mines has occurred since DOE issued the Yucca Mountain FEIS. There are no known active or abandoned mines in the Valley Modified rail corridor or its options and, therefore, no change since the Yucca Mountain FEIS.

The Yucca Mountain FEIS reported that the Valley Modified rail corridor would cross linear land features such as rights-of-way for utilities, and roads. A review of BLM records, including Master Title Plats, indicated the authorization of additional rights-of-way since DOE completed the Yucca Mountain FEIS (DIRS 182772-MTS 2007, pp. 116 to 117).

5.4.2 AIR QUALITY

The Yucca Mountain FEIS evaluated air quality impacts common to all proposed corridors and noted these would include temporary increases in criteria pollutant concentrations from construction of the rail line. Construction equipment would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, and PM_{10} and $PM_{2.5}$. Construction activities would emit PM_{10} in the form of fugitive dust from land clearing and filling, equipment traffic, activity of a quarry, and operation of concrete batch plants. The emissions would be temporary and would cover a sizeable area as construction progressed along the corridor.

The Valley Modified rail corridor would pass north of the metropolitan Las Vegas area and on through rural parts of Clark and Nye Counties. A portion of the corridor would be in the Las Vegas Valley in Clark County. When DOE prepared the Yucca Mountain FEIS, the Las Vegas Valley was in nonattainment for the criteria pollutants, carbon monoxide and PM_{10}. Areas in violation of one or more of the criteria pollutant standards are classified as nonattainment areas. The Las Vegas Valley remains officially in nonattainment for these two criteria pollutants (DIRS 182772-MTS 2007, p. 119), although progress has been made since 2000; the Valley is attaining the carbon monoxide National Ambient Air Quality Standard (70 *FR* 31353), and the U.S. Environmental Protection Agency approved implementation plans for PM_{10} in 2004 (69 *FR* 32277).

During preparation of the Yucca Mountain FEIS, DOE conducted an air quality conformity review for areas of the Valley Modified rail corridor in the Las Vegas Valley (DIRS 182772-MTS 2007, p. 119). This review determined that construction activities in the Las Vegas Valley would be likely to exceed the General Conformity threshold level for PM_{10}. Reviews of updated and more detailed information and methods (DIRS 180921-Nevada Rail Partners 2006, all; DIRS 180877-Nevada Rail Partners 2007, all) considered rail line construction and additional contributions from construction of access roads, unpaved roads, storage piles, batch plant, coarse stockpiles, and a quarry. The reviews indicated potential construction fugitive dust and PM_{10} emissions would increase above those originally estimated for the Yucca Mountain FEIS. Before any construction activities in the Valley Modified rail corridor, DOE would need to perform more detailed air quality calculations to evaluate the impacts of construction activities.

Potential air quality impacts during railroad operations would result from diesel locomotives, which would emit carbon monoxide, nitrogen dioxide, sulfur dioxide, PM_{10}, and $PM_{2.5}$. Because the earthwork is complete, the extent of these impacts would be smaller during operations than during construction activities but would last longer. The number of locomotives in use and the associated operational characteristics would not differ appreciably from those described in the Yucca Mountain FEIS. Therefore, measurable differences in potential impacts from those described in the Yucca Mountain FEIS are unlikely and remain small.

5.4.3 HYDROLOGY

This section describes surface-water and groundwater resources and impacts to those resources. The Yucca Mountain FEIS analyzed surface-water resources within the 400-meter (0.25-mile)-wide corridor and within 1 kilometer (0.6 mile) along each side of the corridor. For the Nevada Rail Corridor SEIS, the region of influence for hydrology is the same as for the Yucca Mountain FEIS.

5.4.3.1 Surface Water

The corridor and its options would cross only two mapped, 100-year flood zones or flood zone groups (DIRS 155970-DOE 2002, Table 6-74). These remain unchanged since DOE published the Yucca Mountain FEIS. Impacts to surface-water resources from the rail line construction in the Valley Modified rail corridor would be the same as those reported in the Yucca Mountain FEIS for all three options. Although unlikely, the spread of construction-related materials by precipitation or intermittent runoff events could occur during the construction of the rail line. Impacts associated with altering drainage patterns or changing erosion and sedimentation rates or locations would be small and localized.

5.4.3.2 Groundwater

In the Yucca Mountain FEIS, the Department used terrain types to estimate total water demand. Since DOE completed the Yucca Mountain FEIS, the Department has canvassed similar projects throughout Nevada and determined that the amount and type of earthwork, not the terrain, would more accurately estimate total water demand associated with the construction of a rail line. Therefore, DOE updated the water demand based on earthwork needs. This resulted in an estimated water demand for the Valley Modified rail corridor of approximately 3.44 million cubic meters (2,800 acre-feet) (DIRS 180877-Nevada Rail Partners 2007, p. 2-7) compared to the estimate based on terrain types reported in the Yucca Mountain FEIS of 395,000 cubic meters (320 acre-feet). To accommodate this increase in estimated water demand, DOE would need to draw more water than originally estimated in the Yucca Mountain FEIS from the underlying hydrographic basins and pump from additional wells. Groundwater withdrawal could temporarily affect discharge from nearby wells or springs. DOE would conduct detailed analyses if new wells required for construction of the rail line were to be located near other water sources.

Water use during construction would come primarily from groundwater resources, specifically, hydrographic basins. If the hydrographic basin is designated, permitted groundwater rights approach or exceed the estimated perennial yield, water resources are being depleted or require additional administration, and the Nevada State Engineer has declared preferred uses of the water. Table 5-16 updates the designation status of the hydrographic basins and the percentage of the Valley Modified rail corridor that is in the respective basin. The total percentage of the Valley Modified rail corridor in designated basins is about 54 percent. The Yucca Mountain FEIS estimated that about 70 percent of the length of the Valley Modified rail corridor would be in designated basins.

Table 5-16. Hydrographic basins associated with the Valley Modified rail corridor.[a,b]

Hydrographic basin (and subbasin where applicable)	Length (kilometers)[c]	Percentage of total[d]	Designated
Fortymile Canyon/Jackass Flats	17	11	No
Indian Springs Valley	29	18	Yes
Las Vegas Valley	56	36	Yes
Mercury Valley	19	12	No
Rock Valley	18	12	No
Three Lakes Valley	19	12	No

a. Source: DIRS 182772-MTS 2007, p. 120.
b. To calculate water demand for each basin, multiply the total water demand for a given corridor by the percentage of total.
c. km = kilometer; to convert kilometers to miles, multiply by 0.62137.
d. Based on primary option in Yucca Mountain FEIS.

Operations along the completed rail line would have little impact on groundwater resources. Possible changes in recharge, if any, would be the same as those at the completion of construction.

5.4.4 BIOLOGICAL RESOURCES AND SOILS

Potential impacts to biological resources and soils from the construction and operation of a railroad in the Valley Modified rail corridor would be consistent with those reported in the Yucca Mountain FEIS. Maximum land disturbance for the construction of a rail line in the Valley Modified rail corridor would not differ from the estimates in the Yucca Mountain FEIS and therefore the potential impacts would not change.

Consistent with the Yucca Mountain FEIS, this update considered the potential for impacts to vegetation communities; special status species (plants and animals), including their habitat; springs, wetlands, and riparian areas; big game habitat; and wild horse and burro herd management areas that may occur within the 400-meter (0.25-mile)-wide corridor. The analysis considered special status species and big game habitat within 5 kilometers (3 miles) of the corridor that may be affected by construction of the rail line. DOE also analyzed springs and riparian areas that could be affected by permanent changes in surface-water flows.

5.4.4.1 Biological Resources

The Valley Modified rail corridor is in the Mojave Desert; the predominant land-cover types are creosote-bursage and Mojave mixed scrub.

Table 5-17 presents the special status species, big game habitat, and herd management areas identified in the Yucca Mountain FEIS and identifies additional information resulting from this update. The updated version of the NNHP database examined for Nevada Rail Corridor SEIS included observations of six additional sensitive species not included in the Yucca Mountain FEIS. They include the:

- Southwestern willow flycatcher (*Empidonax traillii extimus*)
- Clarke phacelia *(Phacelia filiae)*
- Clokey buckwheat (*Eriogonum heermannii var. clokeyi*)
- Fringed myotis (*Myotis thysanodes*)
- Las Vegas buckwheat (*Eriogonum corymbosum var. nilesii*)
- Planoconvex cordmoss (*Entosthodon planoconvexus*)

Table 5-17. Special status species, big game habitat, and herd management areas associated with the Valley Modified rail corridor[a] (page 1 of 2).

Resource	Type	Yucca Mountain FEIS		Nevada Rail Corridor SEIS	
		In corridor	Within 5 kilometers	In corridor	Within 5 kilometers
Threatened or endangered species (separated by type)					
Southwestern willow flycatcher (*Empidonax traillii extimus*)	B				●
Desert tortoise (*Gopherus agasizii*)	A/R	●		●	
Pahrump poolfish (*Empetrichthys latos*)[b]	F		●		●
Razorback sucker (*Xyrauchen texanus)*	F		●		●
Sensitive Species					
Fringed myotis (*Myotis thysanodes*)	M				●
Townsend's big-eared bat (*Corynorhinus townsendii*)	M	●		●	
Clarke phacelia *(Phacelia filiae)*	P			●	
Beatley's scorpionweed (*Phacelia beatleyae*)	P		●		●

Table 5-17. Special status species, big game habitat, and herd management areas associated with the Valley Modified rail corridor[a] (page 2 of 2).

Resource	Type	Yucca Mountain FEIS: In corridor	Yucca Mountain FEIS: Within 5 kilometers	Nevada Rail Corridor SEIS: In corridor	Nevada Rail Corridor SEIS: Within 5 kilometers
Sensitive Species (continued)					
California bearpoppy (*Arctomecon californica*)	P		●		●
Clokey buckwheat (*Eriogonum heermannii var. clokeyi*)	P				●
Death Valley beardtongue (*Penstemon fruticiformis ssp. amargosae*)	P		●		●
Desert/White/Merrium bearpoppy (*Arctomecon merriamii*)	P		●	●	●
Half-ring milkvetch/ Mojave milkvetch (*Astragalus mohavensis* var. *hemygurus)*	P	●		●	●
Largeflower suncup (*Camissonia megalantha*)	P		●		●
Las Vegas buckwheat (*Eriogonum corymbosum var. nilesii*)	P				●
Parish scorpionweed (*Phacelia parishii*)	P	●	●	●	●
Pinto beardtongue (*Penstemon bicolor ssp.*)	P		●	●	●
Planoconvex cordmoss (*Entosthodon planoconvexus*)	P				●
Ripley's springparsley/ Sanicle biscuitroot *(Cymopterus ripleyi var. saniculoides)*	P	●		●	
White-Margined beardtongue (*Penstemon albomarginatus*)	P	●		●	
Game Habitat					
Bighorn sheep (*Ovis Canadensis*)	M	●		●	
Mule deer (*Odocoileus hemionus*)	M	●		●	
Quail (*Callipepla gambelii)*	B	●		●	
Wild horse and burro herd manaagement areas					
Johnnie				●	
Wheeler Pass			●		●

Species Type Key
M = Mammal
B = Bird
A/R = Amphibian or Reptile
F = Fish
MO = Mollusk
I = Insect
P = Plant

a. Source: Data collected from DIRS 182772 MTS 2007, pp. 121 and 122; DIRS 182760-URS Corporation/Potomac-Hudson Engineering 2006, all.

b. Pahrump pool fish have been introduced into ponds in Floyd Lamb State Park and into the outflow of Corn Creek Springs, both of which are outside the region of influence for surface waters.

DOE evaluated surface-water resources, which include springs, streams, riparian areas, and reservoirs for all options. No springs, perennial streams, or riparian areas occur in the Valley Modified rail corridor. These remain unchanged since DOE completed the Yucca Mountain FEIS.

There are no other known changes to the information in the Yucca Mountain FEIS on existence of game habitat, sensitive species, or springs within 5 kilometers (3 miles) of the corridor.

5.4.4.2 Soils

The Yucca Mountain FEIS classified soils in the Valley Modified rail corridor with four attributes: shrink swell, erodes easily, unstable fill, and blowing soil. As noted in the Yucca Mountain FEIS, the shrink swell and blowing soils attributes are common in the Valley Modified rail corridor. The Yucca Mountain FEIS also reported that there were no soils classified as prime farmlands within the Valley Modified rail corridor. No significant new information was readily available about the attributes of the soils surveyed in the corridor.

According to the Yucca Mountain FEIS, soils in and adjacent to the Valley Modified rail corridor would be disturbed on approximately 5 square kilometers (1,200 acres) of land during construction of the rail line. Impacts to soils in the corridor would be small, but could occur throughout construction. Shrink-swell soils occur along much of the corridor, as does the potential for blowing soils. Disturbance during construction would increase the amount of soil that could be transported by wind because the existing vegetation would be disturbed, at least temporarily. Vegetation or other means of soil stabilization after construction could minimize this. The soils within the Valley Modified rail corridor and the potential impacts to these soils remain unchanged since DOE completed the Yucca Mountain FEIS.

5.4.5 CULTURAL RESOURCES

The effects of rail line construction in Valley Modified rail corridor on cultural resources would be essentially the same as those DOE reported in the Yucca Mountain FEIS. Impacts to cultural resources from operation of a railroad in the Valley Modified rail corridor would be unlikely.

Cultural resources include any prehistoric or historic archaeological sites, buildings, structures, landscapes, or object resulting from or modified by human activity and include mining, ranching, and linear features such as roads and trails. Cultural resources designated as historic properties warrant consideration with regard to potential adverse impacts resulting from proposed federal actions.

For this update, DOE conducted an archaeological site-file search using records from the Desert Research Institute, the Nevada Cultural Resources Information System, and archaeological information repositories at the Harry Reid Center at the University of Nevada-Las Vegas, and the Nevada State Museum in Carson City.

The records search revealed the presence of 45 known archaeological sites within the 400 meters (0.25 mile) width of the Valley Modified rail corridor. The difference between the 19 sites reported in the Yucca Mountain FEIS and the 45 identified in the new survey reflects the addition of sites recorded in the past decade, particularly in the vicinity of Yucca Mountain, where cultural resources inventories and improvements in cultural resources records have been ongoing. Of the 45 known sites, 12 are eligible or potentially eligible for inclusion on the *National Register of Historic Places* (DIRS 182772-MTS 2007, p. 123).

The types of sites found in the new survey records are the same as those reported in the Yucca Mountain FEIS. The total amount of archaeological inventories conducted is approximately less than 1 percent of the total area for the Valley Modified rail corridor. Prior to construction of a rail line, field surveys and potentially mitigation of cultural resources would be required.

5.4.6 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

5.4.6.1 Industrial Safety

The categories of worker impacts include total recordable incidents, lost workdays, and fatalities. Recordable incidents or cases are occupational injuries or occupation-related illnesses that result in (1) a fatality, regardless of the time between the injury or the onset of the illness and death, (2) lost workday cases (nonfatal), and (3) incidents that result in the transfer of a worker to another job, termination of employment, medical treatment, loss of consciousness, or restriction of motion during work activities.

Revised estimates of the number of workers needed to construct the rail line resulted in 2,500 worker-years in comparison to the 405 worker-years estimated in the Yucca Mountain FEIS (2,000 hours per worker-year). Estimates of industrial safety impacts incorporate updated Bureau of Labor Statistics data for 2005 (DIRS 179131-BLS 2006, all; DIRS 179129-BLS 2007, all). The Yucca Mountain FEIS used 1998 data from the same source. Industrial safety impacts from operations in the Valley Modified rail corridor would be lower than those in the Yucca Mountain FEIS because of differences in the labor statistics used. Operation of the railroad would require about 45 workers each year. Table 5-18 lists estimated industrial safety impacts reported in the Yucca Mountain FEIS as well as the updated information.

5.4.6.2 Transportation

Since DOE completed the Yucca Mountain FEIS, there have been updates to the methods and data to estimate the radiation doses for workers and members of the public. Section 3.2.6 of this Nevada Rail Corridor SEIS describes updates to the methods and data used to estimate impacts for the rail corridors. The impacts for the Valley Modified rail corridor reflects new information resulting from these changes.

Updates for transportation estimated impacts during construction from the transportation of construction materials to the construction sites and impacts from commuting workers. Operation of the railroad could result in incident-free radiological impacts, risks from radiological accidents, impacts from vehicle emissions from waste transportation and commuting workers, and traffic fatalities associated with waste transport and commuting workers.

The Yucca Mountain FEIS evaluated traffic fatality and vehicle emission impacts from the movement of equipment and delivery of materials for construction, worker commutes to and from construction sites, and transport of water to construction sites. Table 5-19 lists the impacts of transportation during the construction phase. Due to the increased number of construction workers from the estimate in the Yucca

Mountain FEIS, estimated traffic fatalities could increase from 0.4 to 1.5, and fatalities from exposure to vehicle emissions could increase from 0.05 to 0.2. Total transportation impacts from construction could be about 1.7 fatalities.

Transportation of spent nuclear fuel and high-level radioactive waste in the Valley Modified rail corridor could result in radiological and nonradiological impacts to workers and the public. Radiological impacts could result from radiation that the rail casks emitted during incident-free transportation, from radionuclides released from the rail cask during transportation accidents, or from radiation the rail cask emitted because of a loss of shielding during a transportation accident. Nonradiological impacts (vehicle emission-related fatalities) could result from diesel locomotives and fugitive dust. Nonradiological impacts could also result from traffic accidents that involved workers and members of the public.

Table 5-18 Impacts to workers from industrial hazards during railroad construction and operations for the Valley Modified rail corridor.[a]

Group and industrial hazard category	Construction		Operations		Total	
	Yucca Mountain FEIS [b]	Update[c]	Yucca Mountain FEIS [d]	Update[e]	Yucca Mountain FEIS	Update
Involved worker						
Total recordable cases[d]	32	110	73	37		
Lost workday cases	16	64	40	28		
Fatalities	0.04	0.23	0.20	0.26		
Noninvolved worker						
Total recordable cases	1.9	12	4.1	8.9		
Lost workday cases	0.7	6.3	1.5	4.8		
Fatalities	0.002	0.02	0.004	0.01		
Totals[f]						
Total recordable cases	34	130	77	46	111	176
Lost workday cases	16	70	41	33	57	103
Fatalities	0.05	0.2	0.20	0.3	0.25	0.5

a. Estimates of worker-years multiplied by accident rate (DIRS 179131-BLS 2006, all; DIRS 179129-BLS 2007, all).
b. Estimated workforce to construct the railroad would be 405 worker-years.
c. Estimated workforce to construct the railroad would be 2,500 worker-years.
d. Totals for 24 years for operations.
e. Totals for 33 years of operations within a 50-year period.
f. Total recordable cases include injuries, illnesses, and fatalities.

Table 5-19. Transportation impacts during railroad construction for the Valley Modified rail corridor.[a]

Transportation impact category	Traffic fatalities		Number of cancers		Total	
	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
Vehicle emission impacts (cancer fatalities)						
Material delivery vehicles	–	–	0.02	0.02		
Worker commuting	–	–	0.03	0.2		
Transportation accidents (fatalities)						
Material delivery vehicles	0.1	0.1	–	–		
Worker commuting	0.2	1.4	–	–		
Totals[b]	0.4	1.5	0.05	0.2	0.45	1.7

a. Source: DIRS 182772-MTS 2007, p. 125.
b. Totals might differ from sums of values due to rounding.

Table 5-20 lists the impacts of using the Valley Modified rail corridor to ship spent nuclear fuel and high-level radioactive waste calculated using updated methods and data. The impacts presented reflect those from the mainline to the repository. This is in contrast to the Yucca Mountain FEIS, where the Nevada impacts started where the mainline intersects the Nevada border.

For members of the public, estimated radiological impacts from incident-free (routine) transportation decreased from those in the Yucca Mountain FEIS, from 0.00065 to 0.00014 latent cancer fatality. This

Table 5-20. Operations impacts of transportation for the Valley Modified rail corridor.[a]

Transportation impact category	Traffic fatalities		Number of cancers	
	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
Incident-free radiological impacts (LCFs)[b]				
Public (LCFs)	Not applicable	–	0.00065	0.00014
Workers (LCFs)	–	–	0.27	0.21
Radiological accident risks (LCFs)	-	-	0.0000000029	0.0000013
Vehicle emission impacts (cancer fatalities)				
Waste transportation	–	–	0.000047	0.0006
Worker commuting	–	–	0.07	0.2
Transportation accidents (fatalities)				
Waste transportation	0.016	0.1	–	–
Worker commuting	0.5	1.3	–	–
Totals[c]	0.5	1.4	0.3	0.4

a. Source: DIRS 182772-MTS 2007, p. 126.
b. LCF = latent cancer fatality.
c. Totals might differ from sums of totals due to rounding.

would be due primarily to the change in analysis for the Nevada rail line to model dedicated trains for shipments to the repository (DIRS 182772-MTS 2007, p. 125), which would be partially offset by the increase in the latent cancer fatality conversion factor.

For workers, estimated radiological impacts from incident-free transportation would decrease from 0.27 to 0.21 latent cancer fatality. The decrease would be due primarily to the decrease in the exposure time at the staging yard, which would partially offset by the increase in the latent cancer fatality conversion factor, the use of escorts in all areas, and the estimation of impacts for non involved workers at the staging yard.

Estimated radiological accident risks increased from 0.0000000029 to 0.0000013 latent cancer fatality. This would be due primarily to the use of the combined Track Class 3 transportation accident rate (DIRS 182772-MTS 2007, p. 125) based on train kilometers and railcar kilometers and the increase in the latent cancer fatality conversion factor, and the increase in the population along the Valley Modified rail corridor. Although this is an increase, radiological accident risk would still be a negligible contributor to the overall transportation risk.

Estimated impacts from waste transportation vehicle emissions would increase from 0.000047 to 0.0006 fatality. This would be due primarily to the increase in populations along the Valley Modified rail corridor. Vehicle emission impacts from commuting workers could increase from those reported in the Yucca Mountain FEIS because of the longer operations phase.

Estimated impacts from nonradiological transportation accidents would increase from 0.016 to 0.095 fatality. This is the most notable change to accident risk and would be due primarily to the use of the updated rail fatality rate (DIRS 178016-DOT 2005, all) and from accounting for the presence of locomotives and buffer cars in the estimation of the number of nonradiological transportation accident fatalities. Traffic fatalities associated with commuting workers could also increase.

Overall, the estimated total number of transportation-related fatalities from operation of a railroad in the Valley Modified rail corridor has increased from 0.8 fatality reported in the Yucca Mountain FEIS to 1.8 fatalities in the current assessment. This change is due primarily to the increase in the number of fatalities from traffic accidents.

5.4.7 SOCIOECONOMICS

In the Yucca Mountain FEIS, DOE used construction costs, workforce estimates, and state and regional economic data to identify potential direct and indirect changes in state and regional economic activity. The Department noted that construction activities would cause short-term, temporary increases in employment and population.

Revised estimates of the number of workers needed to construct the rail line in the Valley Modified rail corridor resulted in 2,500 worker-years in comparison to the 405 worker-years estimated in the Yucca Mountain FEIS.

Operation of the railroad would require about 32 workers each year in comparison to the 36 workers estimated in the Yucca Mountain FEIS. Increased workforce estimates would not notably affect the regional economy. Given the relatively low number of employees necessary for the operation of the railroad, the potential for socioeconomic impacts in the corridor would be short-term and small.

Clark County, which includes Las Vegas, dominates the region of influence with a 2006 estimated population of 1.89 million, which is approximately 7 percent more than the population that DOE reported in the Yucca Mountain FEIS. Population growth in the unincorporated town of Pahrump dominates Nye County's growing popularity as a residential destination. Since DOE completed the Yucca Mountain FEIS, Pahrump, the largest population center in Nye County, has experienced double-digit growth. The estimated population of Pahrump increased from 23,000 in July 1999 to 33,000 by July 2005, an increase of about 45 percent (DIRS 182772-MTS 2007, p. 127). In the same period, the State Demographer estimates that Nye County, as a whole, grew from about 31,000 to about 41,000. The average annual impact from the construction and operation of a railroad to the baselines population in Clark and Nye Counties would be small.

Because the construction workforce is expected to come largely from Clark County, any changes to the regional employment and population baselines would be nearly imperceptible. Meaningful changes in employment and population due to the construction and operation of the railroad is unlikely. Current population growth in these Clark and Nye counties would mask socioeconomic impacts due to the short-term growth in the workforce or the associated impact on population growth.

5.4.8 NOISE AND VIBRATION

The Yucca Mountain FEIS analysis for noise considered typical day-night sound levels, the distance of the rail line from communities along the rail line, and estimated the impacts from the construction and operation of a railroad to these communities. The Yucca Mountain FEIS analysis for vibration considered typical background level of ground vibration, the number of trains, and the distance of the rail line from to historic structures or sites of cultural significance, and estimated the impacts from the operation of a railroad. There are no significant new circumstances or information that would cause the affected environment or the estimated impacts from noise and vibration to change from what was reported in the Yucca Mountain FEIS.

5.4.9 AESTHETICS

Based on a corridor-level analysis and an evaluation of current BLM resource management plans, there have been no changes to Visual Resource Management classifications for the Valley Modified rail corridor since DOE completed the Yucca Mountain FEIS and, therefore, impacts would be the same as those discussed in the Yucca Mountain FEIS. As stated in the Yucca Mountain FEIS, operation of a railroad in the Valley Modified rail corridor would cause small impacts to visual resources in the area because the entire corridor would fall within the BLM Class III designation.

5.4.10 UTILITIES, ENERGY, AND MATERIALS

The Yucca Mountain FEIS evaluated utilities, energy, and materials impacts common to all corridors and noted that these impacts would include the use of motor fuel, steel, and concrete. The estimated impacts from these resources associated with the construction and operation of a railroad in Nevada would be small, similar to those in the Yucca Mountain FEIS.

The Valley Modified rail corridor would pass north of the Las Vegas metropolitan area. Electric power for construction would be initially supplied by portable generators. New power lines would be installed to provide power for construction services and would be extended, via underground distribution along the rail roadbed to meet all other construction and operational needs. Construction equipment would also consume motor fuel (diesel and gasoline). The total motor fuel use in Nevada in 2005 was about 5.8 billion liters (1.5 billion gallons) in 2005 (DIRS 182772-MTS 2007, p. 127). Highway motor fuel use in the state in 2005 increased 6.2 percent over that in 2004, the largest percentage increase for any state and attributable to Nevada's growing population. Table 5-21 lists the estimated amounts of diesel fuel and gasoline for construction for the Valley Modified rail corridor, which are higher than the estimates in the Yucca Mountain FEIS. Based on a construction period of 40 months, the annual average use of motor fuel would be about 0.27 percent of that consumed annually in Nevada. Unlike overall state use, construction activities would use primarily diesel fuel, which would be about 1 percent of all special fuel (mainly diesel) used annually in Nevada.

Table 5-21. Construction energy and materials impacts for the Valley Modified rail corridor.[a]

Length (kilometers)[b,c]	Diesel fuel use (million liters)[d]		Gasoline use (million liters)		Steel (thousand metric tons)[e]		Concrete (thousand metric tons)	
	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update	Yucca Mountain FEIS	Update
160	13	49	0.27	1.0	22	26	130	100

a. Sources: DIRS 180877-Nevada Rail Partners 2007, p. 2-7, Table 2-1; DIRS 182772-MTS 2007, p. 128.
b. Rail corridor length used for comparative evaluation.
c. To convert kilometers to miles, multiply by 0.623.
d. To convert liters to gallons, multiply by 0.264.
e. To convert metric tons to tons, multiply by 1.102.

Steel for rails, concrete (principally for rail ties, bridges, and drainage structures), and rock for ballast would be the primary materials that the construction of a rail line would consume. Table 5-21 lists estimates of steel consumption, which have increased over those in the Yucca Mountain FEIS, and concrete consumption, which have decreased from those in the Yucca Mountain FEIS.

The estimated impacts to utilities, energy, and materials from the operation of a railroad in Nevada would be small, similar to those in the Yucca Mountain FEIS. The estimated use of motor fuel by locomotives would increase over that in the Yucca Mountain FEIS due to more weekly train trips, but the overall use would still be small.

5.4.11 WASTE MANAGEMENT

The Yucca Mountain FEIS evaluated common waste management impacts for all corridors rather than for individual corridors. Information to allow differentiation between corridor waste management impacts is now much more readily available. Therefore, this readily available information has been included at a level of analysis that was similar to the Yucca Mountain FEIS.

Waste generation and management impacts common to all corridors would result from construction and operation a railroad in the Valley Modified rail corridor. There would be relatively low amounts of construction debris and sanitary waste generated.

The Yucca Mountain FEIS estimated that the peak annual generation would be 910 metric tons (1,000 tons) of sanitary solid waste. DOE now estimates solid municipal waste from construction facilities would be 380 metric tons (410 tons) during the peak year of construction. An assumed 25 percent of the waste generated would be recyclable, which would result in about 280 metric tons (310 tons) of waste for disposal at municipal landfills. The estimated total mass of waste generated during construction of the rail line would be about 760 metric tons (840 tons). This mass of sanitary solid waste would occupy about 1,800 cubic meters (2,400 cubic yards) of landfill volume at a waste density of 410 kilograms per cubic meter (700 pounds per cubic yard) (DIRS 182772-MTS 2007, p. 128). Heavier equipment used at large facilities such as the Apex Landfill in Clark County would result in greater waste compaction and less waste volume. The estimated average daily disposal mass would be about 0.6 metric ton (0.7 ton) per day.

Nye County disposed of about 250 metric tons (280 tons) of waste during 2003 at three different landfills (DIRS 182772-MTS 2007, p. 128), but the county plans to close two of these landfills by 2011, which would represent 96 percent of the county's current waste disposal capacity. The Apex Landfill in Clark County serves the Las Vegas Valley and receives 8,000 metric tons (8,800 tons) each day (DIRS 174041-State of Nevada 2004, pp. 6 and 7). The estimated closure is in 2047. Waste generated during construction could be trucked to larger landfills with small impact on waste disposal capacity.

Operations would generate waste during periodic maintenance activities. Locomotive and railcar maintenance could generate used oil and solvents that DOE would recycle or dispose of as hazardous chemicals.

5.4.12 ENVIRONMENTAL JUSTICE

The Yucca Mountain FEIS environmental justice analysis considered the potential for disproportionately high and adverse impacts on two segments of the overall population – minority communities and low-income communities. In the Yucca Mountain FEIS, DOE employed a criterion for identifying minority and low-income communities by applying a 10-percent threshold, meaning that the environmental analyses for environmental justice purposes focused on Census blocks and Census block groups having minority or low-income populations at least 10 percent higher than state averages.

For Nevada Rail Corridor SEIS, DOE adopted new criteria based upon revised NRC guidance. The new criteria are Census blocks having a 50 percent or higher minority population (for example, 10 percent higher than the State average), and Census block groups having a 30.5 percent low-income population (for example, 20 percent higher than the State average).

Updates for the 2000 U.S. Census Bureau block group data used in the Yucca Mountain FEIS to examine the location and concentration of low income populations were not available at the time DOE completed the Yucca Mountain FEIS. Instead, the Yucca Mountain FEIS used 1990 U.S. Census Bureau block group data to identify low income populations. For Nevada Rail Corridor SEIS, DOE used the more current 2000 U.S. Census Bureau block group data to identify both low income and minority populations. The next set of comprehensive Census Bureau data will not be released until the 2010 Census, thus, the 2000 data is still considered the most current data set. The region of influence identified in the Yucca Mountain FEIS for the Valley Modified rail corridor has remained the same. Furthermore, county level U.S. Census Bureau data estimates for 2006 suggest that while the population in southern Nevada is growing rapidly, the location of concentrations of minority and low income populations have remained relatively constant and static since 2000 (DIRS 182772-MTS 2007, p. 129).

DOE concluded in the Yucca Mountain FEIS that there would not be any high and adverse impacts from transportation of spent nuclear fuel and high-level radioactive waste in Nevada on any populations, and that disproportionately high and adverse effects would be unlikely for any specific segment of the population, including minorities and low-income communities. DOE further concluded that there were no special pathways (unique practices and activities creating opportunities for increased impacts) that could not be mitigated. Therefore, the Yucca Mountain FEIS concluded that there were no environmental justice impacts associated with any proposed rail corridor.

Since DOE completed the Yucca Mountain FEIS, the Department has not identified any new large and adverse impacts to any population. DOE has also not identified any new minority or low income populations in the Valley Modified rail corridor region of influence, and has not identified any special pathways that could increase impacts to these populations. Therefore, DOE maintains that there would be no environmental justice impacts associated with the Valley Modified rail corridor.

6. CONCLUSION

DOE concludes that the Mina rail corridor warrants further study at the alignment level under the National Environmental Policy Act, although as a nonpreferred alternative. In addition, DOE concludes that, based on the analyses described herein, there are no significant new circumstances or information relevant to environmental concerns that would warrant further consideration of the Carlin, Jean, or Valley Modified rail corridor at the alignment level.

Glossary terms shown in ***bold italics***.

The U.S. Department of Energy (DOE or the Department) concludes that the Mina ***rail corridor*** warrants further study to determine an alignment for the construction and operation of a ***railroad***. In reaching this conclusion, DOE considered the environmental conditions and associated potential environmental impacts of constructing and operating a railroad for each of 12 environmental resource areas and found overall that impacts would be small. The Mina rail corridor coincides in part with an abandoned rail line and follows relatively flat terrain over much of its length, which would minimize construction earthworks (***cuts*** and ***fills***); this would tend to reduce environmental impacts. Cumulative impacts to groundwater resources for construction and operation of a railroad in the Mina rail corridor ***region of influence***, however, would be small to moderate.

On April 17, 2007, the Walker River Paiute Tribal Council passed a resolution withdrawing the Tribe from participating in the Supplemental Yucca Mountain Nevada Rail Corridor EIS and Rail Alignment EIS preparation process. The Tribal Council's resolution also renewed the Tribe's past objection to the transportation of nuclear waste through their Reservation. Accordingly, DOE has identified the Mina Implementing Alternative as nonpreferred in this Supplemental Yucca Mountain Nevada Rail Corridor EIS and Rail Alignment EIS.

In addition, the Department has updated the environmental information in 12 resource areas for three of the other rail corridors (Carlin, Jean, and Valley Modified) evaluated in detail in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS). For the most part, the environmental conditions and associated potential environmental impacts for each rail corridor remain unchanged from, or are substantially similar to, those reported in the Yucca Mountain FEIS. Notably, however, land use and ownership conflicts in the Jean and Valley Modified corridors have increased, and, although the amount of private land within the Carlin rail corridor appears to have decreased (based on a more refined analysis using land ownership databases) since DOE completed the Yucca Mountain FEIS, the complex land-ownership pattern resulting from the mix of private and public lands the corridor would cross remains unchanged. Such land use and ownership conflicts and complexity increase the potential to adversely affect construction of a railroad, and to increase the potential for delays that could affect the availability of a railroad in these corridors. Moreover, air quality management goals in the Jean corridor have changed since DOE completed the Yucca Mountain FEIS, and construction of a railroad could increase the potential for conflicts with these goals. For these reasons, the Department concludes there are no significant new circumstances or information relevant to environmental concerns that would warrant further consideration of these three rail corridors at the alignment level.

Part 2

Draft Environmental Impact Statement
for a Rail Alignment for the
Construction and Operation of a Railroad
in Nevada to a Geologic Repository at
Yucca Mountain, Nye County, Nevada
DOE/EIS-0369D

Chapters 1 and 2

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

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1. PURPOSE AND NEED FOR AGENCY ACTION

This chapter explains why DOE needs to construct and operate a railroad in Nevada, summarizes the process leading to the selection of the Caliente and Mina rail corridors for further study, and describes the interests and roles of cooperating agencies. It also describes the Supplemental Rail Corridor EIS and Rail Alignment EIS scoping process, and summarizes public scoping comments and how DOE acted on those comments.

Glossary terms are shown in ***bold italics***.

1.1 Background

The United States has focused a national effort on siting and developing a ***geologic repository*** for the ***disposal*** of ***spent nuclear fuel*** and ***high-level radioactive waste*** and on developing systems for transporting these materials from their present locations throughout the country to that repository.

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation.

- **Commercial spent nuclear fuel** comes from civilian nuclear power plants that generate electricity.
- **DOE spent nuclear fuel** comes from DOE production reactors (such as defense nuclear material production reactors), naval reactors, and university- and government-owned test and experimental reactors.

High-level radioactive waste is the highly radioactive material that results from the reprocessing of spent nuclear fuel and other highly radioactive material, which the U.S. Nuclear Regulatory Commission determines by rule requires permanent isolation.

The Nuclear Waste Policy Act of 1982 (Public Law 97-425) acknowledged the Federal Government's responsibility to provide for the disposal of the Nation's spent nuclear fuel and high-level radioactive waste, and initiated a process to select sites for technical study as potential geologic repository locations. In 1987, Congress amended the Nuclear Waste Policy Act. This Act, as amended (42 United States Code [U.S.C.] 10101 *et seq.*), which this ***environmental impact statement*** (EIS) refers to as the NWPA, identifies the ***Yucca Mountain Site*** in Nye County, Nevada, as the site to be studied as a potential location for a geologic repository.

After completion of ***site characterization*** studies at Yucca Mountain, the Secretary of Energy found the site to be scientifically and technically suitable for development of a repository. On February 14, 2002, the Secretary submitted his recommendation, along with a comprehensive statement of the basis for the recommendation, to the President of the United States, George W. Bush, for approval of the Yucca Mountain Site for the development of a ***nuclear waste repository***. As required by the NWPA, the U.S. Department of Energy (DOE or the Department) had prepared an EIS, *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DIRS 155970-DOE 2002, all) (Yucca Mountain FEIS), to accompany the Secretary's recommendation to the President.

On February 15, 2002, the President, in accordance with the NWPA, approved the Secretary of Energy's recommendation of the Yucca Mountain Site for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. On July 23, 2002, the President signed into law a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain

Site for development as a geologic repository (Yucca Mountain Development Act of 2002, Public Law 107-200).

As part of its obligations under the NWPA, DOE is responsible for developing a system to transport spent nuclear fuel and high-level radioactive waste to the repository. In the Yucca Mountain FEIS, DOE analyzed a ***proposed action*** to construct, operate, monitor, and eventually close a geologic repository at Yucca Mountain in southern Nevada for the disposal of spent nuclear fuel and high-level radioactive waste. As part of that action, DOE evaluated various modes of transporting spent nuclear fuel and high-level radioactive waste from 72 commercial sites and five DOE sites nationwide to the Yucca Mountain Site. (Note: DOE now plans to move all spent nuclear fuel from Fort St. Vrain to Idaho National Laboratory before the repository at Yucca Mountain is scheduled to open. Therefore, the number of DOE sites is four.) Figure 1-1 shows the locations of the commercial and DOE sites that would ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain.

The Yucca Mountain FEIS examined various national transportation scenarios and Nevada transportation scenarios to evaluate and compare the range of potential transportation ***impacts*** to human health. DOE evaluated two national transportation scenarios, referred to as the "mostly legal-weight truck scenario" and the "mostly rail scenario," and three Nevada transportation scenarios, referred to as the "Nevada mostly legal-weight truck scenario," the "Nevada mostly rail scenario," and the "Nevada mostly heavy-haul truck scenario." In the Yucca Mountain FEIS, DOE identified the mostly rail scenario as its preferred mode of transportation, both nationally and in Nevada (DIRS 155970-DOE 2002, p. 1-3), due in part to lower potential impacts to the health and safety of workers and the public.

1.2 Purpose and Need

Based on its obligations under the NWPA and its decision to select the mostly rail scenario for the transportation of spent nuclear fuel and high-level radioactive waste, DOE needs to ship these materials by rail in Nevada to a repository at Yucca Mountain.

At present, there is no ***railroad*** to the Yucca Mountain Site. In the Yucca Mountain FEIS, DOE evaluated in detail five potential ***rail corridors*** within Nevada in which the Department could construct a railroad to link an existing ***rail line*** to Yucca Mountain: Caliente, Carlin, Caliente-Chalk Mountain, Jean, and Valley Modified rail corridors (DIRS 155970-DOE 2002, Chapter 6). Figure 1-2 shows the five rail corridors analyzed in the Yucca Mountain FEIS.

The Yucca Mountain FEIS did not specify a rail corridor preference, but on December 29, 2003, in the subsequent *Notice of Preferred Nevada Rail Corridor* (68 *Federal Register* [*FR*] 74951) (see Appendix A), DOE announced its preference for the Caliente rail corridor. Figure 1-3 shows the Caliente ***rail alignment***, including ***alternative segments*** considered, as analyzed in this Rail Alignment EIS. The Caliente rail alignment is an engineered refinement of the Caliente rail corridor analyzed in the Yucca Mountain FEIS.

Rail corridor: A strip of land 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at Yucca Mountain.

Rail alignment: An engineered refinement of a rail corridor in which DOE would identify the location of a rail line. A rail alignment is comprised of ***common segments*** and ***alternative segments***.

Railroad: A transportation system incorporating the rail line, operations support facilities, railcars, locomotives, and other related property and infrastructure.

Rail line: An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.

Legend

- ▲ Yucca Mountain
- ★ Commercial Sites

  Note: The Yucca Mountain FEIS analysis considered three commercial site pairs—Salem and Hope Creek, Nine Mile Point and FitzPatrick, and Dresden and Morris—to be single sites because of their proximity to each other.

- ◉ DOE Sites

  Notes:

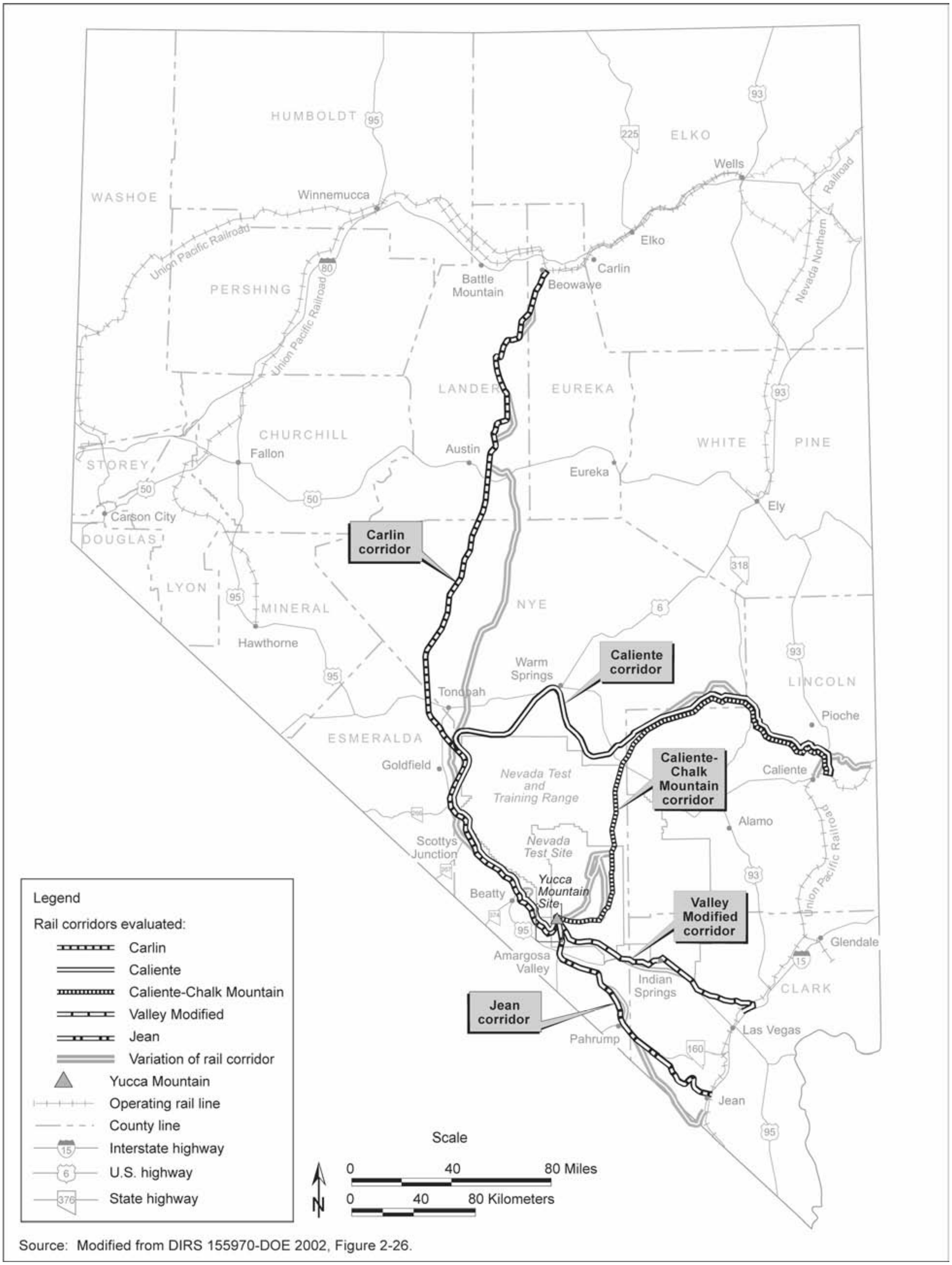
  The Yucca Mountain FEIS analysis included the high-level radioactive waste at West Valley. The State of New York owns the high-level radioactive waste and the site. Under the West Valley Demonstration Project Act, DOE is responsible for solidifying and transporting the high-level radioactive waste to a repository.

  The Yucca Mountain FEIS analysis included DOE spent nuclear fuel at a fifth DOE location, Fort St. Vrain in Colorado. DOE will move that waste to the Idaho National Laboratory for processing and it will be included in the laboratory inventory. Therefore, this map does not show Fort St. Vrain as a DOE source of spent nuclear fuel.

Notes: DOE = U.S. Department of Energy; FEIS = Final Environmental Impact Statement. Symbols do not reflect precise locations.

Source: Modified from DIRS 155970-DOE 2002, Figure 1-1.

Figure 1-1. Locations of commercial and DOE sites that would ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain.



Source: Modified from DIRS 155970-DOE 2002, Figure 2-26.

Figure 1-2. Five rail corridors evaluated in the Yucca Mountain FEIS.

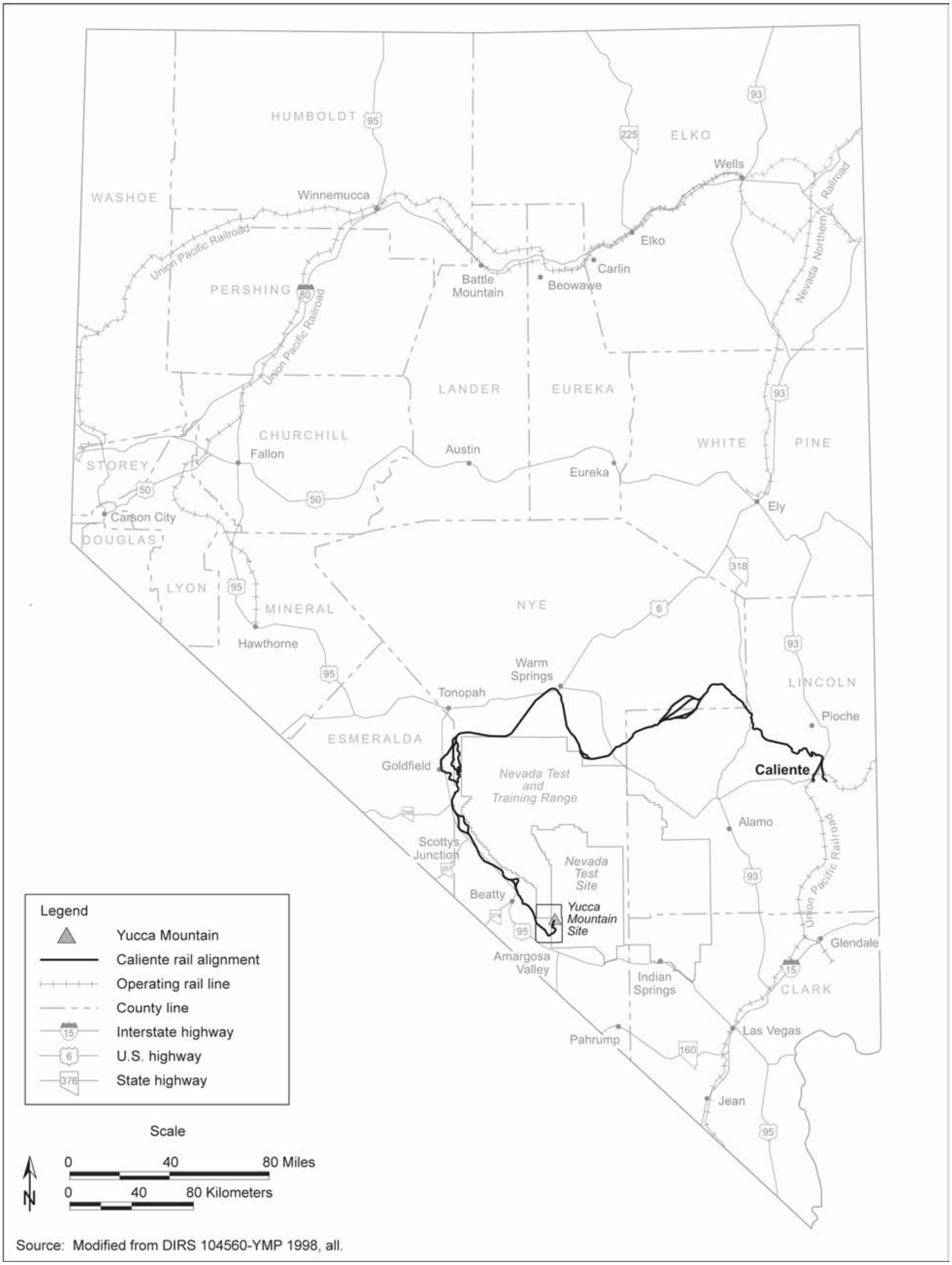


Figure 1-3. Caliente rail alignment analyzed in this Rail Alignment EIS.

In 2004, DOE announced the selection of the mostly rail scenario analyzed in the Yucca Mountain FEIS for transporting spent nuclear fuel and high-level radioactive waste nationally and within Nevada (*Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV*, 69 *FR* 18557, April 8, 2004). Implementation of the mostly rail scenario ultimately would require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. DOE also announced in that ***Record of Decision*** that it had selected the Caliente rail corridor for further evaluation for the construction and operation of a railroad in Nevada. (The Record of Decision referred to construction and operation of a rail line. However, this Rail Alignment EIS refers to construction and operation of a railroad, which better describes the ***infrastructure*** required under the Proposed Action.)

During the subsequent public scoping process, DOE received comments suggesting that other rail corridors be considered, in particular, the Mina route. In the Yucca Mountain FEIS, DOE had considered but eliminated the Mina route from detailed study because a rail line within the Mina route could only connect to an existing rail line in Nevada by crossing the Walker River Paiute Reservation, and the Tribe had informed DOE that it would not allow nuclear waste to be transported across the Reservation.

Following the review of the scoping comments, DOE held discussions with the Walker River Paiute Tribe and, in May 2006, the Tribal Council informed DOE that it would allow the Department to consider the potential impacts of constructing and operating a railroad to transport spent nuclear fuel and high-level radioactive waste across its reservation. On October 13, 2006, after a preliminary evaluation of the feasibility of the Mina rail corridor, DOE announced its intent to expand the scope of the Rail Alignment EIS to include the Mina corridor (*Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV;* 71 *FR* 60484). Although the expanded NEPA analysis, the Nevada Rail Corridor SEIS and the Rail Alignment EIS, analyze the potential environmental impacts associated with the Mina rail corridor, it identifies the Mina alternative as nonpreferred because the Tribe has withdrawn its support for the EIS process. Figure 1-4 shows the existing rail lines, alternative segments, and ***common segments*** along the Mina rail alignment, as analyzed in this Rail Alignment EIS.

1.3 Selection of the Caliente Rail Corridor for Further NEPA Evaluation

In the Yucca Mountain FEIS, DOE identified the mostly rail scenario as its preferred mode for transporting spent nuclear fuel and high-level radioactive waste to a repository at Yucca Mountain, both nationally and in Nevada (DIRS 155970-DOE 2002, p. 1-3). DOE stated that the Yucca Mountain FEIS could be used to support the choice among Nevada rail corridors (DIRS 155970-DOE 2002, p. 1-3), but additional field surveys, state and local government and American Indian tribal consultations, environmental and engineering analyses, and further National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) review would be required to support a decision about the selection of a specific rail alignment within a rail corridor.

DOE also stated that if the Yucca Mountain Site was approved, it would issue at some future date a Record of Decision to select a mode of transportation and that if mostly rail was selected, DOE would announce a preference for one of the rail corridors and then publish a Record of Decision announcing the selection of a rail corridor (DIRS 155970-DOE 2002, p. 1-3). On December 29, 2003, DOE announced its preference for the Caliente rail corridor (68 *FR* 74951). On April 8, 2004, DOE announced the selection of the mostly rail scenario analyzed in the Yucca Mountain FEIS for transporting spent nuclear fuel and high-level radioactive waste nationally and within Nevada (69 *FR* 18557). The DOE decision to select the mostly rail scenario was based on analyses in the Yucca Mountain FEIS (specifically those

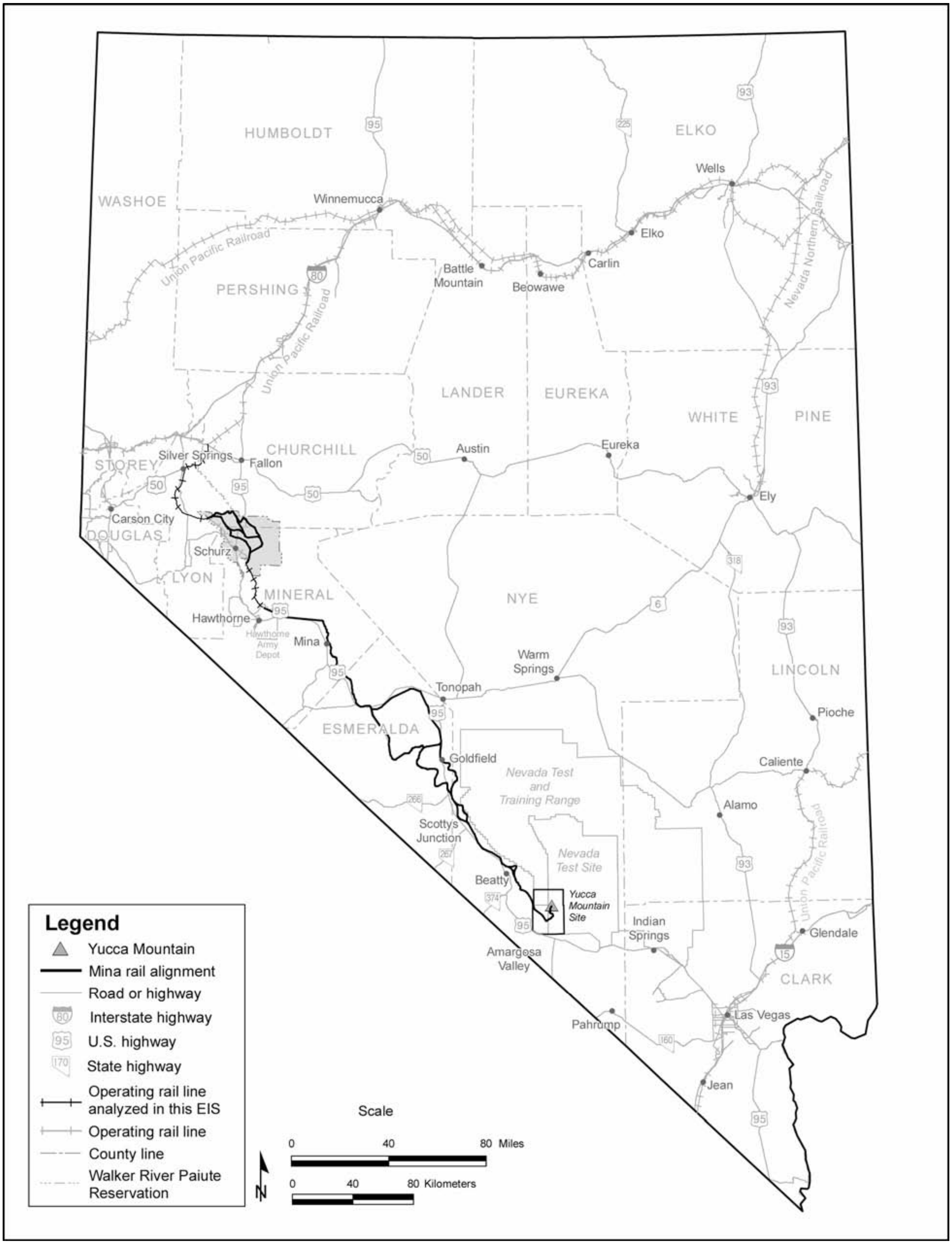


Figure 1-4. Mina rail alignment analyzed in this Rail Alignment EIS.

analyses related to impacts on the health and safety of workers and the public), preferences expressed by the State of Nevada, consideration of irreversible and irretrievable commitments of resources, and ***cumulative impacts*** from transporting other radioactive materials. DOE also announced that it had selected the Caliente rail corridor for further evaluation for the construction and operation of a railroad within Nevada. This decision was based primarily on the analyses in the Yucca Mountain FEIS, including land-use conflicts and their potential to adversely affect railroad construction. DOE considered the direct and indirect costs associated with railroad construction and operation within each rail corridor, potential for construction delay, and comments received from the public. DOE received comments from the public stating opposition to all the rail corridors and, in particular, stating that DOE should avoid rail corridors in the Las Vegas Valley. The DOE preference for the Caliente rail corridor considered many factors, including its more remote location, the diminished likelihood of land-use conflicts, concerns raised by Nevadans, and national security issues the U.S. Air Force raised regarding the Caliente–Chalk Mountain rail corridor.

Overall, it appeared that the Caliente rail corridor would have the fewest land-use or other conflicts that could lead to substantial delays in acquiring the necessary land and rights-of-way or that could lead to substantial delays in beginning construction. DOE also considered the direct costs of constructing and operating the proposed railroad, and the indirect costs resulting from potential delays in the availability of the railroad. The Jean and Valley Modified rail corridors are the shortest and would have the lowest estimated construction costs. The Carlin and Caliente rail corridors are the longest and, on the basis of construction cost alone, would be more expensive to develop. However, railroad construction delays because of land-use or other conflicts, and the resulting inability to accept large amounts of spent nuclear fuel and high-level radioactive waste transported via a railroad to the repository in a timely manner, could add both to the liability costs for delayed acceptance of ***commercial spent nuclear fuel*** and to the costs of continued ***storage*** of DOE wastes. Therefore, DOE concluded that the Caliente rail corridor would be preferable to the other rail corridors and selected the Caliente rail corridor as the one within which to evaluate possible alignments for the rail line connecting the repository to an existing rail line in Nevada (69 *FR* 18557, April 8, 2004).

1.4 Selection of the Mina Rail Corridor for Further NEPA Evaluation

DOE originally identified the Mina rail corridor in a series of three transportation studies prior to preparation of the Yucca Mountain FEIS, as follows:

- *Preliminary Rail Access Study* (DIRS 104792-YMP 1990, all)
- *Nevada Potential Repository Preliminary Transportation Strategy Study 1* (DIRS 104795-CRWMS M&O 1995, all)
- *Nevada Potential Repository Preliminary Transportation Strategy Study 2* (DIRS 101214-CRWMS M&O 1996, all)

The Department did not study the Mina rail corridor in detail in the Yucca Mountain FEIS because a railroad in the that corridor could only connect to an existing rail line in Nevada by crossing the Walker River Paiute Reservation, and the Walker River Paiute Tribe had informed DOE in 1991 that it would not allow nuclear waste to be transported across its Reservation.

During the first scoping period for this Rail Alignment EIS, DOE received comments from the public suggesting that the Department consider the Mina rail route. DOE held discussions with the Walker River Paiute Tribe regarding the availability of the Mina route for evaluation. In May 2006, the Tribal

Council informed DOE that it would allow the Department to evaluate the environmental impacts of transporting nuclear waste across the Reservation.

DOE prepared a preliminary feasibility study of the Mina ***rail route*** to identify a specific rail corridor and associated preliminary common segments and alternative segments (DIRS 180222-BSC 2006, all). The preliminary feasibility study considered the original Mina rail route, which was referred to as Option 6 in the *Preliminary Rail Access Study,* and refined the route using updated design criteria, literature reviews, limited field studies, and initial design analyses. The feasibility study concluded that construction, operation, and maintenance of a railroad in the Mina rail corridor appeared to be feasible.

On October 13, 2006, DOE announced its intent to expand the scope of this Rail Alignment EIS to incorporate analysis of the potential environmental impacts associated with constructing and operating a railroad within the Caliente rail corridor or the Mina rail corridor. DOE also announced that it would supplement the rail corridor analysis of the Yucca Mountain FEIS. DOE announced that it would update, as appropriate (that is, identify any significant new circumstances or information relevant to environmental concerns), the information and analysis for other rail corridors analyzed in the Yucca Mountain FEIS. *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (DOE/EIS-0250F-S2D; the Nevada Rail Corridor SEIS) provides the analysis and information regarding the Mina rail corridor and the other rail corridors analyzed in the Yucca Mountain FEIS. In the Nevada Rail Corridor SEIS, DOE concludes that the Mina rail corridor warrants further study to determine an alignment for the construction and operation of a railroad. That alignment-level study is included in this Rail Alignment EIS.

1.5 Cooperating and Consulting Agencies

Pursuant to the NWPA, DOE is responsible for the disposal of spent nuclear fuel and high-level radioactive waste to protect public health, safety, and the environment, and for developing and implementing a plan for transporting spent nuclear fuel and high-level radioactive waste to a repository at Yucca Mountain. The Council on Environmental Quality regulations at 40 Code of Federal Regulations (CFR) 1501.6 emphasize agency cooperation early in the NEPA process and allow a lead agency (in this case, DOE) to request the assistance of other agencies that either have jurisdiction by law or have special expertise regarding issues considered in an EIS. The Bureau of Land Management (BLM or the Bureau); the Surface Transportation Board (STB); and the U.S. Air Force are cooperating agencies in the development of this Rail Alignment EIS (see Section 1.5.1), pursuant to Council on Environmental Quality regulations, and have participated in the preparation of the EIS. Cooperating agencies that could issue decisions concerning the Proposed Action and alternatives to the Proposed Action could adopt the Nevada Rail Corridor SEIS and the Rail Alignment EIS in whole or in part and use them as a basis for their decisions. These agencies have management and regulatory authority over lands and resources that would be crossed by or be close to the proposed railroad or they have special expertise related to the Proposed Action.

The Walker River Paiute Tribe, the Bureau of Indian Affairs, and the U.S. Army are consulting agencies in the development of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (see Section 1.5.2).

1.5.1 COOPERATING AGENCIES

1.5.1.1 Bureau of Land Management

The BLM is an agency within the U.S. Department of the Interior and is responsible for administering more than 1 million square kilometers (250 million acres) of ***public lands***, mostly in 12 western states, including Alaska. Congress enacted the Federal Land Policy and Management Act (43 U.S.C. 1701 *et seq.*) "to establish public land policy; to establish guidelines for its administration; to provide for the management, protection, development, and enhancement of the public lands; and for other purposes." It is the primary legislation guiding the BLM in its responsibility to manage the public lands and resources in a combination of ways that best serve the present and future needs of the American people.

To construct that portion of the proposed railroad that would cross public land, DOE must obtain a ***right-of-way grant*** from the BLM. BLM regulations at 43 CFR Part 2800 establish the procedures for processing right-of-way applications from federal agencies. The right-of-way application would include public land required for access roads, ***construction camps***, water wells, and other facilities that would be part of the proposed railroad. The BLM may adopt this Rail Alignment EIS as authorized by 40 CFR 1506.3 to satisfy the NEPA requirements for the right-of-way application. The BLM will determine whether to grant a right-of-way for the construction and operation of the DOE-proposed railroad.

Resource management plan: A land-use plan for public lands as described by the Federal Land Management and Policy Act. Among other things, it establishes land areas for limited, restricted, or exclusive use; allowable resource uses; resource condition goals and objectives; general management practices to achieve the goals; the need for more specific management plans for certain areas; general implementation sequences; and monitoring intervals and standards (43 CFR Part 1610).

Right-of-way grants on public lands must be consistent with the applicable BLM ***resource management plan***(s). Four resource management plans cover the areas of the Caliente rail alignment and the Mina rail alignment. These resource management plans are included in the following four documents:

- *Draft – Resource Management Plan/Environmental Impact Statement for the Ely District* (DIRS 174518-BLM 2005, all)
- *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all)
- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (DIRS 176043-BLM 1998, all)
- *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all)

Free-use permit: An authorization to extract mineral materials from public lands at no charge. The BLM issues free-use permits to a federal or state agency when the materials are for use in a public project (43 CFR Part 3620).

The BLM will determine whether the proposed railroad is consistent with these resource management plans and, if not, whether to amend them.

DOE could need one or more quarries to provide rail line construction materials. The potential quarry sites analyzed in this Rail Alignment EIS are all on BLM-administered land, with the exception of one potential site, which would be partially on private land. Before excavating materials at any of the potential quarry sites, DOE would obtain ***free-use permits*** from the BLM. Additional rights-of-way might also be required to facilitate transporting the materials to the construction site. Free-use permits are issued to federal and state agencies under the Materials Act of 1947 (30 U.S.C. 601 *et seq.*) for use of common varieties of sand, stone, and gravel. BLM regulations at 43 CFR Part 3604 establish procedures for the designation of free-use permits.

The BLM agreed to be a cooperating agency in the preparation of this Rail Alignment EIS to increase the potential for the Bureau to adopt and use the EIS to process a DOE right-of-way application for access to the public lands that would be required for construction and operation of the proposed railroad. The procedures for BLM adoption of another agency's EIS (DIRS 182299-BLM 1988, all) specify that the

BLM conduct an independent review of the EIS and issue its own Record of Decision. Cooperating agency status provides the Bureau the opportunity to work closely with the lead agency during development of the NEPA document to encourage a product that meets the NEPA requirements for processing a right-of-way application. Cooperating agency status does not imply endorsement of the lead agency's preferred alternative.

In December 2003, DOE notified the BLM that it would be submitting an application for a ***Public Land Order*** to administratively withdraw 1,249 square kilometers (308,600 acres) of public land encompassing the Caliente rail corridor, from surface and mineral entry for up to 20 years, to evaluate the land for the potential construction, operation, and maintenance of the proposed railroad for the transportation of spent nuclear fuel and high-level radioactive waste to a geologic repository at Yucca Mountain. Upon receipt of the DOE notification, the BLM issued a notice announcing the segregation of the land from surface and mineral entry for up to 2 years to allow a ***case file*** containing various studies and analyses to be prepared to support a final decision on the ***withdrawal*** application (*Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada*, 68 *FR* 74965, December 29, 2003). Although in its 2003 withdrawal application DOE sought a 20-year land withdrawal, DOE determined that a 10-year land withdrawal would be adequate for conducting necessary activities. DOE prepared *Environmental Assessment for the Proposed Withdrawal of Public Lands Within and Surrounding the Caliente Rail Corridor* (DIRS 176452-DOE 2005, all) to support the Public Land Order request. The BLM was a cooperating agency in the preparation of that environmental assessment.

Public Land Order: An order affecting, modifying, or canceling a withdrawal or reservation that has been issued by the Secretary of the Interior pursuant to powers of the President delegated to the Secretary by Executive Order 9146 of April 24, 1942, or 9337 of April 24, 1943.

The BLM processed the DOE Public Land Order request in accordance with its regulations at 43 CFR Part 2310, which define the procedures and analyses necessary to meet public involvement requirements and to develop and process the case file for submission to the Secretary of the Interior. The Secretary of the Interior issued Public Land Order No. 7653, withdrawing the requested public lands within the Caliente rail corridor from surface and mineral entry for 10 years to allow DOE to evaluate the lands for the potential construction, operation, and maintenance of the proposed railroad (*Public Land Order No. 7653; Withdrawal of Public Lands for the Department of Energy to Protect the Caliente Rail Corridor; Nevada,* 70 *FR* 76854, December 28, 2005). The Public Land Order does not affect existing ***mining claims*** or other activities such as grazing rights, water rights, and recreational uses. Some of the Caliente alternative segments evaluated in this Rail Alignment EIS are outside the land subject to Public Land Order No. 7653.

In December 2006, DOE filed another application with the BLM to withdraw an additional 842 square kilometers (208,037 acres) of public lands from surface and mineral entry through December 27, 2015 (the same date as the expiration of Public Land Order No. 7653), to evaluate the lands for the potential construction, operation, and maintenance of the proposed railroad. This application included 278 square kilometers (68,646 acres) of public lands that encompass the Caliente rail alignment that fall outside of Public Land Order No. 7653 and 564 square kilometers (139,391 acres) of public lands encompassing the Mina rail alignment. The BLM issued a notice of proposed withdrawal and announced the segregation of the lands for up to 2 years to allow a case file to be prepared to support the final decision on the withdrawal application (*Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada*, 72 *FR* 1235, January 10, 2007).

1.5.1.2 Surface Transportation Board

The STB is an economic regulatory agency that Congress charged with the fundamental missions of resolving railroad rate and service disputes and reviewing proposed railroad constructions, acquisitions, mergers, and abandonments. The STB is decisionally independent, although it is administratively affiliated with the U.S. Department of Transportation. The ICC (Interstate Commerce Commission) Termination Act of 1995 (Public Law No. 104-88) created the STB, which is the successor agency to the Interstate Commerce Commission.

The STB has jurisdiction over railroad rate and service issues, and rail structuring transactions such as new line construction, line sales, line abandonments, and railroad mergers. The STB has exclusive jurisdiction over rail transportation that is part of the interstate rail network. All railroads (except private carriers) have a common-carrier obligation to provide reasonable service upon reasonable request.

If the proposed railroad were to be operated as a common-carrier rail line, the Department would have to apply to the STB for a license to construct and operate the railroad (certificate of public convenience and necessity). DOE would need a license to construct and operate the proposed railroad as a common-carrier rail line. As part of the licensing process, the STB must consider the environmental effects of railroad construction and operation. The STB Section of Environmental Analysis is responsible for preparing the appropriate NEPA documentation for railroad construction and operation cases under the jurisdiction of the STB. If any NEPA documentation were required in addition to this Rail Alignment EIS to support the STB decision to issue a license, DOE would provide additional information as necessary.

1.5.1.3 U.S. Air Force

The mission of the U.S. Air Force, in conjunction with the other armed services, is to preserve the peace and security and provide for the defense of the United States, its Territories, Commonwealths, and possessions, and any U.S.-occupied areas. The Caliente rail corridor skirts the northern and western boundaries of the Nevada Test and Training Range. The Air Force agreed to become a cooperating agency as a consequence of its jurisdiction over airspace and land on the Nevada Test and Training Range that would be affected by one or more of the alternative segments. DOE coordinates and at times obtains approval from the responsible armed service when DOE actions might encroach on U.S. Department of Defense land and potentially affect military operations. Although DOE has decided not to pursue alternative segments that would have entered the Nevada Test and Training Range, DOE is coordinating with the Air Force (for example, on the nature, extent, and location of Air Force overflights) to minimize any impacts of the proposed railroad to Air Force operations. In addition, the U.S. Air Force offers special expertise associated with the project area around the Nevada Test and Training Range.

1.5.2 CONSULTING AGENCIES

1.5.2.1 Walker River Paiute Tribe

The Walker River Paiute Tribe is a Northern Paiute tribe and is a federally recognized tribal entity eligible to receive services from the Bureau of Indian Affairs. If DOE constructed and operated the proposed railroad along the Mina rail alignment, the Department would construct a segment of the rail line on the Walker River Paiute Reservation to bypass Schurz and operate over segments of the existing Department of Defense Branchline that runs through the Reservation. DOE would need to apply to the Bureau of Indian Affairs for a right-of-way in which to construct the railroad (see Section 1.5.2.2). The Walker River Paiute Tribe had initially agreed to become a cooperating agency in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS to allow the Tribe to make an informed decision on granting a right-of-way and because of the Tribe's special expertise associated with the environmental resources on the Reservation. However, on April 17, 2007, the Walker River Paiute Tribal Council announced a resolution that withdrew the Tribe from participating in the EIS process. The Walker River Paiute Tribe also decided to withdraw as a cooperating agency.

1.5.2.2 Bureau of Indian Affairs

The Bureau of Indian Affairs, an agency of the U.S. Department of the Interior, is responsible for the administration and management of 225,410 square kilometers (55.7 million acres) of land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives. There are 561 federally recognized tribal governments in the United States. The Bureau of Indian Affairs is also responsible for developing forestlands, leasing assets on these lands, directing agricultural programs, protecting water and land rights, and developing and maintaining infrastructure and economic development.

To build the proposed railroad along the Mina rail alignment, the Department would construct a segment of rail line on the Walker River Paiute Reservation to bypass Schurz and would operate over segments of the existing Department of Defense Branchline that runs through the Reservation. DOE would need to apply to the Bureau of Indian Affairs for a right-of-way in which to construct the rail line. Bureau of Indian Affairs regulations in 25 CFR Part 169 establish procedures for the issuance of rights-of-way over Indian lands. The Bureau of Indian Affairs was a cooperating agency in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS to fulfill its NEPA responsibilities associated with any decision to grant a right-of-way for railroad construction and operation and because of its expertise in American Indian issues. However, the Bureau of Indian Affairs decided not to remain a cooperating agency due to the nonpreferred status of the Mina Implementing Alternative resulting from the Walker River Paiute Tribe's withdrawal from the EIS process.

1.5.2.3 U.S. Army

The mission of the U.S. Army is to serve the American people, to defend the Nation, to protect vital national interests, and to fulfill national military responsibilities. The Mina rail alignment includes segments of an Army-owned rail line (referred to in this document as the Department of Defense Branchlines) that runs from the Fort Churchill ***siding*** near Wabuska, Nevada, to the Hawthorne Army Depot near Hawthorne, Nevada. In addition, DOE is considering constructing a segment of rail line and a staging yard facility on the Hawthorne Army Depot. The U.S. Army, through the Hawthorne Army Depot and the U.S. Army Corps of Engineers, was a cooperating agency in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS to ensure that the Army fulfilled its NEPA responsibilities associated with any decision to allow DOE to construct a segment of rail line and a staging yard facility on Army-controlled property. In addition, the U.S. Army offered special expertise associated with the project area around Hawthorne Army Depot. The U.S. Army decided not to remain a cooperating agency due to the nonpreferred status of the Mina Implementing Alternative resulting from the Walker River Paiute Tribe's withdrawal from the EIS process.

1.6 Environmental Impact Statement Process

Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR Parts 1500 through 1508) and DOE NEPA regulations (10 CFR Part 1021) provide procedures to use when preparing an EIS. A major emphasis of the EIS process is to promote public awareness of the proposed action and its alternatives and to provide opportunities for public involvement. An agency prepares an EIS in a series of steps: (1) by publishing a Notice of Intent to prepare an EIS and implementing a process known as "scoping," whereby comments are solicited from federal, state, and local agencies, American Indian tribes and organizations, other organizations, and the general public to assist in defining the proposed action, alternatives, and issues requiring analysis; (2) by preparing a Draft EIS for public review and comment; (3) by preparing a Final EIS that incorporates and responds to all comments received on the Draft EIS; and (4) by preparing a Record of Decision to announce the agency's decision on a project and explaining the reasons for the decision.

In the Yucca Mountain FEIS, DOE noted that determining the specific rail alignment in which to construct the proposed railroad would require further NEPA analysis. This Rail Alignment EIS addresses the selection of a rail alignment within which to construct, operate, and possibly abandon the proposed railroad for ***shipment*** of spent nuclear fuel, high-level radioactive waste, and ***other materials*** from an existing rail line in Nevada to a repository at Yucca Mountain, Nye County, Nevada.

DOE will use this Rail Alignment EIS to decide whether to construct and operate the proposed railroad, and if so, to:

- Select a rail alignment in which to construct the railroad.
- Select the common segments and combination of alternative segments within the selected alignment. The Department would use the selected combination of segments to identify the public lands to be included in a right-of-way application to the BLM.
- Decide where to construct certain proposed railroad operations support facilities.
- Decide whether to restrict use of the rail line to DOE trains, or whether to allow common carriers to operate over the rail line.
- Determine what ***mitigation*** measures to implement.

1.6.1 DEPARTMENT OF ENERGY NOTICES OF INTENT AND SCOPING MEETINGS

On April 18, 2004, DOE published a Notice of Intent (69 *FR* 18565) announcing that it would prepare an EIS for the alignment, construction, and operation of a railroad (called rail line in the Notice of Intent) for shipment of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. The Notice also announced the schedule for public scoping meetings, and invited and encouraged comments on the scope of this Rail Alignment EIS to ensure that all relevant environmental issues and reasonable alternatives would be addressed. To facilitate the scoping process, in the Notice of Intent DOE identified a preliminary list of issues and environmental resources that might be considered in this Rail Alignment EIS, and specifically invited comments on the following six questions to help define the scope of the EIS.

1. Should additional alternatives be considered that might minimize, avoid, or mitigate adverse environmental impacts (for example, looking beyond the 400-meter [0.25-mile]-wide corridor, avoiding ***Wilderness Study Areas***, American Indian Trust Lands, or encroachment on the Nevada Test and Training Range)?
2. Should any of the preliminary alternatives be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. Should DOE allow private entities to ship commercial commodities on the rail line?
5. What mitigation measures should be considered?
6. Are there national security issues that should be addressed?

The scoping comment period began with publication of the Notice of Intent in the *Federal Register* and was originally scheduled to close on May 24, 2004. In response to a request from the State of Nevada, DOE extended the comment period by 7 days, to June 1, 2004 (69 *FR* 22496, April 26, 2004), bringing the total length of the scoping comment period to 55 days. DOE held five public scoping meetings on this Rail Alignment EIS at the following locations on the following dates in Nevada:

- Amargosa Valley – Longstreet Hotel Casino, Nevada State Highway 373, May 3, 2004
- Goldfield – Goldfield Community Center, 301 Crook Street, May 4, 2004
- Caliente – Caliente Youth Center, U.S. Highway 93, May 5, 2004
- Reno – University of Nevada, Reno, Fifteenth and North Virginia, May 12, 2004
- Las Vegas – Cashman Center, 850 North Las Vegas Boulevard, May 17, 2004

In addition to the *Federal Register* notices announcing the meetings, DOE advertised the meetings in five local newspapers that have a total circulation of approximately 250,000; sent four separate press releases to media outlets, industry, and stakeholders; mailed several thousand letters to stakeholders, members of the public, and other interested parties; and distributed over 1,000 handbills in Lincoln, Nye, and Esmeralda Counties.

DOE conducted the public scoping meetings in an open-house format. Members of the public were invited to attend the meetings at their convenience, any time during meeting hours, and submit their comments in writing at the meeting, or in person to a court reporter who was available throughout the meeting. The open-house format provided for one-on-one discussions with DOE representatives responsible for the preparation of this Rail Alignment EIS. Approximately 440 people attended the meetings (this count is approximate because not all attendees signed in), and 86 submitted oral comments (that the court reporters later transcribed) on the scope of the EIS.

DOE considered all comments received on the scope of this Rail Alignment EIS, along with information the BLM received, including results of interviews with ***grazing allotment*** permittees and other interested parties documented in *Proposed Yucca Mountain Corridor Affected Grazing Permittees* (DIRS 173845-Resource Concepts 2005, all). DOE considered American Indian perspectives documented in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (DIRS 174205-Kane et al. 2005, all). DOE also considered information obtained through sources such as the interviews Lincoln and Nye Counties conducted under a cooperative agreement with the Department.

On October 13, 2006, DOE published an Amended Notice of Intent (71 *FR* 60484) announcing the expanded scope of this Rail Alignment EIS to include detailed analysis of alternative segments (called alternative alignments in the Amended Notice of Intent) within the Mina rail corridor, should the Mina corridor warrant further consideration based on the Nevada Rail Corridor SEIS analysis. The Notice also announced the schedule for public scoping meetings, and invited and encouraged comments on the scope of this Rail Alignment EIS to ensure that all relevant environmental issues and reasonable alternatives would be addressed. To facilitate the scoping process, in the Amended Notice of Intent DOE provided a brief summary of public comments received during the previous scoping period and identified a preliminary list of issues and environmental resources that might be considered in this Rail Alignment EIS. DOE also specifically invited comments on the following four questions related to the Mina rail corridor to help define the scope of the analysis:

1. Should additional alternative alignments (now called alternative segments) be considered that might minimize, avoid, or mitigate adverse environmental impacts (for example, looking beyond the 400-meter [0.25-mile]-wide Mina corridor, avoiding environmentally sensitive areas)?
2. Should any of the preliminary alternative segments be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. What mitigation measures should be considered?

The second scoping comment period began with publication of the Amended Notice of Intent in the *Federal Register* and was originally scheduled to close on November 27, 2006. In response to requests from the public, DOE extended the comment period by 15 days, to December 12, 2006 (71 *FR* 65785, November 9, 2006), bringing the total length of the scoping comment period to 61 days. DOE held eight public scoping meetings during the second public scoping period at the following locations on the following dates in Nevada and Washington, D.C.:

- Washington, D.C. – L'Enfant Plaza Hotel, 480 L'Enfant Plaza, SW, October 30, 2006
- Amargosa Valley – Longstreet Hotel Casino, Nevada State Highway 373, November 1, 2006
- Las Vegas – Cashman Center, 850 North Las Vegas Boulevard, November 2, 2006
- Caliente – Caliente Youth Center, U.S. Highway 93, November 8, 2006
- Goldfield – Goldfield School Gymnasium, Hall and Euclid, November 13, 2006
- Hawthorne – Hawthorne Convention Center, 932 E. Street, November 14, 2006
- Fallon – Fallon Convention Center, 100 Campus Way, November 15, 2006
- Reno – University of Nevada, Reno, Lawlor Event Center, 1500 N. Virginia Street, November 27, 2006

In addition to the *Federal Register* notices announcing the meetings, DOE advertised the meetings in eight local newspapers, including the Washington Post. Total circulation of the newspapers is approximately 280,000 plus an additional 750,000 for the Washington Post. DOE sent four separate press releases to media outlets, industry, and stakeholders; mailed several thousand letters to stakeholders, members of the public, and other interested parties; and distributed over 1,300 handbills in Washoe, Churchill, Lyon, Mineral, Esmeralda, Lincoln, and Nye Counties.

DOE conducted the public scoping meetings in an open-house format. Members of the public were invited to attend the meetings at their convenience, any time during meeting hours, and submit their comments in writing at the meeting, or in person to a court reporter who was available throughout the meeting. The open-house format provided for one-on-one discussions with DOE representatives responsible for the preparation of this Rail Alignment EIS. Approximately 330 people attended the meetings (this count is approximate because not all attendees signed in), and 63 submitted oral comments (that the court reporters transcribed) on the scope of the EIS.

In addition to the second public scoping period for this Rail Alignment EIS, DOE held concurrent public scoping periods for its Repository SEIS (DOE/EIS-0250F-S1D) and the Nevada Rail Corridor SEIS (DOE/EIS-0250F-S2D). To ensure proper consideration of all public comments, DOE assigned each comment to one or more SEIS or EIS. The Department reviewed all comments for applicability to this the Nevada Rail Corridor SEIS, the Rail Alignment EIS, and the Repository SEIS and assigned them accordingly. DOE has considered all comments, including those received after the close of the scoping period, on the scope of these documents.

1.6.2 SCOPING COMMENTS

Section 1.6.2.1 summarizes the scoping comments received during the first scoping period and refers to the Caliente rail alignment. Section 1.6.2.2 summarizes scoping comments received during the second scoping period, in which most comments referred to the Mina rail alignment.

1.6.2.1 Caliente Rail Alignment

DOE received more than 4,100 comments during the first public scoping period for this Rail Alignment EIS, and some after the close of the scoping period. DOE summarized all comments received (including those submitted after the close of the scoping period) in *Summary of Public Scoping Comments Related to the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV* (DIRS 176463-Craig, Lechel, and Morton 2004*,* all), and considered the content of all comments in determining the scope of the EIS. Table 1-1 summarizes the comments that address the six questions listed in the Notice of Intent and any other comments that led to changes in the scope of the EIS. Table 1-1 also notes DOE responses to those comments and directs the reader to sections of the EIS that address certain issues.

1.6.2.2 Mina Rail Alignment

DOE received nearly 800 comments during the second public scoping period for this Rail Alignment EIS, and some comments after the close of the scoping period. DOE summarized all comments received (including those submitted after the close of the scoping period) in *Summary of Public Scoping Comments on the Expanded Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV* (DIRS 181379-Oakes 2007*,* all), and considered the content of all comments in determining the scope of the EIS. Table 1-2 summarizes the comments that address the four questions listed in the Amended Notice of Intent and any other comments that led to changes in the scope of the EIS. Many of the comments received were similar in nature to comments received during the first scoping period. Table 1-2 focuses on comments that changed the scope of the EIS beyond those listed in Table 1-1. Table 1-2 also notes DOE responses to those comments and directs the reader to sections of the EIS that address certain issues.

1.6.3 TRIBAL UPDATE MEETINGS

The Consolidated Group of Tribes and Organizations is composed of 17 tribes and organizations with appointed representatives who are responsible for representing their respective tribal concerns and perspectives. In 1987, DOE began a long-term relationship with the Consolidated Group of Tribes and Organizations to inventory and evaluate the American Indian cultural resources in the Yucca Mountain area. The primary focus of the group has been the protection of cultural resources and environmental restoration.

The American Indian Writers Subgroup is composed of representatives from the Western Shoshone, Owens Valley Paiute and Shoshone, and Southern Paiute groups. The Consolidated Group of Tribes and Organizations appointed these representatives to write the American Indian perspective of a proposed railroad in the Caliente corridor. DOE has provided members of the American Indian Writers Subgroup with opportunities to travel along the Caliente rail corridor, funding, technical assistance, and other resources necessary to develop a resource document that expresses American Indian perspectives on the proposed railroad.

DOE held a tribal update meeting in Las Vegas, Nevada, on June 2 and June 3, 2004, to obtain comments from tribal representatives from the Consolidated Group of Tribes and Organizations. During the second scoping comment period for this Rail Alignment EIS, DOE held another meeting for the Consolidated Group of Tribes and Organizations on November 29, 2006, in Pahrump, Nevada. DOE considered all comments submitted during the meetings in the development of the scope of the EIS. Commenters called for continued consultation with tribes that would be culturally affected by the transportation of spent nuclear fuel and high-level radioactive waste, not only in Nevada but across the country. DOE is committed to continuing the consultation process throughout the development of this Rail Alignment EIS

Table 1-1. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Caliente rail alignment[a] (page 1 of 5).

Notice of Intent question	Scoping comment summary	DOE response summary
Should additional alternatives be considered that might minimize, avoid, or mitigate adverse environmental impacts?	DOE received many comments regarding proposed alternative segments or rail corridors that should either be included for consideration or dismissed. Suggestions for new alternative segments gave justifications such as minimizing risks to population centers, avoiding American Indian Trust Lands, bypassing private lands, avoiding impacts to mining and ranching operations, maintaining access to the local transportation network, avoiding sensitive biological and cultural resource areas, and avoiding impacts to the Nevada Test and Training Range.	DOE considered changes to the alternative segments identified in the Notice of Intent and the new alternative segments suggested during scoping. Some of these proposed alternative segments are studied in detail in this Rail Alignment EIS, and others were eliminated from detailed study. Chapter 2 of this Rail Alignment EIS provides information about the proposed alternative segments considered in detail. Chapter 2 and Appendix C discuss other alternative segments suggested during scoping but dismissed from further consideration, and describe the evolution of the rail alignments considered in this Rail Alignment EIS and the reasons for dismissing certain alternative segments.
	Commenters suggested a rail alignment along, but outside, the western boundary of the Nevada Test and Training Range.	As described in Chapter 2 of this Rail Alignment EIS, DOE investigated alternative segments along, but outside, the western boundary of the Nevada Test and Training Range. DOE analyzed several alternative segments close to the boundary of the Nevada Test and Training Range in detail. All common segments and alternative segments analyzed in detail in this Rail Alignment EIS are outside the Nevada Test and Training Range.
	DOE received comments regarding potential environmental impacts associated with constructing and operating the proposed railroad. A number of commenters expressed concern about the proximity of the rail line to Wilderness Study Areas and suggested that DOE avoid those areas. The President signed the Lincoln County Conservation, Recreation, and Development Act into law on December 1, 2004 (Public Law 108-424). It designates Wilderness Areas in Lincoln County, including the Weepah Springs Wilderness Area.	DOE adjusted or eliminated alternative segments to avoid Wilderness Study Areas and Wilderness Areas. For example, one of the proposed alternative segments that would have passed through the White River area (White River 2) would have crossed into the Weepah Springs Wilderness Area for a short distance. DOE adjusted this alternative segment to avoid the Wilderness Area. In addition, the common segment of the rail alignment that would pass through Reveille Valley would cross into the Reveille Valley Wilderness Study Area for a short distance. DOE identified two new alternative segments (South Reveille 2 and 3) to avoid the Wilderness Study Area.
	Commenters urged DOE to adopt an alternative segment that would bypass Garden Valley. Commenters suggested an alternative segment that would follow existing highways from Caliente to Tonopah (U.S. Highway 93 to Route 375 to Route 6). Other commenters suggested an alternative segment that would pass through Coal Valley and Murphy Gap in the Golden Gate Range.	DOE considered several alternative segments that would bypass Garden Valley. While the alternative segments that would avoid Garden Valley were determined not to be reasonable and were eliminated from detailed study due to feasibility and cost issues, DOE added and studied in detail, Garden Valley 3 and Garden Valley 8 to the proposed alternative segments to provide more alternatives within Garden Valley and to reduce environmental impacts.

Table 1-1. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Caliente rail alignment[a] (page 2 of 5).

Notice of Intent question	Scoping comment summary	DOE response summary
Should additional alternatives be considered that might minimize, avoid, or mitigate adverse environmental impacts? (continued)	Commenters suggested interfacing with the Union Pacific Railroad Mainline at Elgin.	DOE considered the Elgin alternative segment to connect to the Union Pacific Railroad Mainline. However, the Elgin alternative segment would cross several areas of private land and would require steep grades coming out of Rainbow Canyon. DOE determined that this alternative segment was not reasonable and eliminated it from detailed study.
	Commenters suggested relocating the Goldfield alternative segments farther west to avoid the historic mining district, private property, and access roads.	DOE added Goldfield alternative segment 4, which would run to the west of Goldfield and avoid the mining district.
Should any of the preliminary alternatives be eliminated from detailed consideration?	Commenters suggested that a Bonnie Claire alternative segment (Bonnie Claire 1) should either be eliminated from consideration or moved, because it would cross Timbisha Shoshone Trust Lands. The Air Force indicated that Bonnie Claire 2 was unacceptable because it would enter the Nevada Test and Training Range.	DOE eliminated Bonnie Claire 1 from detailed study, adjusted Bonnie Claire 2 to avoid the Nevada Test and Training Range, and added a new alternative segment (Bonnie Claire 3, which would avoid the Timbisha Shoshone Trust Lands and the Nevada Test and Training Range) for detailed study.
Should additional environmental resources be considered?	Commenters expressed concern about potential impacts to private land, ranching, mining, and other land-use issues. Commenters expressed interest in how construction and operation of the proposed railroad might affect access to public and private lands. Commenters requested that DOE provide maps showing the proposed railroad in relation to grazing allotments and private property. DOE and the BLM also solicited and received comments from grazing permittees that described the potential impacts to ranching operations that could occur if DOE constructed the proposed railroad (see DIRS 173845-Resource Concepts 2005, all). Comments from grazing permittees also included suggested measures DOE could consider to mitigate potential impacts.	DOE initially selected the Caliente rail corridor in which to determine an alignment for a rail line, in part to minimize private land-use conflicts. This Rail Alignment EIS analyzes potential land-use impacts, including impacts to ranching (see Section 4.2.2, Land Use and Ownership). DOE has prepared a detailed Map Atlas (DIRS 182844-ICF 2007, Part B) that shows the proposed locations of the rail line and the infrastructure associated with construction and operation of the proposed railroad. The Map Atlas also shows private property and grazing allotment boundaries.

Table 1-1. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Caliente rail alignment[a] (page 3 of 5).

Notice of Intent question	Scoping comment summary	DOE response summary
Should additional environmental resources be considered? (continued)	Commenters stated that the impacts of the rail line to the *City* sculpture in Garden Valley must be thoroughly assessed in terms of disturbance of viewsheds, loss of visual resources, and noise. One commenter stated that the prevailing silence and the undisturbed environment are essential to the character of the sculpture.	DOE conducted ***ambient noise*** monitoring in Garden Valley and in other locations along the Caliente rail corridor to provide a ***baseline*** from which to analyze potential noise impacts (see Sections 3.2.8 and 4.2.8, Noise and Vibration). DOE also prepared photo simulations of the four Garden Valley alternative segments and used BLM methodology for analyzing impacts to visual resources (see Sections 3.2.3 and 4.2.3, Aesthetic Resources).
	Commenters asked how silica and ***erionite*** would be disposed of, and how DOE would prevent worker and public exposure to these materials.	DOE has analyzed the potential risks of exposure to silica and erionite and has identified best management practices to reduce public and worker exposure (see Section 4.2.10, Occupational and Public Health and Safety).
	Commenters highlighted the generation of dust and impacts to air resources that could occur during construction and noted potential impacts on fragile ***desert*** soils.	DOE has analyzed the potential for impacts to air resources and desert soils and identified the best management practices and mitigation measures to control dust generation and soil erosion (see Section 4.2.1, Physical Setting, and Section 4.2.4, Air Quality and Climate).
	Commenters requested that DOE analyze the socioeconomic impacts of construction and operations jobs on rural communities.	This Rail Alignment EIS includes analysis of socioeconomic impacts from railroad construction and operations on rural communities (see Section 4.2.9, Socioeconomics).
	Commenters stated that the Rail Alignment EIS must fully analyze the possible environmental impacts of potential ***accidents*** and train derailments, and the potential for an attack on a train carrying spent nuclear fuel or high-level radioactive waste, making the assumption that the ***cask*** sustains significant damage and is breached. One commenter noted that the dismissal of this concern on the grounds that such an event is not likely enough to be significant would not be acceptable. Commenters stated that the Rail Alignment EIS must identify the methodology DOE would employ to regularly inspect the rail line to ensure its integrity and safety.	DOE has analyzed the risks of accidents and releases that could occur during the railroad operations phase (see Section 4.2.10, Occupational and Public Health and Safety). This Rail Alignment EIS also analyzes releases that could occur from acts of terrorism. In the Yucca Mountain FEIS, DOE analyzed the environmental implications of transporting spent nuclear fuel and high-level radioactive waste throughout the United States by rail. DOE has incorporated security measures into its planning for transportation of these materials, both nationally and in Nevada.

Table 1-1. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Caliente rail alignment[a] (page 4 of 5).

Notice of Intent question	Scoping comment summary	DOE response summary
Should additional environmental resources be considered? (continued)	Commenters expressed concern about the potential impact to local economies and communities from development of the proposed railroad. These concerns included the potential economic loss resulting from restricted access to the land adjacent to the rail line, and the negative public perception of the area of the railroad. One commenter expressed concern about the possible displacement of community members through the government's use of eminent domain.	DOE has analyzed the potential socioeconomic impacts of the proposed railroad, and the potential land-use conflicts that could occur (see Section 4.2.9, Socioeconomics, and Section 4.2.2, Land Use and Ownership).
	Several commenters stated that the Rail Alignment EIS must thoroughly address the safety measures and adequacy of emergency response in case of a rail accident or accidental release of radioactive material. Specifically, commenters mentioned addressing the need to provide support facilities close to established communities and the need to define the acceptable statistical probabilities of health and environmental risks.	DOE has evaluated the risk of accidents and releases of radioactive material (see Section 4.2.10, Occupational and Public Health and Safety). Appendix L, Supplemental Transportation Information, discusses emergency response.
Should DOE allow private entities to ship commercial commodities on its rail line?	Commenters expressed support for public or commercial use of the rail line. Commenters noted the potential for economic development (that is, maximize value and minimize risk); shipping of various commodities such as building materials, oil, and minerals from mining; and use by passengers or tourists pursuing various recreational interests.	As described in Chapter 2, DOE prepared a shared-use report to assess the demand for shared use and to identify a potential level of rail traffic that could be generated under shared use. The Department has analyzed the ***Shared-Use Option*** in this Rail Alignment EIS to make an informed decision on shared use.
	Other commenters stated that the rail line should be used only for DOE shipments and should not be made available for shared use.	DOE has analyzed the Shared-Use Option in this Rail Alignment EIS to provide decisionmakers with enough information to make an informed decision on shared use.

Table 1-1. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Caliente rail alignment[a] (page 5 of 5).

Notice of Intent question	Scoping comment summary	DOE response summary
What mitigation measures should be considered?	Various commenters noted best management practices and mitigation issues surrounding impacts to livestock, fencing, revegetation of disturbed areas, waterways and washes, mining and mineral development, and truck transportation. More than 200 commenters indicated that the Rail Alignment EIS should address how ranchers and miners would be compensated for loss of grazing and mineral development rights, either financially or through granting of new grazing rights in other areas.	DOE developed a series of mitigation measures to avoid, minimize, rectify, reduce, or compensate for potential impacts associated with construction and operation of the proposed railroad. DOE and the BLM solicited comments on potential mitigation measures from grazing permittees along the rail alignment, and considered these comments when developing mitigation measures. Chapter 7 describes potential mitigation measures. In addition, DOE would implement best management practices during construction and operation of the railroad. Best management practices are considered part of the Proposed Action and are also described in Chapter 7.
Are there national security issues that should be addressed?	The Air Force indicated that for national security, safety, and training reasons, it would be unacceptable for alternative segments to enter the Nevada Test and Training Range.	DOE concluded that such alternative segments would not be reasonable and eliminated from detailed study all proposed alternative segments that would have entered the Nevada Test and Training Range.
Other comments that affected the scope of this Rail Alignment EIS	Commenters suggested that DOE identify and analyze the entire infrastructure necessary to construct and operate the proposed railroad, including construction camps, ***ballast*** sources, borrow and fill areas, access roads, rail yards, maintenance facilities, and an operations center.	DOE has identified the entire infrastructure necessary for construction and operation of the proposed railroad (see Chapter 2), and this Rail Alignment EIS analyzes the potential impacts associated with that infrastructure.

a. Source: DIRS 176463-Craig, Lechel, and Morton 2004, all.

Table 1-2. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Mina rail alignment[a] (page 1 of 3).

Amended Notice of Intent question	Scoping comment summary	DOE response summary
Should additional alternative alignments (segments), be considered that might minimize, avoid, or mitigate adverse environmental impacts?	DOE received many comments regarding proposed alternative segments. For example, commenters suggested that DOE avoid Silver Peak in favor of a route that avoids the steep grades, length, and construction costs associated with Montezuma alternative segment 1. Other commenters suggested linking the Silver Peak and Goldfield alternative segments (Montezuma alternative segments 1 and 2). Other commenters suggested that DOE avoid all communities in the Mina rail corridor.	As described in Chapter 2, DOE added Montezuma alternative segment 3, which provides an alternative that avoids the communities of Silver Peak and Goldfield. Montezuma alternative segment 3 incorporates parts of Montezuma alternative segments 1 and 2 and links them at the northern end of the Montezuma Range. DOE has avoided the communities of Luning, Mina, and Sodaville by keeping Mina common segment 1 on the eastern side of Soda Spring Valley.
	DOE received a suggestion that Mina common segment 1 in the Redlich area be moved east due to mining exploration.	DOE moved Mina common segment 1 east to avoid mining operations.
	Commenters suggested that DOE evaluate alternative segments in the Crater Flat area to facilitate possible rail spurs to areas identified by Nye County for potential industrial development.	DOE evaluated the location of common segment 6 in the Crater Flat area and determined that rail line construction sidings could be left in place to facilitate shared use in this area. Shared-use opportunities are described in Chapter 2 and shared-use impacts are described in Chapter 4.
Should any of the preliminary alternatives be eliminated from detailed consideration?	Commenters suggested that DOE move Oasis Valley alternative segments 1 and 3 at least 5 miles east of their current location. These commenters expressed concerns about potential noise and vibration to a ranch located approximately 8 miles north of Beatty.	As described in Chapter 2, DOE considered the suggestion of moving Oasis Valley alternative segments 1 and 3 to the east, but decided that this was not feasible due to land-use conflicts with the Nevada Test and Training Range.

Table 1-2. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Mina rail alignment[a] (page 2 of 3).

Amended Notice of Intent question	Scoping comment summary	DOE response summary
Should additional environmental resources be considered?	Commenters requested that DOE consider the impacts on grade crossings in Lyon County on the existing Union Pacific Railroad Hazen Branchline. Commenters questioned whether the grade crossings at Hazen (Alternate U.S. Highway 50), Silver Springs (U.S. Highway 50), Fort Churchill State Historic Park (Alternate U.S. Highway 95), and at Wabuska (Alternate U.S. Highway 95) would need to be grade separated due to the increase in rail traffic proposed by DOE.	DOE performed a ***quantitative*** analysis of the impacts to all of the public road grade crossings along the existing Union Pacific Railroad and Department of Defense Branchlines. The analysis included consideration of whether any existing grade crossings need to be grade separated. This analysis is described in Section 4.3.9, Socioeconomics.
	Commenters suggested that the Rail Alignment EIS address a planned industrial and rail park in the Hazen area. Other commenters suggested inclusion of a planned airport in the Hazen area.	The Western Nevada Rail Park and the expansion of the airport near Silver Springs are considered in the cumulative impacts analysis (see Chapter 5).
	Commenters suggested that the scope of the Rail Alignment EIS include sufficiently large regions of influence for each resource studied so that real impacts can be assessed from railroad construction and operation. For example, commenters suggested that the scope for the Mina rail alignment should be from Hazen to Yucca Mountain.	The scope of the Rail Alignment EIS for the Mina rail alignment considers railroad operations impacts and rail traffic during construction from Hazen to Yucca Mountain. For rail line and facility construction, the scope includes Wabuska to Yucca Mountain (Wabuska being the most northerly location where DOE is proposing any rail line construction, in this case, a siding). The scope does include construction impacts from Hazen to Wabuska, but only in relation to the increase in rail traffic from trains carrying construction materials during the construction phase. Chapters 2, 3, and 4 describe this approach in more detail.
	DOE received comments highlighting plans to establish a new state park at Monte Cristo's Castle near Blair Junction. The comments suggested that the Mina rail alignment could interfere with and prevent access to the park from U.S. Highways 95 and 96.	DOE considered potential impacts associated with the Mina rail alignment on the development of the new park at Monte Cristo's Castle (see Section 4.3.2, Land Use, and Chapter 5, Cumulative Impacts).
	Commenters requested that the Rail Alignment EIS describe the fiscal consequences of ***stigma***-induced impacts to counties and cities along all waste-shipment routes in Nevada and along the Caliente and Mina rail alignments. Commenters suggested that the Rail Alignment EIS analyze stigma effects from both routine shipments and accidents. Commenters also suggested that DOE conduct a perceived risk assessment to evaluate cultural concerns along the rail alignments.	DOE considered stigma-induced impacts and perceived risk but found that analysis of impacts is highly uncertain. Section 4.1.3 describes the Department's consideration of stigma and perceived risk.

Table 1-2. Summary of Rail Alignment EIS scoping comments and DOE responses related to the Mina rail alignment[a] (page 3 of 3).

Amended Notice of Intent question	Scoping comment summary	DOE response summary
What mitigation measures should be considered?	Commenters suggested that the Rail Alignment EIS discuss all proposed efforts to monitor and mitigate impacts from construction and operation of the railroad.	Chapter 7 describes potential mitigation measures. In addition, DOE would implement best management practices during construction and operation of the railroad. Best management practices are considered part of the Proposed Action and are also described in Chapter 7.
Other comments that affected the scope of this Rail Alignment EIS	Commenters urged DOE to begin working with affected jurisdictions and individual property owners to ensure that they are involved in the decisionmaking process.	In addition to the scoping meetings, DOE has held several informational meetings with affected units of local government and has involved the counties in discussions about shared-use opportunities. Appendix B provides a description of interagency and intergovernmental interactions.
	Commenters suggested that DOE include a list of the environmental features and engineering and design factors used to determine the range of reasonable alternatives.	Appendix C describes the environmental and engineering factors DOE used in developing the range of reasonable alternatives.
	Commenters suggested that the Rail Alignment EIS include detailed maps and plan views of all common segments and alternative segments for the Caliente and Mina rail alignments. Commenters suggested that the maps show the relationship of the proposed railroad to the existing transportation network, including all highway and road crossings, rights-of-way according to ownership, and land use.	DOE prepared a detailed Map Atlas (DIRS 182843 and DIRS 182844-ICF 2007, all) that shows the proposed locations of the Caliente and Mina rail alignments and the infrastructure associated with construction and operation of the railroad. The Map Atlas shows the existing transportation network, proposed road crossings, ***cut*** and ***fill*** areas, rights-of-way, private property, and grazing allotment boundaries.

a. Source: DIRS 181379-Oakes 2007, all.

and plans to continue consultation with American Indians to ensure that tribal concerns and perspectives are considered. In response to comments received from the Consolidated Group of Tribes and Organizations, and as a result of DOE cultural resource surveys, the Department avoided certain American Indian sites in the areas of North Pahroc summit, Reveille Valley, and Beatty. Appendix B contains information on additional American Indian consultation and input to this Rail Alignment EIS.

DOE supported the American Indian Writers Subgroup, which submitted input to this Rail Alignment EIS. The subgroup developed *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (DIRS 174205-Kane et al. 2005, all). The Subgroup prepared the document for the Caliente rail alignment. No such document was prepared for the Mina rail alignment.

1.6.4 BLM NOTICE OF INTENT AND PUBLIC MEETINGS

On December 29, 2003, the BLM announced the receipt of an application from DOE requesting that approximately 1,249 square kilometers (308,600 acres) of public land in Nevada be withdrawn from surface and mineral entry for 20 years to evaluate the land for the potential construction, operation, and maintenance of a railroad for the transportation of spent nuclear fuel and high-level radioactive waste (68 *FR* 74965). The *Federal Register* notice stated that the BLM had segregated the land from surface and mineral entry for up to 2 years while various studies and analyses are conducted to support a final decision on the withdrawal application. In a May 21, 2004, Notice of Public Meetings (69 *FR* 29323), the BLM invited the public to submit written comments on the proposed withdrawal and possible land-use plan amendments by June 30, 2004. The BLM held two public scoping meetings on the proposed withdrawal and possible land-use plan amendments. Many of the comments the BLM received were similar to those DOE received (as described in Table 1-1). For example, many of the alternatives suggested in the BLM scoping meetings were the same as those DOE received. Commenters also raised concerns about impacts to mining, grazing, visual resources, water resources, and recreation. DOE considered all comments the BLM received in developing the scope for this Rail Alignment EIS and some of these comments led to the actions described in Table 1-1.

1.6.5 ADDITIONAL INFORMATION

In addition to the DOE and BLM scoping meetings, and comments from the Tribal update meetings, DOE used other information to define the scope of this Rail Alignment EIS. The Department worked with the Central Nevada Community Protection Working Group to gain the assistance of Nye, Lincoln, and Esmeralda Counties and the City of Caliente in obtaining information to support the EIS. Under a cooperative agreement with DOE, Lincoln County led an effort to interview landowners, business owners, county officials, elected officials, and other potentially interested parties. Comments received during these interviews closely mirrored the comments previously submitted to both DOE and the BLM. In addition, Nye County surveyed property owners along the Caliente rail corridor under a cooperative agreement with DOE. The surveys solicited comments on potential impacts of the proposed railroad and possible measures to mitigate those impacts. In addition, the BLM interviewed grazing permittees along the Caliente rail corridor and asked for their comments on potential impacts associated with construction and operation of the proposed railroad and for their input on potential mitigation measures. DOE used the information obtained through these interviews and surveys to help define the scope of this Rail Alignment EIS.

1.7 Relationship to Other NEPA-Related Documents

A number of completed, in-preparation, or proposed DOE NEPA documents relate to this Rail Alignment EIS. The Foreword to this Rail Alignment EIS describes the relationships between the Yucca Mountain FEIS, the Repository SEIS (DOE/EIS-0250F-S1D), the Rail Corridor SEIS (DOE/EIS-0250F-S2D), and the Rail Alignment EIS (DOE/EIS-0369D).

In addition, other federal agencies have prepared related EISs. Consistent with Council on Environmental Quality regulations that implement the provisional requirements of NEPA (40 CFR Parts 1500 through 1508), DOE has used information from these documents in its analysis and has incorporated this material by reference as appropriate throughout this Rail Alignment EIS. Table 1-3 lists these documents.

Table 1-3. NEPA documentation related to the proposed railroad[a] (page 1 of 3).

Document	Relationship to this Rail Alignment EIS
Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, DOE/EIS-0250F (DIRS 155970-DOE 2002, all)	Examines the impacts of constructing, operating, monitoring, and eventually closing a geologic repository at Yucca Mountain. Examines the potential impacts of transporting spent nuclear fuel and high-level radioactive waste nationally and in the State of Nevada.
Notice of Preferred Nevada Rail Corridor (68 *FR* 74951, December 29, 2003)	Announces the Caliente rail corridor, from the five rail corridors studied in the Yucca Mountain FEIS, as the DOE preferred rail corridor in which to construct a railroad.
Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada (68 *FR* 74965, December 29, 2003)	Announced BLM receipt of a request from DOE to withdraw public land in the Caliente rail corridor from surface and mineral entry for a period of 20 years to evaluate the land for the potential construction, operation, and maintenance of a railroad for the transportation of spent nuclear fuel and high-level radioactive waste in Nevada. Segregates the land from surface and mineral entry for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.
Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV (69 *FR* 18557, April 8, 2004)	Selected the mostly rail scenario analyzed in the Yucca Mountain FEIS as the mode of transportation nationally and within the State of Nevada. Selects the Caliente rail corridor for alignment, construction, and operation of a proposed railroad to Yucca Mountain.
Notice of Intent to Prepare an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV (69 *FR* 18565, April 8, 2004)	Announced the DOE intent to prepare an EIS for the alignment, construction, and operation of a railroad for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada.

Table 1-3. NEPA documentation related to the proposed railroad[a] (page 2 of 3).

Document	Relationship to this Rail Alignment EIS
Environmental Assessment for the Proposed Withdrawal of Public Lands Within and Surrounding the Caliente Corridor, DOE/EA-1545 (DIRS 176452-DOE 2005, all)	Examines the environmental impacts of withdrawing public lands from surface and mineral entry for up to 20 years to allow evaluation of the land for the proposed railroad.
Notice of Intent to Prepare an Environmental Impact Statement for the Disposal of Greater-Than-Class-C Low-Level Radioactive Waste (72 *FR* 40135, July 23, 2007)	Announced the DOE intent to prepare an EIS to evaluate disposal options for Greater-Than-Class-C ***low-level radioactive waste***.
Notice of Intent to Prepare a Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement—Complex 2030 (71 *FR* 61731, October 19, 2006)	Announced the DOE intent to supplement the Stockpile Stewardship and Management Programmatic EIS to analyze the environmental impacts from continued transformation of the United States' nuclear weapons complex.
Notice of Intent to Prepare a Programmatic Environmental Impact Statement for the Global Nuclear Energy Partnership (72 *FR* 331, January 4, 2007)	Announced the DOE intent to prepare a programmatic EIS to analyze the potential environmental impacts of recycling spent nuclear fuel.
Public Land Order No. 7653; Withdrawal of Public Lands for the Department of Energy to Protect the Caliente Rail Corridor, Nevada (70 *FR* 76854, December 28, 2005)	Withdraws public lands within the Caliente rail corridor from surface and mineral entry, subject to valid existing rights, for 10 years to allow DOE to evaluate the lands for the potential construction, operation, and maintenance of a rail line.
Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV (71 *FR* 60484, October 13, 2006)	Announced the DOE intent to expand the scope of the Rail Alignment EIS to include the Mina rail alignment.
Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada (72 *FR* 1235, January 10, 2007)	Announced BLM receipt of an application from DOE to withdraw public lands from surface and mineral entry through December 27, 2015, to evaluate the lands for the potential construction, operation, and maintenance of a rail line. This covers the Mina rail alignment and segments of the Caliente rail alignment not covered in Public Land Order No. 7653. Segregates the land from surface and mineral entry for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.
Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, DOE/EIS-0250F-S1	Updates the Yucca Mountain FEIS and examines the impacts of construction, operation, monitoring, and eventual closure of a geologic repository at Yucca Mountain. Examines the potential impacts of transporting spent nuclear fuel and high-level radioactive waste nationally.

Table 1-3. NEPA documentation related to the proposed railroad[a] (page 3 of 3).

Document	Relationship to this Rail Alignment EIS
Proposed Las Vegas Resource Management Plan and Final Environmental Impact Statement (DIRS 103079-BLM 1998, all)	Examines implementation of BLM management goals and actions in the Las Vegas area.
Proposed Tonopah Resource Management Plan and Final Environmental Impact Statement (DIRS 101523-BLM 1994, all)	Examines implementation of BLM management goals and actions in the Tonopah area.
Draft - Resource Management Plan/Environmental Impact Statement for the Ely District (DIRS 174518-BLM 2005, all)	Examines implementation of BLM resource management plans, actions, and goals in the Ely area.
Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada. DOE/EIS-0243. Las Vegas, Nevada: U.S. Department of Energy, Nevada Field Office. (DIRS 101811-DOE 1996, all)	Examines the impacts from the continued operations of the Nevada Test Site.
Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-site Locations in the State of Nevada: DOE/EIS-0243-SA-01. Las Vegas, Nevada: U.S. Department of Energy, National Nuclear Security Administration, Nevada Field Office. (DIRS 162638-DOE 2002, all)	Documents the ***affected environment*** in 2002 and discusses any changes from the 1996 Site-wide EIS (DOE/EIS-0243). Provides the status of new programs as of 2002.
Notice of Intent to Prepare a "Programmatic Environmental Impact Statement (PEIS) – Designation of Energy Corridors on Federal Land in 11 Western States" (70 *FR* 56647, September 28, 2005)	DOE is preparing an EIS in conjunction with the BLM and other agencies to evaluate the impacts of designating corridors in the western United States for use primarily as electric transmission, communications and natural gas transmission corridors. Potential corridors would cross Nevada.
Notice of Availability of the Draft Environmental Assessment for the Proposed Infrastructure Improvements for the Yucca Mountain Project, Nevada (71 *FR* 38391, July 6, 2006)	DOE released a Draft Environmental Assessment in 2006 that evaluated several proposed improvements to infrastructure at the Yucca Mountain Repository Site and adjacent portions of the Nevada Test Site. Proposed infrastructure improvements that were analyzed in the Draft EA are being analyzed in the Yucca Mountain Repository Supplemental EIS. Hence, a Final Infrastructure EA will not be published.
Final Environmental Impact Statement: Weber Dam Repair and Modification Project (DIRS 182302-Miller Ecological Consultants 2005, all)	Examines potential environmental impacts to the Walker River from repair and modification of the Weber Dam.

a. BLM = Bureau of Land Management; DOE = U.S. Department of Energy; EA = environmental assessment; EIS = environmental impact statement; FEIS = final environmental impact statement; *FR* = *Federal Register*.

2. PROPOSED ACTION AND ALTERNATIVES

2.1 Introduction

This chapter describes the ***Proposed Action*** and ***No-Action Alternative*** analyzed in this Rail Alignment ***environmental impact statement*** (EIS). As shown in Figure 2-1, the Proposed Action includes two implementing ***alternatives***, each with a ***Shared-Use Option***. Glossary terms are shown in ***bold italics***.

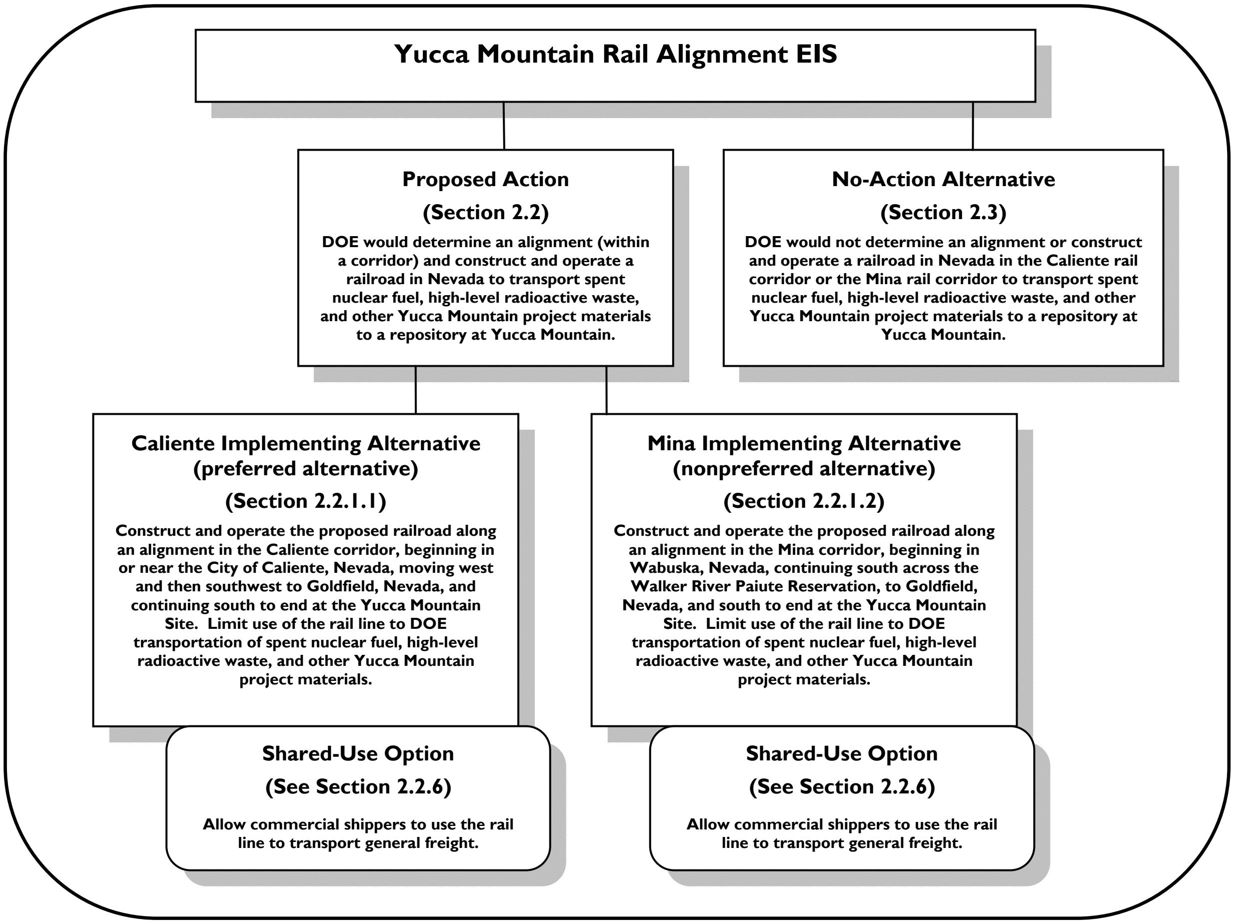


Figure 2-1. Alternatives analyzed in this Rail Alignment EIS.

Under the Proposed Action **Caliente Implementing Alternative**, the U.S. Department of Energy (DOE or the Department) would determine a ***rail alignment*** within the Caliente ***rail corridor*** and would construct, operate, and potentially abandon a ***railroad*** for the ***shipment*** of ***spent nuclear fuel***, ***high-level radioactive waste***, and ***other materials*** within Nevada. The proposed railroad would run from a site in or near the City of Caliente, Lincoln County, Nevada, to a ***geologic repository*** at Yucca Mountain, Nye County, Nevada. The Caliente Implementing Alternative is the DOE **preferred alternative** (see Section 2-4). Section 2.2.1.1 describes the Caliente Implementing Alternative.

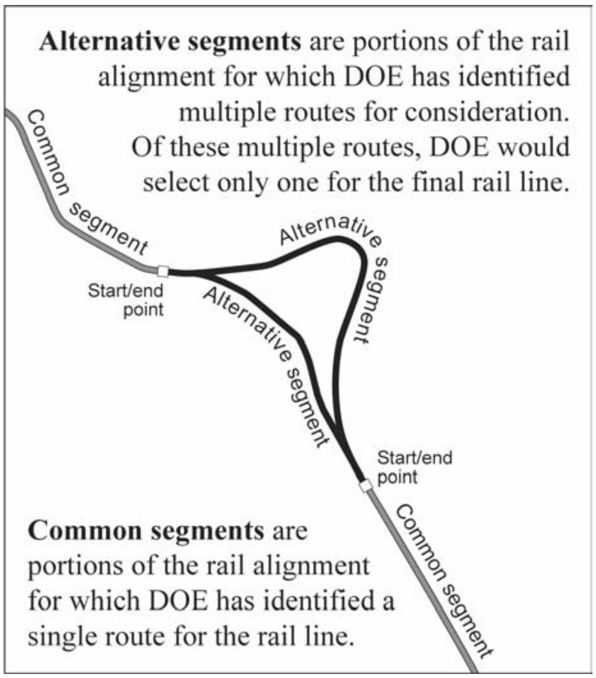
Under the Proposed Action **Mina Implementing Alternative**, DOE would determine a rail alignment within the Mina rail corridor and would construct, operate, and potentially abandon a railroad for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials within Nevada. The proposed railroad would run from Wabuska, Lyon County, Nevada, to a geologic ***repository*** at Yucca

Mountain, Nye County, Nevada. The Mina Implementing Alternative is the DOE **nonpreferred alternative** (see Section 2.4). Section 2.2.1.2 describes the Mina Implementing Alternative.

In each of the rail corridors, DOE considered a range of ***alternative segments*** and a series of ***common segments*** and eliminated the unreasonable alternative segments from detailed analysis based on environmental criteria and engineering factors. Appendix C, Evolution of Common Segments and Alternative Segments, describes the elimination process.

Under either Proposed Action implementing alternative, the **Shared-Use Option** would allow commercial and other shippers to use the ***rail line***. Under the Shared-Use Option, other organizations could construct commercial ***sidings*** (see Section 2.2.2.8) and additional facilities that would allow commercial commodities (such as nonmetallic minerals or stone) to be transported on the rail line. Section 2.2.6 describes the Shared-Use Option.

Council on Environmental Quality regulations (40 Code of Federal Regulations [CFR] 1502.14) that implement the procedural requirements of the National Environmental Policy Act (NEPA; 42 United States Code [U.S.C.] 4321 *et seq.*) require that the alternatives analysis in an EIS include the alternative of no action. Under the **No-Action Alternative**, DOE would not determine a rail alignment or construct the proposed railroad within the Caliente rail corridor or the Mina rail corridor. The No-Action Alternative provides a basis for comparison with the Proposed Action. Section 2.3 describes the No-Action Alternative in greater detail.



Council on Environmental Quality regulations require an agency to identify its preferred alternative, if one or more exists, in the draft EIS (40 CFR 1502.14[e]). For this Rail Alignment EIS, the DOE preferred alternative would be to construct, operate, and possibly abandon a railroad along the Caliente rail alignment for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials within Nevada to the ***Yucca Mountain Site***, and to implement the Share-Use Option. Section 2.4 describes the DOE preferred and nonpreferred alternatives in greater detail.

Section 2.5 summarizes potential environmental ***impacts*** under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative.

2.2 Proposed Action

Under the Proposed Action, DOE would determine an alignment (within a corridor) and construct and operate a railroad (called rail line in the Notice of Intent [69 *Federal Register* {*FR*} 18565, April 8, 2004] and the Amended Notice of Intent [71 *FR* 60484, October 13, 2006]) in Nevada to transport spent nuclear fuel, high-level radioactive waste, and other materials to a repository at Yucca Mountain. There are two implementing alternatives under the Proposed Action – the Caliente Implementing Alternative, under which the Department would construct the proposed railroad in the Caliente rail corridor, and the Mina Implementing Alternative, under which the Department would construct the proposed railroad in the Mina rail corridor (Figure 2-2). DOE would also use the railroad to transport materials needed for construction, operation, and maintenance of the proposed railroad and the proposed repository at Yucca Mountain.

A rail line in the Caliente rail corridor would extend north from Caliente, Nevada, turn in a westerly direction and head to near the northwest corner of the Nevada Test and Training Range, and then continue south-southeast to Yucca Mountain. The rail line could range in length from approximately 528 to 541 kilometers (328 to 336 miles) (DIRS 180916-Nevada Rail Partners 2007, Table E-2), depending on the specific alternative segments DOE selected.

A rail line in the Mina rail corridor would extend from near Wabuska, Nevada, in a southeasterly direction to Yucca Mountain. The total length of the rail line could range from approximately 452 to 502 kilometers (281 to 312 miles), including the existing Department of Defense Branchlines. The portions of the Mina rail alignment that would require construction of a new rail line could range in length from approximately 410 to 459 kilometers (255 to 285 miles), depending on the combination of alternative segments (DIRS 180872-Nevada Rail Partners 2007, Table 4-2).

The southern portion of each rail alignment would be the same for approximately 190 kilometers (120 miles) from south of Goldfield to Yucca Mountain.

As discussed in Section 1.5.1, the Proposed Action includes acquiring a ***right-of-way grant*** from the U.S. Department of the Interior, Bureau of Land Management (BLM), which would authorize DOE access to sufficient lands for the rail alignment, rail facilities, and associated construction ***infrastructure*** (for example, ***construction camps***, access roads, and quarries for ***ballast***). DOE would also need to obtain access to some private land. In addition, under the Mina Implementing Alternative, DOE would need to obtain right-of-way access from the Walker River Paiute Tribe/Bureau of Indian Affairs to access lands on the Walker River Paiute Reservation. Sections 3.2.2 and 3.3.2 describe land use and ownership along the Caliente rail alignment and the Mina rail alignment, respectively.

During construction of the proposed railroad, a ***construction right-of-way*** would be established that would nominally occupy a 300-meter (1,000-foot)-wide strip of land centered on the rail alignment (that is, 150 meters [500 feet] on either side of the rail

Right-of-way grant: Authorization from the BLM to use a specific portion of public land for construction and operation of the proposed railroad. The land covered by the right-of-way grant would include the area of construction, known as the construction right-of-way, and the area of operations, known as the operations right-of-way.

Construction right-of-way: Property over which DOE would obtain access for construction of the railroad, nominally 150 meters (500 feet) on either side of the centerline of the rail alignment (for a total width of nominally 300 meters [1,000 feet]). The width could vary at specific locations to accommodate, for example, certain deep cuts and fills, and construction of drainage controls. The construction right-of-way would also include the locations of construction support facilities (such as quarries) and operations support facilities (such as the Staging Yard).

Operations right-of-way: Property over which access would be obtained for operation of the proposed railroad. In most cases, the width of the operations right-of-way would be less than that of the construction right-of-way (nominally 61 meters [200 feet] on either side of the rail line centerline, for a total width of 122 meters [400 feet]). The width could vary at specific locations to accommodate, for example, access and maintenance roads and drainage structures. The operations right-of-way would also include the locations of operations support facilities (such as the Staging Yard).

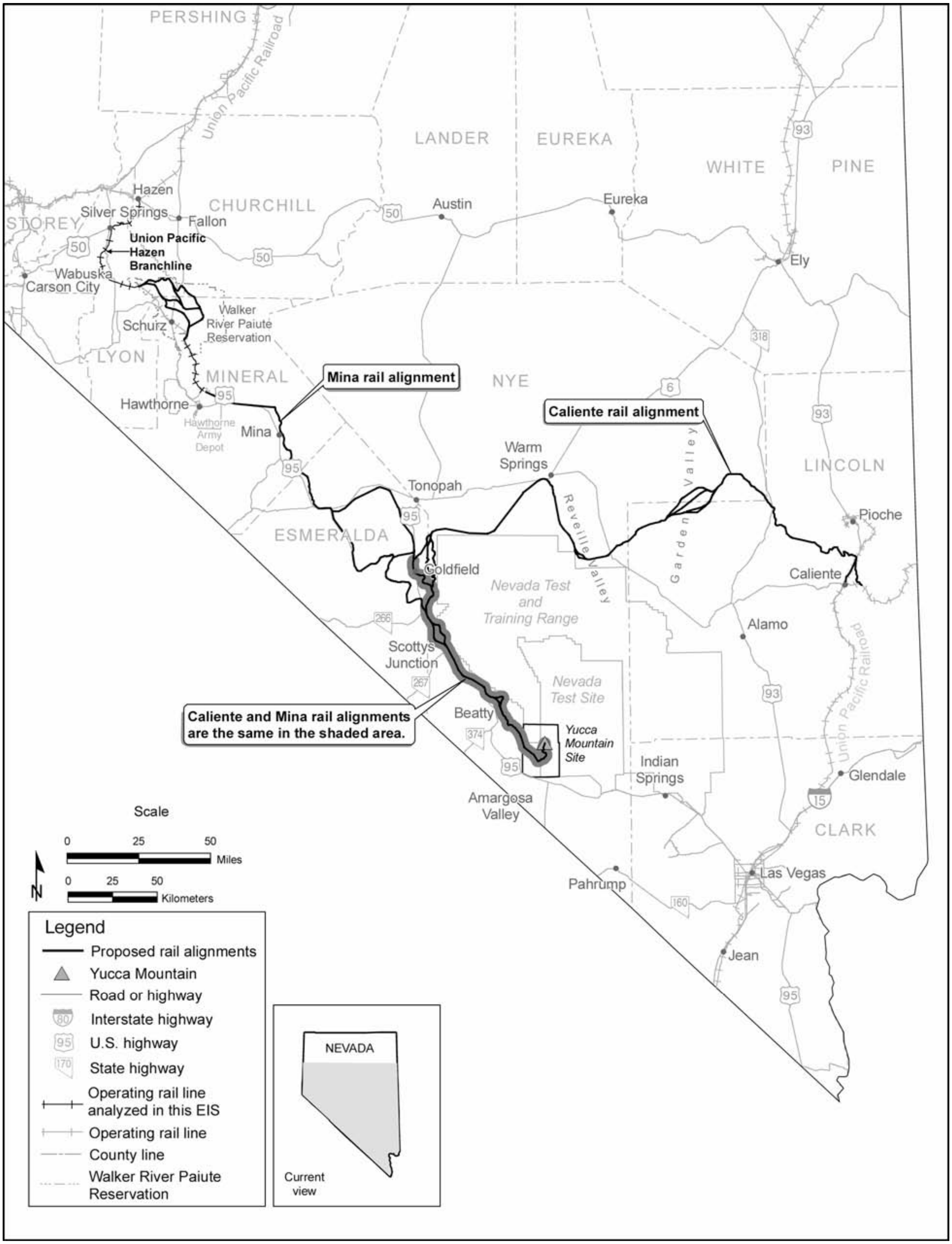


Figure 2.2. The proposed Caliente and Mina rail alignments.

alignment centerline). The width of the construction right-of-way would vary as necessary and would be minimized to reduce impacts to, for example, sensitive environmental features (Figure 2-3) (DIRS 180918-Nevada Rail Partners 2007, p. ii).

During the railroad operations phase, the right-of-way would be reduced to a smaller width (nominally 61 meters [200 feet] on either side of the centerline of the rail line). DOE would minimize this ***operations right-of-way*** to the extent practicable and would determine the operations right-of-way in consultation with the BLM. Lands formerly inside the construction right-of-way but not included in the operations right-of-way would be reclaimed (restored to natural conditions), as appropriate.

Under the Caliente Implementing Alternative, the Department estimates the total cost to construct the railroad would be approximately $2.2 billion (in year 2005 dollars) (DIRS 176176-BSC 2007, p. ES-1). Under the Mina Implementing Alternative, the Department estimates that the total cost of construction would be approximately $1.7 billion (in year 2005 dollars) (DIRS 182778-BSC 2007, p. ES-1).

Both ***implementing alternatives*** would require operations support facilities (see Section 2.2.4). Under the Caliente Implementing Alternative, facilities would include:

- ***Interchange Yard***
- ***Staging Yard***
- Maintenance-of-Way Headquarters Facility
- Maintenance-of-Way Trackside Facility
- ***Rail Equipment Maintenance Yard***
- ***Cask Maintenance Facility***
- ***Nevada Railroad Control Center*** and National Transportation Operations Center

Under the Mina Implementing Alternative, facilities would include:

- Staging Yard
- Maintenance-of-Way Facility
- Rail Equipment Maintenance Yard
- ***Cask Maintenance Facility***
- Nevada Railroad Control Center and National Transportation Operations Center

Although the specific facilities identified under each implementing alternative are different, in total they would provide the same functions under either implementing alternative. For example, due to the need to support road-based maintenance activities, which would not be easy to access from along the Caliente rail alignment, the Caliente Implementing Alternative would require the Maintenance-of-Way Trackside Facility and the Maintenance-of-Way Headquarters Facility. However, under the Mina Implementing Alternative, a single Maintenance-of-Way Facility would house all of the functions for both of these facilities.

Under the Caliente Implementing Alternative, two facilities (the Interchange Yard and the Staging Yard) would be required to fulfill the functional requirements of exchanging railcars between the Union Pacific Railroad Mainline and the proposed railroad. This is because there is not enough space where the Caliente rail alignment would intersect the Union Pacific Railroad Mainline to house all of the necessary functions of these facilities in one location. However, under the Mina Implementing Alternative, there is enough space to locate all the functions in a single facility (the Staging Yard) at Hawthorne.

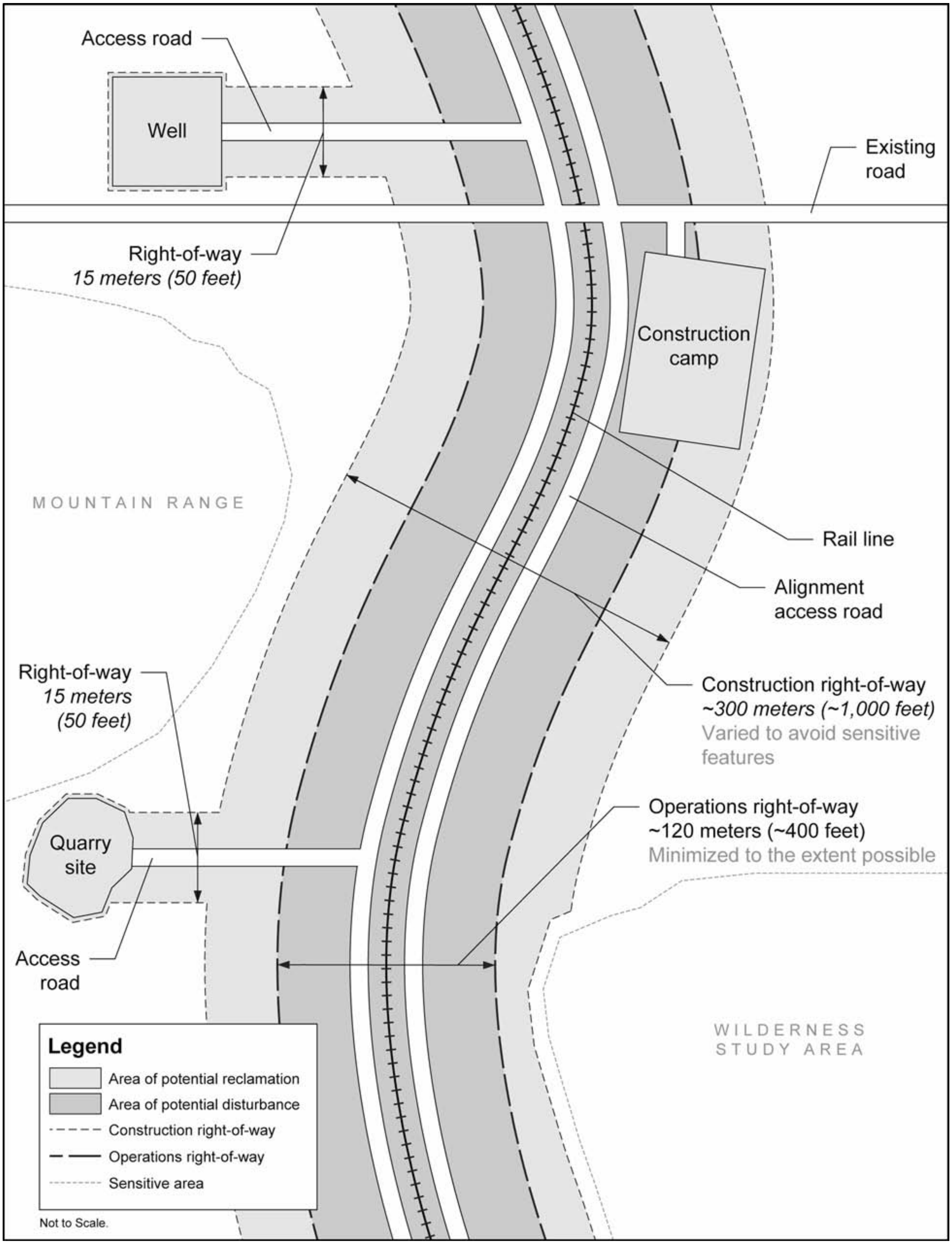


Figure 2-3. The construction and operations rights-of-way.

DOE would construct and operate the proposed railroad in accordance with applicable federal and State of Nevada laws and regulations, and in compliance with all stipulations and conditions in associated permits. Chapter 6, Statutory, Regulatory, and other Applicable Requirements, describes such requirements. To help ensure compliance with applicable requirements, DOE would implement an array of ***best management practices*** as part of the Proposed Action. Best management practices would include practices such as dust suppression and the use of silt fencing to control soil erosion during construction activities. Chapter 7, Best Management Practices and Impacts Mitigation, describes representative best management practices DOE would implement during construction and operation of the proposed railroad.

> **Best management practices:** Practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that DOE would implement as part of the Proposed Action to facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the environmental impacts of an action.

> **Mitigation** (40 CFR 1508.20) includes:
>
> - Avoiding the impact altogether by not taking a certain action or parts of an action.
> - Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
> - Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
> - Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
> - Compensating for the impact by replacing or providing substitute resources or environments.

Chapter 4, Environmental Impacts, describes the potential environmental impacts of constructing and operating a railroad under the Proposed Action. Where impact analyses results indicate the potential for environmental impacts despite DOE engineering and site evaluation and planning practices and implementation of best management practices, DOE has developed potential ***mitigation*** measures as a step toward reducing the environmental impacts of the project. Chapter 7 identifies the measures DOE would consider to mitigate impacts remaining after engineering and site evaluation and planning, and the implementation of best management practices.

Under the Proposed Action without shared use, use of the railroad would be restricted to DOE shipments; DOE would not allow commercial use of the rail line. DOE would use the railroad to ship approximately 9,500 ***casks*** containing spent nuclear fuel and high-level radioactive waste from the Caliente or Wabuska areas to the repository over an operations phase of up to 50 years (DIRS 180923-Nevada Rail Partners 2007, p. 4-1). Each cask would be shipped on an individual ***cask car***. DOE would also ship approximately 29,000 railcars of other materials, which would include repository construction materials, materials necessary for day-to-day operations of the railroad and the repository, and waste materials for disposal, such as scrap metal and ***solid waste*** (DIRS 180923-Nevada Rail Partners 2007, p. 4-2). Together, these activities equal approximately 17 one-way trips per week during railroad operations along either the Caliente or Mina rail alignment. Table 2-1 summarizes the expected frequencies of the types of trains that would operate on the railroad.

During planning and design of the proposed railroad, DOE employed various engineering and site evaluation measures to avoid, minimize, or otherwise reduce environmental impacts. As the environmental analyses have progressed, DOE has refined the design of the railroad to avoid certain sensitive environmental features and reduce potential impacts to sensitive areas by, for example, limiting the project's ***footprint*** in such areas. As part of the Proposed Action, the Department would continue to incorporate refinements through final engineering and design. The following are examples of the types of design and engineering factors DOE has and will continue to consider, as practicable:

Table 2-1. Summary of potential train frequencies.[a,b]

Train type	Approximate peak frequency (one-way, per week)
Cask trains	8
Repository construction materials and supplies trains	7
Maintenance-of-way trains	2
Total	17[c]

a. Source: DIRS 175036-BSC 2005, Table 4.2.
b. Average frequencies; actual frequencies would vary from year to year over the operating life of the railroad.
c. The equivalent of 8.5 round-trip trains going from the Staging Yard to the repository and back in 1 week.

- Follow the contours of the land to the greatest extent practicable to reduce earthwork, ground disturbance, and visual intrusion.
- Design the rail line and facilities to be consistent with appropriate Nevada building codes.
- Where necessary, limit the area of disturbance (the footprint) to minimize potential impacts to ***wetlands***, highways, and private lands to the extent practicable.
- Reduce the potential for erosion, landslides, mudslides, and rockfalls by establishing proper rail ***roadbed*** grades; building mid-slope benches; varying ***cut*** slope dimensions (depending on the strength and stability of the bedrock); implementing additional stabilization measures (such as rock-bolting or slope terracing); and using stormwater erosion control measures.
- Where practicable, use abandoned rail roadbeds to limit construction impacts.
- Avoid springs, ***riparian*** areas, and wetland ***habitats*** or narrow the project footprint in such areas to the extent practicable.
- Avoid, minimize, or otherwise reduce impacts to special status species to the greatest extent practicable by making adjustments to site locations during final design.
- Design communications systems to be used during construction so as to not interfere with other services operating in the same geographic areas.
- Incorporate hydraulic modeling into the final design process to ensure that ***ephemeral stream*** crossings are properly engineered so that they would not contribute to erosion and sediment pollution, and to minimize impacts to downstream surface-water resources.
- Ensure roadway improvements are in accordance with Nevada Department of Transportation, county, and BLM requirements.
- During final design of the railroad, consider the specific locations of manmade surface-water features in relation to the rail alignment and include consultations with the owners to develop, as appropriate, measures to minimize or otherwise mitigate potential impacts to such manmade systems.
- Minimize filling of wetlands by incorporating avoidance into final engineering and design of the railroad to the extent practicable.
- Incorporate hydraulic modeling into the engineering design process to ensure that all stream crossings would be designed to limit the adverse impacts of flooding to nearby populations and resources.
- Design the railroad to avoid springs and other surface-water resources whenever practicable. In the few cases where there would be springs inside the construction right-of-way, incorporate avoidance into final engineering and design of the railroad to the extent practicable.

This chapter describes the Proposed Action in detail. Tables 2-2 through 2-7 summarize and briefly describe the project attributes associated with the Proposed Action along each of the rail alignments, including operations support facilities.

2.2.1 RAIL ALIGNMENTS

This section describes the Caliente rail alignment alternative segments and common segments (Section 2.2.1.1) and the Mina rail alignment existing rail lines, alternative segments, and common segments (Section 2.2.1.2).

Common segments are portions of the rail alignments for which DOE has identified a single route for the rail line. Along the Caliente rail alignment, there are six common segments, starting with Caliente common segment 1 south of Panaca, and moving west sequentially to common segment 6 near Yucca Mountain. In total, the common segments constitute approximately 380 kilometers (236 miles) of the total length of the Caliente rail alignment (DIRS 180916-Nevada Rail Partners 2007, p. 4-6).

There are four common segments along the Mina rail alignment – Mina common segment 1, which would start west of Hawthorne and continue to Blair Junction; Mina common segment 2, which would start south of Lida Junction; common segment 5; and common segment 6. (Common segments 5 and 6 are the same as common segments 5 and 6 along the Caliente rail alignment.) In total, the common segments constitute approximately 211 kilometers (131 miles) of the Mina rail alignment (DIRS 180872-Nevada Rail Partners 2007, p. 4-2).

Alternative segments are portions of the rail alignments for which DOE is considering two or more reasonable alternative ***routes*** for the rail line. The alternative segments were originally numbered sequentially as they were proposed or developed (for example, Garden Valley 1, Garden Valley 2, and so on); however, DOE eliminated some of those alternative segments from detailed analysis because they were unreasonable. As a result, the remaining alternative segments analyzed in this Rail Alignment EIS are not necessarily numbered sequentially. For example, DOE eliminated the South Reveille 1 and South Reveille 4 alternative segments from consideration; thus, only South Reveille 2 and South Reveille 3 remain. Appendix C describes alternative segments eliminated from detailed study for both the Caliente and Mina rail alignments.

In some cases, two or more alternative segments follow the same route for a few kilometers before splitting and following unique paths. When this occurs, the route on the map is designated with the names of both alternative segments. For example, along the Caliente rail alignment, Garden Valley alternative segments 1 and 2 follow the same route for a few kilometers.

DOE applied various environmental, engineering, and design criteria to generate the common segments and alternative segments to be evaluated in this Rail Alignment EIS. Appendix C provides a detailed discussion of the alternative-segment selection and elimination process; Table C-1 lists the engineering criteria the Department utilized in the identification and analysis of alternative segments and common segments along the Caliente and Mina rail alignments.

DOE based the conceptual design of the rail line on the application of specific criteria used by the commercial rail industry. These criteria govern the horizontal and vertical geometry, structural integrity, and other factors critical to safe and sustained operation of a railroad. In addition, other factors such as environmental constraints and community concerns have been important to the rail alignment-development process. These factors include for example, the consideration of Wilderness Areas and ***Wilderness Study Areas***, avoiding disturbance of private lands where practicable, and avoidance of culturally or biologically sensitive areas.

Table 2-2. General project attributes associated with the Proposed Action.

Attribute	Caliente Implementing Alternative	Mina Implementing Alternative
Length	Total length (all new construction): 328 to 336 miles (528 to 541 kilometers)	Total length: 281 to 312 miles (452 to 502 kilometers) New construction: 255 to 285 miles (410 to 459 kilometers)
Construction phase	4 to 10 years (depending on funding availability for construction activities)	
Operations phase	Up to 50 years	
Construction right-of-way	Nominally 500 feet (150 meters) on either side of the centerline of the rail alignment	
Operations right-of-way	Nominally 200 feet (61 meters) on either side of the centerline of the rail line	

Table 2-3. Project attributes associated with construction of the proposed railroad (page 1 of 2).

Attribute	Caliente Implementing Alternative	Mina Implementing Alternative
Estimated number of bridges	Approximately 215 to 240, ranging in length from 24 to 1,000 feet (7.3 to 300 meters)	Approximately 58 to 69, ranging in length from 50 to 1,000 feet (16 to 300 meters)
Estimated number of culverts	Approximately 96 to 138	Approximately 38 to 60
Estimated number of water wells needed to satisfy construction water demand	Minimum: 94 well sites containing 150 wells Maximum: 107 well sites containing 176 wells	Minimum: 58 well sites containing 77 wells Maximum: 74 well sites containing 110 wells
Sidings	12 sidings, ranging in length from 7,000 to 12,000 feet (2,100 to 3,700 meters)	12 sidings, ranging in length from 7,000 to 19,000 feet (2,100 to 5,800 meters)
Alignment access roads	The railroad alignment is planned to have an access road along most of its length. This road would be used primarily to support maintenance of the railroad infrastructure. In situations where rerouting existing roads to a common crossover point would be appropriate, DOE could use the access road to facilitate routing roads to a single crossing.	
Construction camps	Number: Up to 12; with up to 6 operating at one time	Number: Up to 10; with up to 6 operating at one time
	Function: To house construction workers and provide a logistical support area for construction Location: One approximately every 30 miles (50 kilometers) along the rail alignment Employment: Up to 360 per camp (106 support staff and 254 construction staff) Disturbed area: 25 acres (0.10 square kilometer) per camp	
Total construction employment (required over the entire construction phase)	8,100 employees (total man years)	7,600 employees (total man years)
Peak employment (in any given year during construction)	2,160 employees	2,160 employees

Table 2-3. Project attributes associated with construction of the proposed railroad (page 2 of 2).

Attribute	Caliente Implementing Alternative	Mina Implementing Alternative
Ballast quarries	Number: If necessary, up to four would be developed from six potential sites. Locations: One near Caliente; two in South Reveille Valley; one west of Goldfield; and two northeast of Goldfield.	Number: If necessary, up to two would be developed from five potential sites. Locations: Two east of Hawthorne; one east of Silver Peak; and two west of Goldfield.

Attribute	Caliente and Mina Implementing Alternatives	
Ballast quarries	Employment:	Up to 30 at each quarry
	Disturbed area:	240 to 930 acres (0.97 to 3.8 square kilometers)
Construction train traffic (one-way traffic; that is, one train per day is the equivalent of one trip between the beginning of the line and Yucca Mountain)	Ballast trains:	Approximately 8 per day
	Concrete tie trains:	Approximately 2 per day
	Rail section trains:	Approximately 4 per day
	Other material trains:	Approximately 2 per day
	Total:	Approximately 16 per day
Communications towers	Approximately every 10 to 20 miles (16 to 32 kilometers) along the rail alignment, approximately 55 to 100 feet (23 to 30 meters) tall	

Table 2-4. Project attributes associated with the operation and maintenance of the proposed railroad.

Attribute	Caliente and Mina Implementing Alternatives	
Train traffic (one-way traffic)	Cask trains:	Approximately 8 per week
	Maintenance-of-way trains:	Approximately 2 per week
	Repository supply/construction trains:	Approximately 7 per week
	Total:	Approximately 17 per week
Operational characteristics	Travel time:	Less than 10 hours from the Staging Yard to the Rail Equipment Maintenance Yard
	Train operating speed limits:	25 to 50 miles (40 to 80 kilometers) per hour
	Number of casks to be shipped:	Approximately 9,500 total casks containing spent nuclear fuel or high-level radioactive waste
Cask train components	Locomotives:	2 to 3
	Cask cars:	1 to 12 (3 typical)
	Buffer cars:	2
	Escort cars:	1 to 2

Table 2-5. Project attributes associated with railroad operations support facilities along the Caliente rail alignment (excluding segments in common with the Mina rail alignment).

Facility	Description	
Interchange Yard	Function:	Handling point for the exchange of railcars containing construction and other materials between the Union Pacific Railroad Mainline and the proposed railroad
	Location:	Beginning of the Eccles or Caliente alternative segment
	Employment:	0 (employees would be based at the Staging Yard)
	Disturbed area:	Caliente: 15 acres (0.061 square kilometer)
		Eccles: 30 acres (0.12 square kilometer)
Staging Yard	Function:	Transfer point for casks and other materials shipped to the proposed railroad
	Location:	Caliente alternative segment, Indian Cove; Caliente alternative segment, Upland; or Eccles alternative segment, Eccles-North
	Employment:	50
	Disturbed area:	50 acres (0.20 square kilometer)
Maintenance-of-Way Trackside Facility	Function:	Operational base for maintenance and inspection activities
	Location:	Caliente common segment 3: Approximately 30 miles (50 kilometers) southeast of Tonopah; or anywhere along Caliente common segment 3 between the analyzed location and the start of the Goldfield alternative segments
	Employment:	40
	Disturbed area:	15 acres (0.061 square kilometer)
Maintenance-of-Way Headquarters Facility	Function:	Coordination center for all maintenance and inspection activities on the proposed railroad
	Location:	Approximately 8 kilometers south of Tonopah; or anywhere along U.S. Highway 95 between the analyzed location south of Tonopah and the intersection of Goldfield alternative segment 4 and U.S. Highway 95
	Employment:	10
	Disturbed area:	3 acres (0.013 square kilometer)

Table 2-6. Project attributes associated with railroad operations support facilities along the Mina rail alignment (excluding segments in common with the Caliente rail alignment) (page 1 of 2).

Facility	Description	
Staging Yard	Function:	Transfer point for casks and other materials shipped to the proposed railroad
		Handling point for the exchange of railcars containing construction and other materials between the Union Pacific Railroad and the proposed railroad
	Maintenance-of-way trains:	Approximately 2 per week
	Location:	Mina common segment 1, Hawthorne
	Employment:	40
	Disturbed area:	50 acres (0.20 square kilometer)

Table 2-6. Project attributes associated with railroad operations support facilities along the Mina rail alignment (excluding segments in common with the Caliente rail alignment) (page 2 of 2).

Facility	Description	
Maintenance-of-Way Facility	Function:	Coordination center and operational base for all maintenance and inspection activities for the proposed railroad
	Location:	Montezuma alternative segment 1, Silver Peak; or Montezuma alternative segments 2 and 3, Klondike
	Employment:	40
	Disturbed area:	15 acres (0.061 square kilometer)

Table 2-7. Project attributes associated with the common railroad operations support facilities along the Caliente and Mina rail alignments.

Facility	Caliente and Mina Implementing Alternatives	
Rail Equipment Maintenance Yard	Function:	The termination point for the proposed railroad and the staging area for the delivery of loaded cask cars and other materials to the repository receiving and inspection area
	Location:	Less than 1 mile (1.6 kilometers) south of the southern boundary of the geologic repository operations area
	Employment:	40 (including employees for the Nevada Railroad Control Center and National Transportation Operations Center)
	Disturbed area:	100 acres (0.41 square kilometer)
Cask Maintenance Facility	Function:	Processing location for empty transportation casks used to transport canistered fuel, including testing, inspection, maintenance, and decontamination
	Location:	For purposes of analysis, collocated with the Rail Equipment Maintenance Yard
	Employment:	30
	Disturbed area:	20 acres (0.081 square kilometer)
Satellite Maintenance-of-Way Facilities	Function:	Dispatch point for maintenance activities along the first third and final third of the rail line
	Location:	Two locations: one at the Rail Equipment Maintenance Yard and one at the Staging Yard
	Employment:	Employees housed at the Rail Equipment Maintenance Yard and the Staging Yard
	Disturbed area:	0 (along the Caliente rail alignment, employees housed at the Maintenance-of-Way Facilities; along the Mina rail alignment, employees housed at the Maintenance-of-Way Facility)
Nevada Railroad Control Center and National Transportation Operations Center	Function:	Nevada Railroad Control Center would control operations along the rail line in Nevada; National Transportation Operations Center would coordinate the national shipment of casks and other materials to the proposed railroad
	Location:	Integrated with either the Rail Equipment Maintenance Yard or the Staging Yard
	Employment:	15 (included in the employment number for the Rail Equipment Maintenance Yard)
	Disturbed area:	0 (integrated with the Rail Equipment Maintenance Yard or the Staging Yard)

Design requirements for the proposed railroad would meet or exceed American Railway Engineering and Maintenance-of-Way Association recommendations (DIRS 162040-AREMA 2001, all) consistent with common industry practice for a ***Class 1 commercial railroad***. Appendix C provides a more detailed explanation of the engineering and design considerations DOE used to develop the rail alignment common segments and alternative segments.

Class 1 commercial railroad: The Surface Transportation Board defines a Class 1 commercial railroad as one with an annual operating revenue exceeding $277.7 million.

Section 2.4 identifies the DOE preferred alternative segments.

2.2.1.1 Caliente Rail Alignment

This section describes the alternative segments and common segments along the Caliente rail alignment, beginning in or near the City of Caliente and moving north, west, and then south along the rail alignment toward Yucca Mountain. Figure 2-4 shows the Caliente rail alignment divided into seven map areas, starting with Caliente map area 1 at the beginning of the rail alignment (the east side) and ending with Caliente map area 7 at the end of the rail alignment (the southwest side). Figures in Sections 2.2.1.1.1 through 2.2.1.1.12 show the alternative segments and common segments. The Map Atlas (DIRS 182843-ICF 2007, Part A) contains more than 500 detailed maps depicting all of the Caliente rail alignment alternative segments and common segments, railroad ***construction and operations support facilities***, and engineered features, such as cut and ***fill*** areas.

2.2.1.1.1 Alternative Segments at the Interface with Union Pacific Mainline

DOE is considering either the Caliente or the Eccles alternative segment to connect the proposed railroad to the existing Union Pacific Railroad Mainline in or near the City of Caliente, as shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 1 through 24) and on Figure 2-5.

The Caliente alternative segment would begin in Caliente, enter Meadow Valley at Indian Cove, and extend generally north through Meadow Valley and along U.S. Highway 93. This alternative segment would then cross U.S. Highway 93 about 5 kilometers (3 miles) southwest of Panaca and connect to Caliente common segment 1 about 1 kilometer (0.6 mile) northwest of U.S. Highway 93 and 18 kilometers (11 miles) south of Pioche. The Caliente alternative segment would be approximately 18 kilometers long (DIRS 180916-Nevada Rail Partners 2007, p. E-4).

The Eccles alternative segment would begin along Clover Creek about 8 kilometers (5 miles) east of Caliente and trend generally north to enter Meadow Valley from the southeast (see Figure 2-5). This alternative segment would then cross U.S. Highway 93 about 5 kilometers (3 miles) southwest of Panaca and connect to Caliente common segment 1 about 1 kilometer (0.6 mile) northwest of U.S. Highway 93 and 18 kilometers (11 miles) south of Pioche. The Eccles alternative segment would be about 19 kilometers (12 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-4).

2.2.1.1.2 Caliente Common Segment 1 (Dry Lake Valley Area)

Caliente common segment 1 is shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 25 through 107) and on Figures 2-5 and 2-6. It would begin at the end of the Caliente or Eccles alternative segment. Common segment 1 would trend generally west from Meadow Valley through the Chief Range (Bennett Pass) and across Dry Lake Valley and the North Pahroc Range. On the west side of the North Pahroc Range, common segment 1 would cross Nevada Route 318 near Timber Mountain about 5 kilometers (3 miles) southeast of the Lincoln and Nye County line. It would continue to the northwest

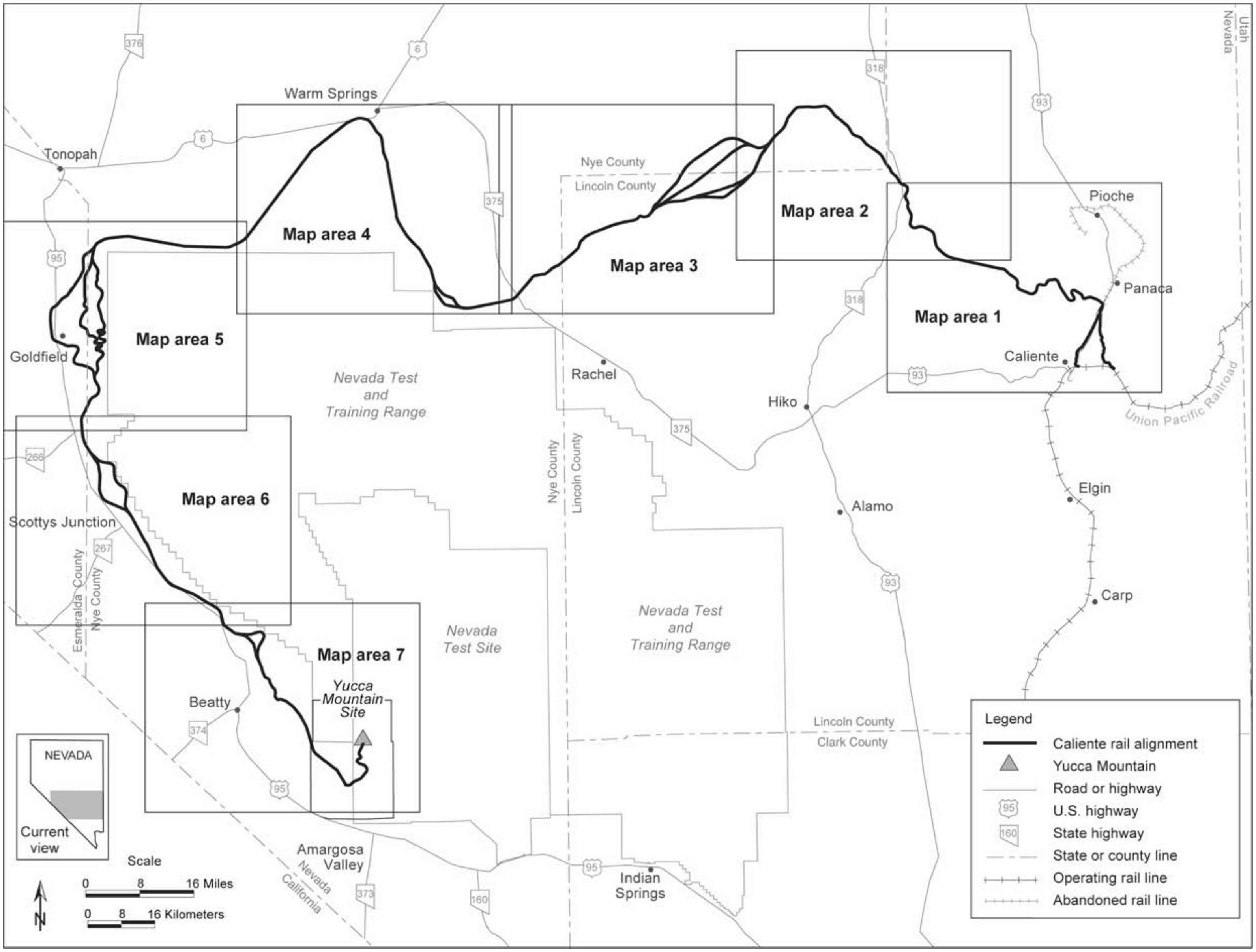


Figure 2-4. Map key for areas along the Caliente rail alignment.

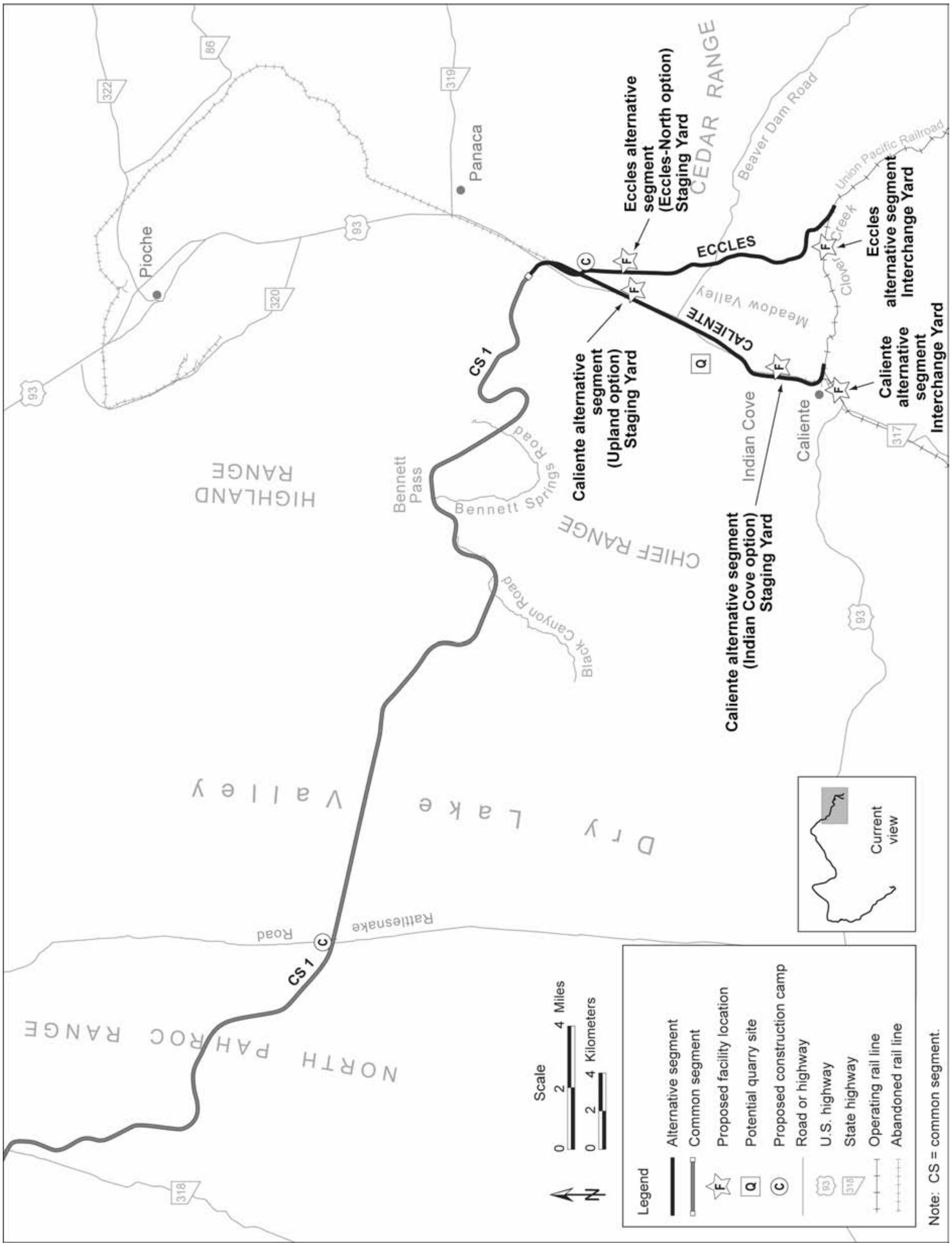


Figure 2-5. Common segments, alternative segments, and related sites within Caliente map area 1.

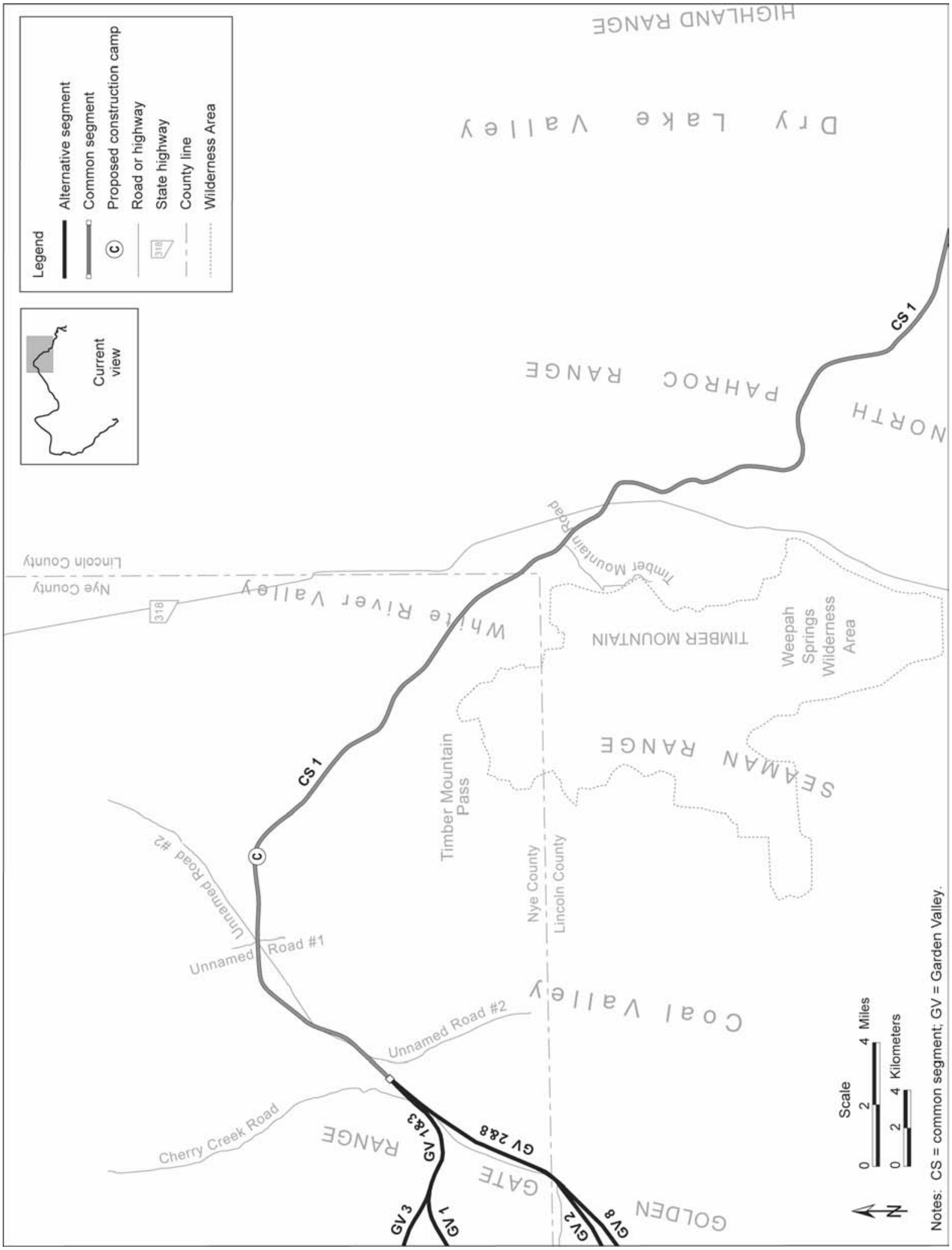


Figure 2-6. Common segments, alternative segments, and related sites within Caliente map area 2.

and then west, passing the northern end of the Seaman Range before turning southwest through Coal Valley. It would then connect to one of the Garden Valley alternative segments about 8 kilometers (5 miles) north of the Lincoln and Nye County line and 28 kilometers (17 miles) west of Nevada Route 318 (see Figure 2-7). Caliente common segment 1 would be approximately 110 kilometers (71 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-5).

2.2.1.1.3 Garden Valley Alternative Segments

DOE is considering four alternative segments in the Garden Valley area, referred to as Garden Valley 1, 2, 3, and 8, and shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 110 through 179) and on Figure 2-7.

Garden Valley alternative segment 1 would begin at the end of Caliente common segment 1 and run due west through the Golden Gate Range for about 7 kilometers (4 miles), trend in a southwesterly direction through Garden Valley, cross the Lincoln and Nye County line, and connect to Caliente common segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area. Garden Valley alternative segment 1 would be approximately 35 kilometers (22 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-6).

Garden Valley alternative segment 2 would begin at the end of Caliente common segment 1 and run to the south of the locations of Garden Valley alternative segments 1 and 3 (see below), crossing the Lincoln and Nye County line. Garden Valley 2 would continue southwestwardly through the Golden Gate Range at Water Gap, turn westward through Garden Valley, and continue southwesterly to connect to Caliente common segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area. Garden Valley alternative segment 2 would be about 35 kilometers (22 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-6).

Garden Valley alternative segment 3 would begin at the end of Caliente common segment 1 and run due west through the Golden Gate Range and then in a northwesterly direction until turning southwest to run along the southeast base of the Quinn Canyon Range. Continuing in a southwesterly direction, it would run through Garden Valley, cross the Lincoln and Nye County line, and connect to Caliente common segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area. Garden Valley alternative segment 3 would be approximately 37 kilometers (23 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-6).

Garden Valley alternative segment 8 would begin at the end of Caliente common segment 1 and run to the south of the locations of Garden Valley alternative segments 1 and 3, crossing the Lincoln and Nye County line and paralleling Cherry Creek Road. It would continue southwestwardly through the Golden Gate Range at Water Gap, would turn westward through Garden Valley, parallel Garden Valley Road, and run in a southwesterly direction before turning sharply westward. Garden Valley alternative segment 8 would proceed westward and connect to Caliente common segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area. Garden Valley alternative segment 8 would be about 37 kilometers (23 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-6).

2.2.1.1.4 Caliente Common Segment 2 (Quinn Canyon Range Area)

Caliente common segment 2 is shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 180 through 219) and on Figures 2-7 and 2-8. It would begin at the west end of Garden Valley and would trend southwest through Sand Springs Valley. It would cross State Route 375 near the south end of Railroad Valley before connecting to one of the South Reveille alternative segments near the southern end of the Reveille Range. Caliente common segment 2 would be approximately 50 kilometers (31 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-7).

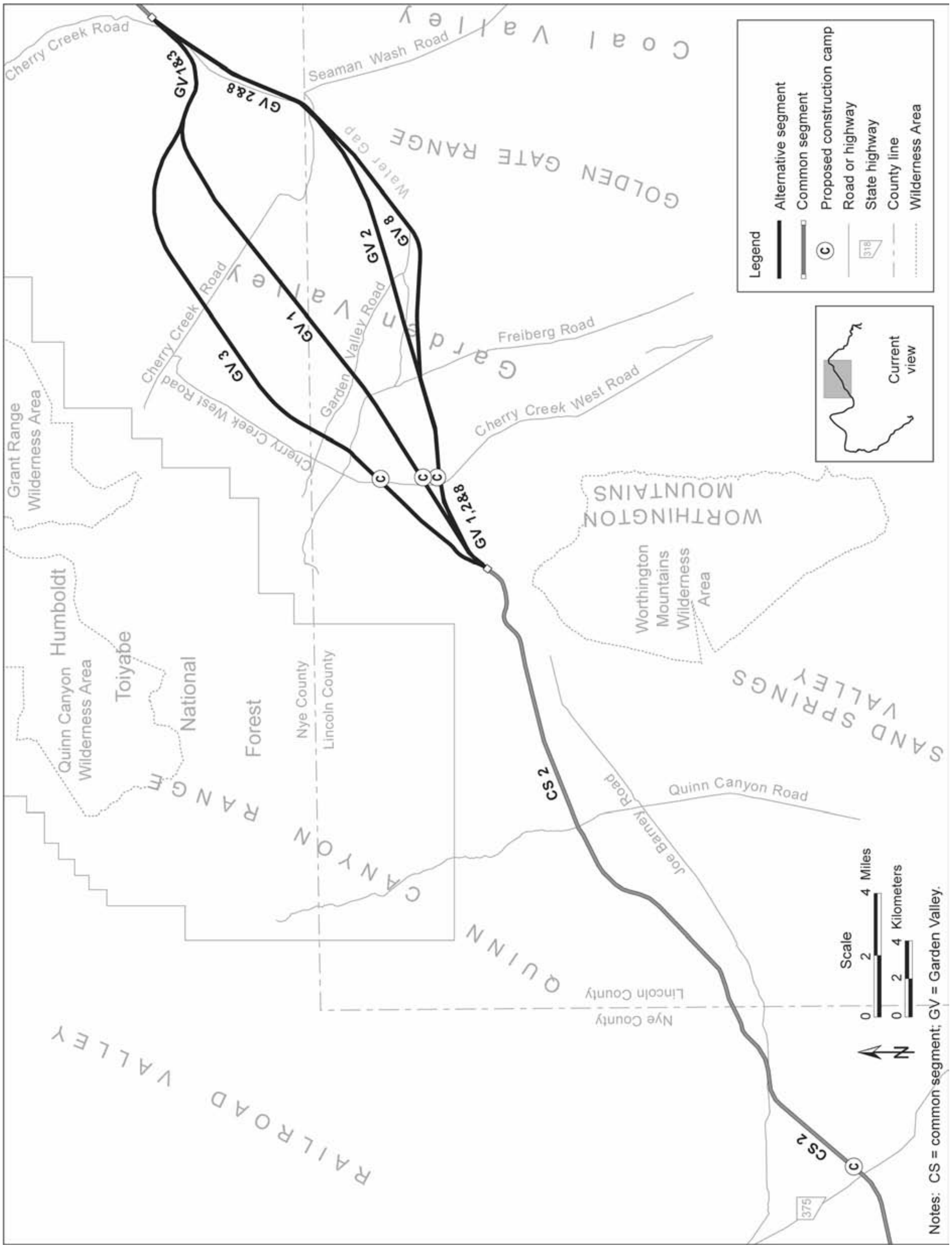


Figure 2-7. Common segments, alternative segments, and related sites within Caliente map area 3.

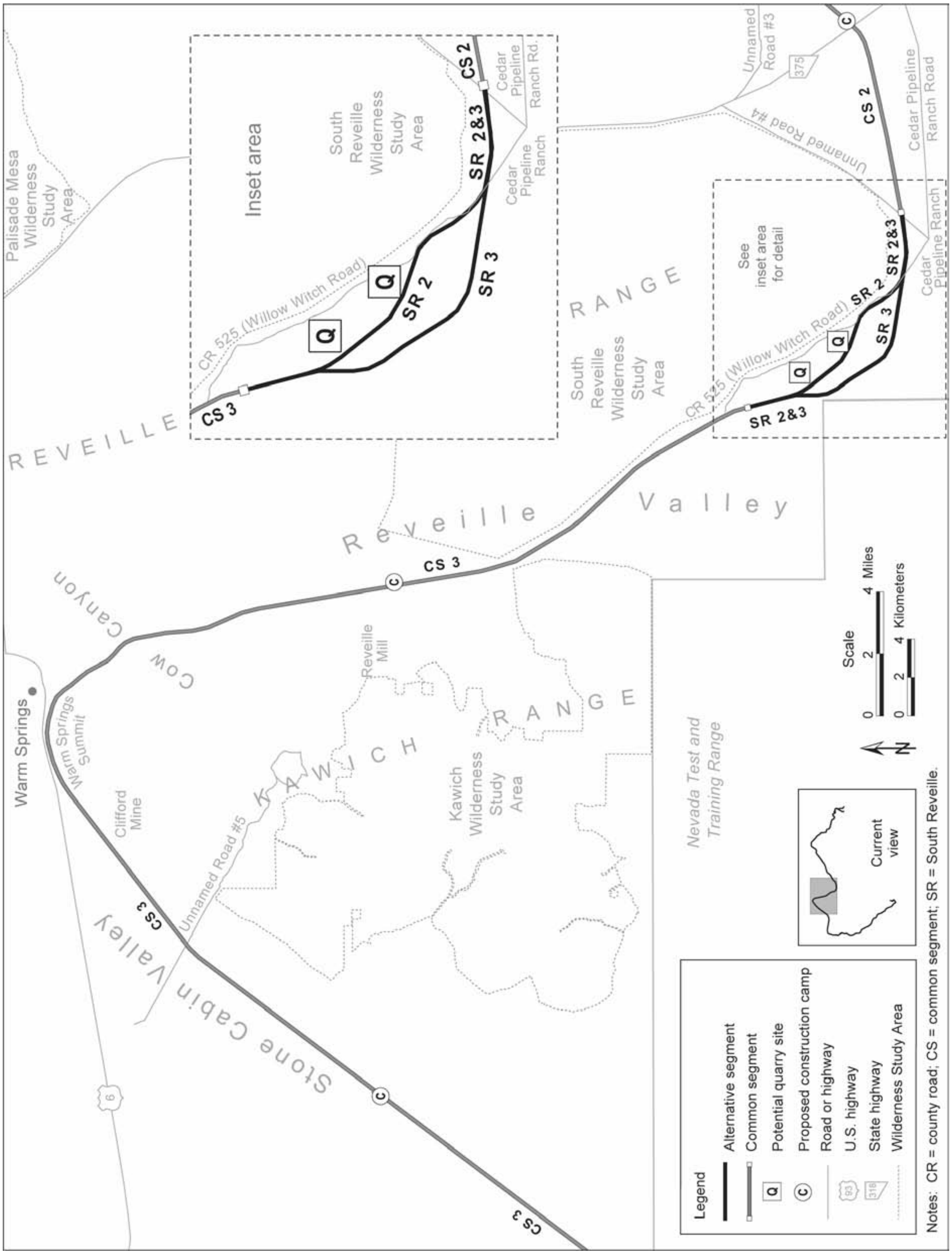


Figure 2-8. Common segments, alternative segments, and related sites within Caliente map area 4.

2.2.1.1.5 South Reveille Alternative Segments

DOE is considering two alternative segments southwest of the South Reveille Wilderness Study Area. These are referred to as South Reveille alternative segments 2 and 3 and are shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 220 through 238) and on Figure 2-8.

Either of these alternative segments would begin 5 kilometers (3 miles) south of the South Reveille Wilderness Study Area at the end of Caliente common segment 2. South Reveille alternative segment 2 would trend to the northwest along the border of the South Reveille Wilderness Study Area. South Reveille alternative segment 3 would trend northwest a few kilometers to the west and roughly parallel to South Reveille alternative segment 2. South Reveille alternative segment 2 or 3 would connect to Caliente common segment 3 in Reveille Valley about 14 kilometers (9 miles) west of State Route 375. South Reveille alternative segment 2 would be approximately 18.8 kilometers (11.7 miles) long and South Reveille alternative segment 3 would be approximately 19.8 kilometers (12.3 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-8).

2.2.1.1.6 Caliente Common Segment 3 (Stone Cabin Valley Area)

Caliente common segment 3 is shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 239 through 319) and on Figures 2-8 and 2-9. It would begin at the end of South Reveille alternative segment 2 or 3 in Reveille Valley, run north across Cow Canyon before turning to the southwest at Warm Springs Summit in the Kawich Range, and run to the southwest around the Kawich Range and turn to the west approximately 3 kilometers (2 miles) north of the Nevada Test and Training Range. It would continue west through Ralston Valley before connecting to one of the Goldfield alternative segments, just east of the Esmeralda and Nye County line. Caliente comment segment 3 would be approximately 110 kilometers (70 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-9).

2.2.1.1.7 Goldfield Alternative Segments

DOE is considering three alternative segments in the Goldfield area. These are referred to as Goldfield alternative segments 1, 3, and 4 and are shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 320 through 392) and on Figure 2-9.

Goldfield alternative segment 1 would extend south into the Goldfield Hills area, passing east of Black Butte. It would turn east near Espina Hill and head south to the east of Blackcap Mountain. It would wind around a series of hills and valleys to maintain an acceptable ***grade*** to meet the rail line design criteria. Goldfield 1 would run for approximately 11 kilometers (7 miles) along an abandoned rail line before joining Caliente common segment 4. In total, Goldfield alternative segment 1 would be approximately 47 kilometers (29 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-10).

Goldfield alternative segment 3 would extend south into the Goldfield Hills area and farther to the east than the other Goldfield alternative segments. Similar to Goldfield alternative segment 1, Goldfield alternative segment 3 would wind around a series of hills and valleys to maintain an acceptable grade to meet the rail line design criteria. Also like Goldfield alternative segment 1, Goldfield alternative segment 3 would run for approximately 11 kilometers (7 miles) along an abandoned rail line before joining Caliente common segment 4. In total, Goldfield alternative segment 3 would be approximately 50 kilometers (31 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-10).

The western Goldfield alternative segment, Goldfield 4, would depart Caliente common segment 3 to the north of Black Butte and trend southwest. It would then cross U.S. Highway 95 and turn south toward Goldfield. After passing through the southwestern edge of Goldfield and crossing U.S. Highway 95

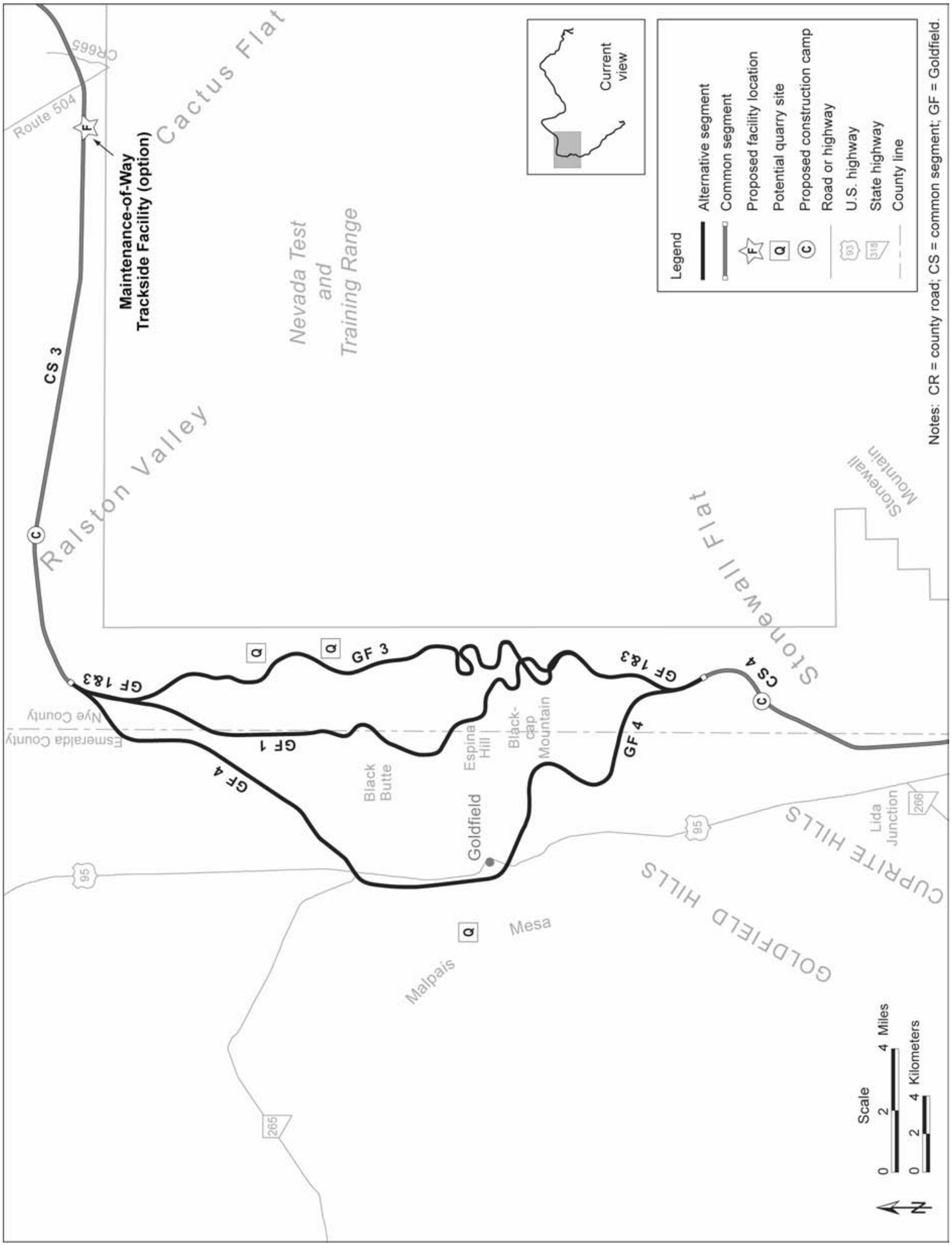


Figure 2-9. Common segments, alternative segments, and related sites within Caliente map area 5.

again, Goldfield alternative segment 4 would turn south to connect with Caliente common segment 4. Goldfield alternative segment 4 would be approximately 53 kilometers (33 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-8).

2.2.1.1.8 Caliente Common Segment 4 (Stonewall Flat Area)

Caliente common segment 4 is shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 393 through 399) and on Figures 2-9 and 2-10. It would run south through Stonewall Flat along the Esmeralda and Nye County line. It would end about 6 kilometers (3.5 miles) southeast of the intersection of State Route 266 and U.S. Highway 95, and 8 kilometers (5 miles) north of Stonewall Pass, where it would connect to one of the Bonnie Claire alternative segments. Caliente common segment 4 would be approximately 11 kilometers (7 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-10).

2.2.1.1.9 Bonnie Claire Alternative Segments

DOE is considering two alternative segments in the area north of Scottys Junction, Bonnie Claire alternative segments 2 and 3, which are shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 399 through 424) and on Figure 2-10.

Bonnie Claire alternative segment 3 would begin at the end of Caliente common segment 4 about 8 kilometers (5 miles) north of Stonewall Pass. Bonnie Claire alternative segment 3 would trend generally south, paralleling U.S. Highway 95 to the east. After approximately 10 kilometers (6 miles), it would turn southeast and continue for an additional 10 kilometers through Sarcobatus Flat, where it would join common segment 5 approximately 4 kilometers (2 miles) north of Scottys Junction near the intersection of State Route 267 and U.S. Highway 95. Bonnie Claire alternative segment 3 would be approximately 19 kilometers (12 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-11).

Bonnie Claire alternative segment 2 would begin at the end of Caliente common segment 4 about 8 kilometers (5 miles) north of Stonewall Pass and would trend east toward the Nevada Test and Training Range for about 5 kilometers (3 miles) before turning south for an additional 17 kilometers (11 miles). Bonnie Claire alternative segment 2 would generally follow the Nevada Test and Training Range boundary and would join common segment 5 in Sarcobatus Flat to the north of Scottys Junction near the intersection of State Route 267 and U.S. Highway 95. Bonnie Claire alternative segment 2 would be approximately 21 kilometers (13 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-11).

2.2.1.1.10 Common Segment 5 (Sarcobatus Flat Area)

Common segment 5 is shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 425 through 452) and on Figures 2-10 and 2-11. This common segment would begin 4 kilometers (2 miles) north of Scottys Junction and trend generally southeast through the Sarcobatus Flat area, approximately 100 meters (330 feet) east of U.S. Highway 95 at its closest point. Common segment 5 would end approximately 6 kilometers (4 miles) north of Springdale, where it would connect to one of the Oasis Valley alternative segments. Common segment 5 would be about 40 kilometers (25 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-12).

2.2.1.1.11 Oasis Valley Alternative Segments

DOE is considering two alternative segments in the Oasis Valley area, Oasis Valley alternative segments 1 and 3, which are shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 453 through 466) and on Figure 2-11.

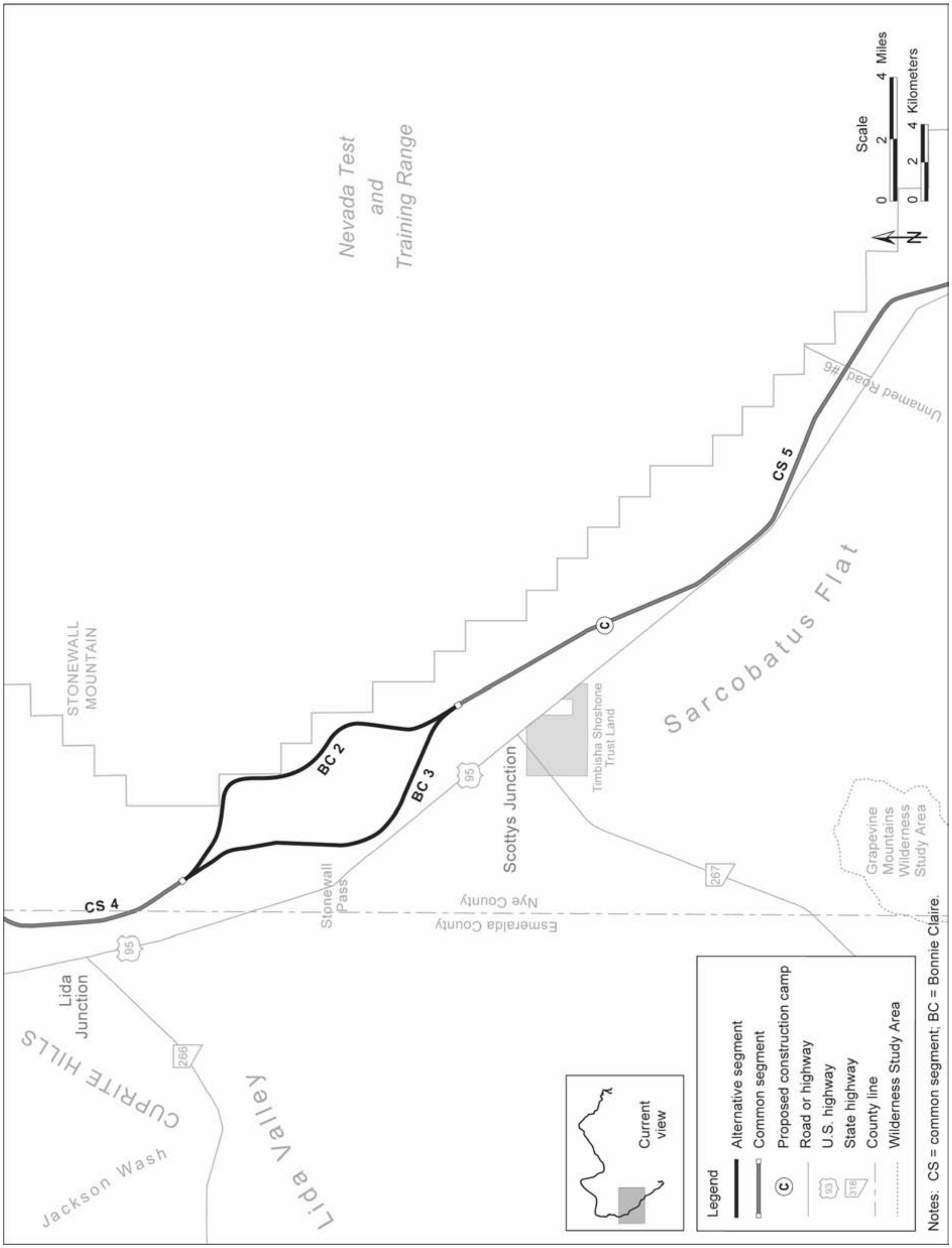


Figure 2-10. Common segments, alternative segments, and related sites within Caliente map area 6.

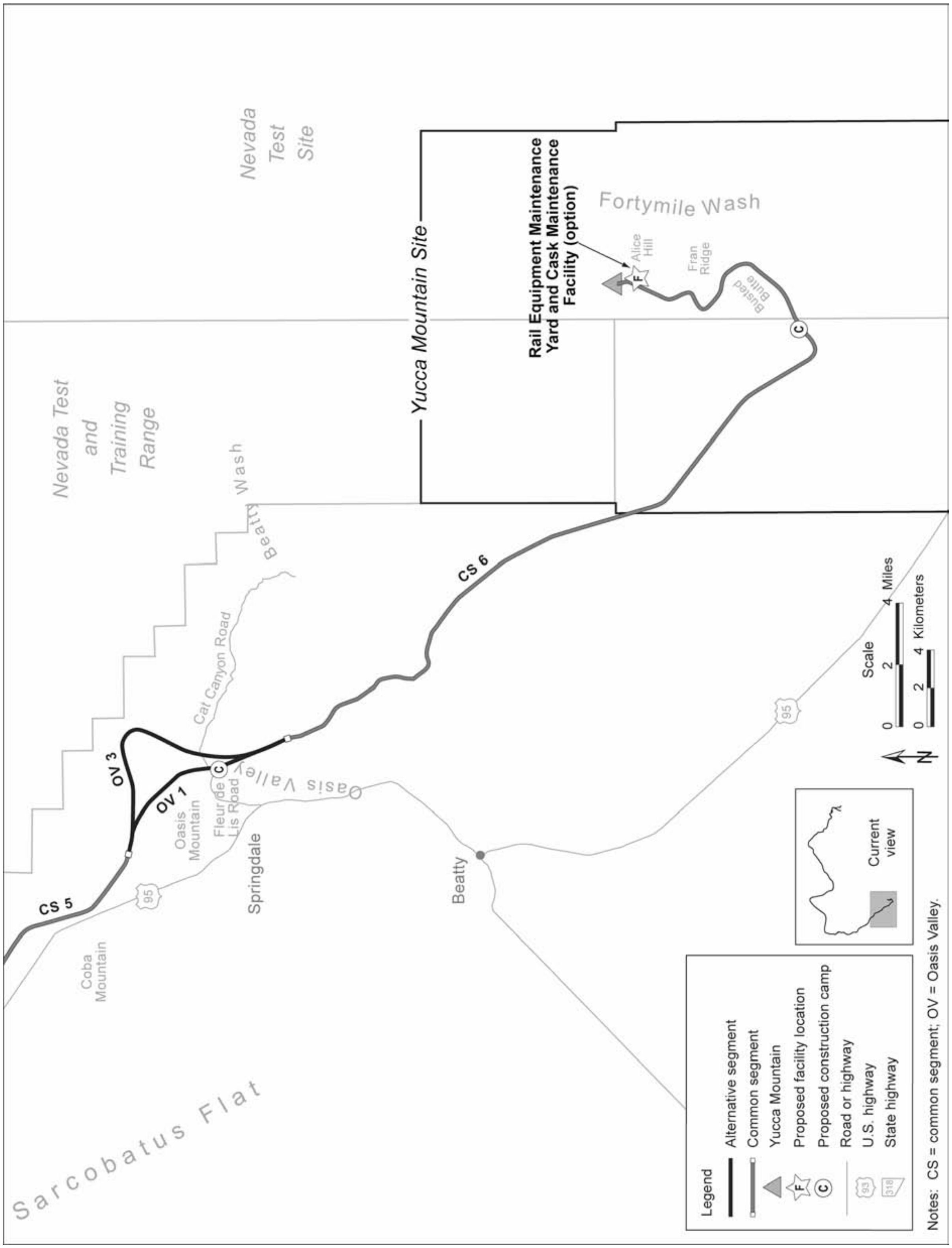


Figure 2-11. Common segments, alternative segments, and related sites within Caliente map area 7.

Oasis Valley alternative segment 1 would begin at the end of common segment 5 approximately 6 kilometers (4 miles) north of Springdale, and would run southeast to connect to common segment 6. Oasis Valley alternative segment 1 would be approximately 10 kilometers (6 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-13).

Oasis Valley alternative segment 3 would begin at the end of common segment 5 approximately 6 kilometers (4 miles) north of Springdale, and would run generally east and then south before crossing Oasis Valley farther to the east than Oasis Valley 1 and connecting to common segment 6. Oasis Valley alternative segment 3 would be 14 kilometers (9 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-13).

2.2.1.1.12 Common Segment 6 (Yucca Mountain Approach)

Common segment 6, shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 466 through 500) and on Figure 2-11, would begin about 3 kilometers (2 miles) east of U.S. Highway 95. This common segment would trend generally southeast for 40 kilometers (25 miles) from Oasis Valley to Beatty Wash. It would then turn north at the southern end of Busted Butte, running west of Fran Ridge and then trending generally north for an additional 11 kilometers (7 miles) until terminating at the Rail Equipment Maintenance Yard inside the ***Yucca Mountain Site boundary***. Common segment 6 would be approximately 51 kilometers (32 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-14).

2.2.1.2 Mina Rail Alignment

This section describes the existing Union Pacific Railroad Hazen Branchline between Hazen and Wabuska and the existing rail lines, alternative segments, and common segments along the Mina rail alignment, which would extend from near Wabuska to the Rail Equipment Maintenance Yard inside the Yucca Mountain Site boundary.

DOE would need to ship spent nuclear fuel, high-level radioactive waste, and other materials over the existing Union Pacific Railroad Hazen Branchline before transferring the cargo to the proposed railroad. This shipping activity would increase train traffic from approximately eight one-way trains to 17 one-way trains per week. Because this activity would cause rail traffic on the branchline to increase by more than 100 percent, Surface Transportation Board (STB) regulations require that DOE analyze the operations impacts of the increased traffic along the line. Therefore, although DOE does not consider the Union Pacific Railroad Hazen Branchline part of the Mina rail alignment, it is included in this Rail Alignment EIS for the purposes of analyzing these operations impacts.

Operation of the proposed railroad along the Mina rail alignment would also require operating on portions of existing Department of Defense Branchlines. These existing rail lines are described below for purposes of proposed railroad operations only; there would be no new track construction along these existing rail lines. However, DOE would install sidings (described in Section 2.2.6.2) and a fiber-optic communications cable (described in Section 2.2.2.9) along these existing branchlines. Additionally, as part of routine operations and maintenance, DOE would expect to perform maintenance activities along Department of Defense Branchlines North and South. Section 2.2.3.2 describes these maintenance activities.

Figure 2-12 shows the Union Pacific Railroad Hazen Branchline and the Mina rail alignment divided into eight map areas, starting with Mina map area 1 near Hazen (to the north) and ending with Mina map area 8 at the end of the rail alignment (to the south). Figures in Section 2.2.1.2.1 through 2.2.1.2.11 show existing rail lines, alternative segments, and common segments within each of these map areas. The Map Atlas (DIRS 182844-ICF 2007, Part B) contains more than 500 detailed maps depicting all of the Mina

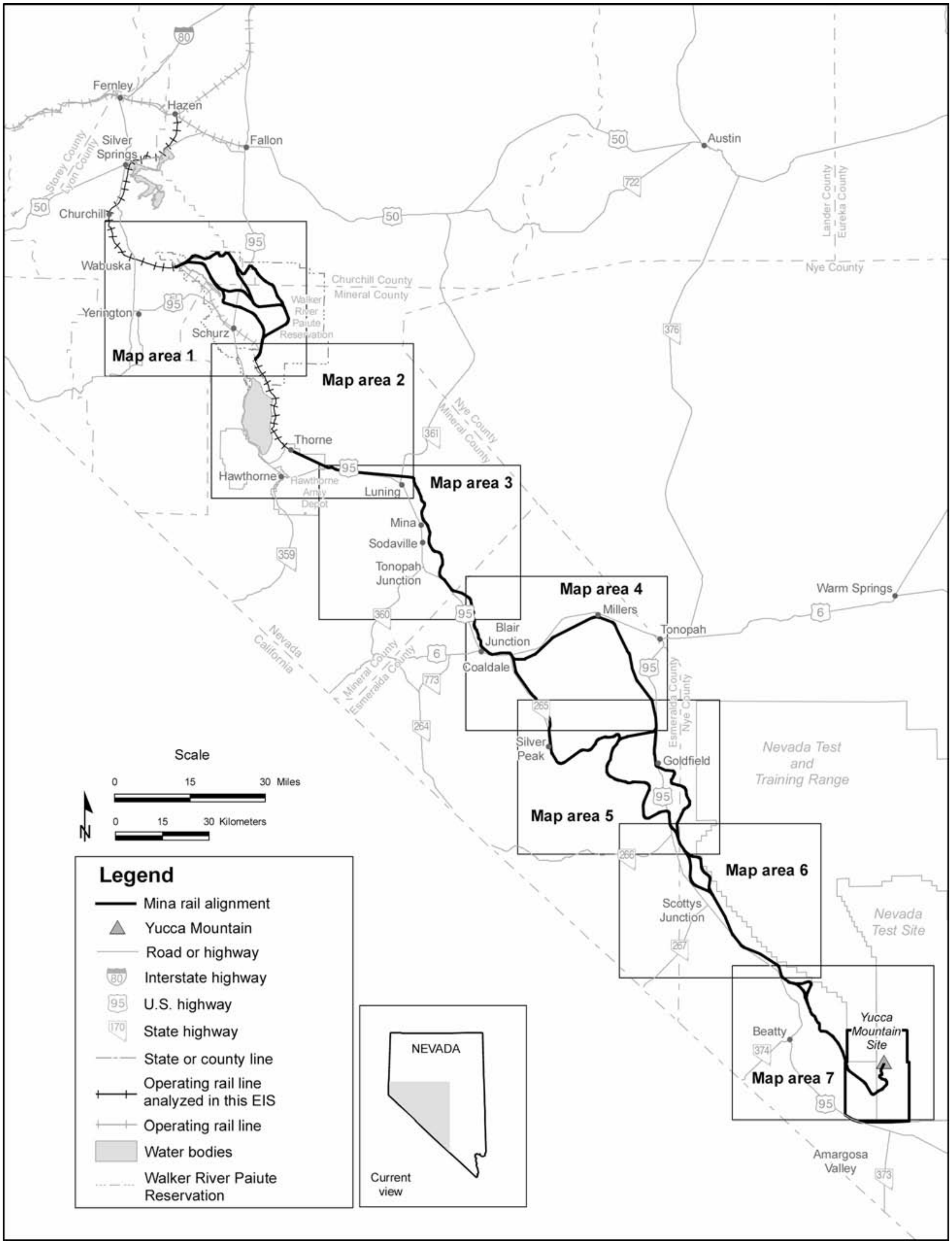


Figure 2-12. Map key for areas along the Mina rail alignment.

alternative segments and common segments, railroad operations support facilities, and engineered features, such as cut and fill areas.

2.2.1.2.1 Union Pacific Railroad Hazen Branchline

The Union Pacific Railroad Hazen Branchline, shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 1 to 46) and on Figure 2-13, is an existing rail line that begins near Hazen, Nevada. From Hazen, it runs south and then southwest for approximately 11 kilometers (7 miles) before meeting and paralleling U.S. Highway 50 west for about 13 kilometers (8 miles) north of the Lahontan Reservoir. The rail line then crosses U.S. Highway 50 and turns southwest about 1.5 kilometers (1 mile) east of Silver Springs. It continues south for the next 16 kilometers (10 miles), flanking Alternate U.S. Highway 95 to the east. The rail line then crosses Alternate U.S. Highway 95 and trends southwest for about 3 kilometers (2 miles) before turning south for the next 14 kilometers (9 miles). The rail line then turns east for 4 kilometers (2.5 miles) and crosses Alternate U.S. Highway 95 at Wabuska. The Union Pacific Railroad Hazen Branchline connects with Department of Defense Branchline North approximately 3 kilometers after crossing Alternate U.S. Highway 95. In total, the Union Pacific Railroad Hazen Branchline is approximately 69 kilometers (43 miles) long, as shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 1 to 46).

There is existing rail traffic along the Union Pacific Railroad Hazen Branchline that would continue during and after construction of the proposed railroad. For purposes of analysis in this EIS, DOE estimated that approximately four one-way Union Pacific Railroad trains en route to Wabuska and four one-way Department of Defense trains en route to the Hawthorne Army Depot would run on this portion of the rail line per week.

2.2.1.2.2 Department of Defense Branchline North

Department of Defense Branchline North is shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 47 through 55) and on Figure 2-13. It is an existing rail line that begins east of Wabuska. It trends east through a valley just south of Parker Butte and north of the Mason Valley Wildlife Management Area. In total, Department of Defense Branchline North is about 8.1 kilometers (5 miles) long, as shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 47 to 55).

There is existing rail traffic along Department of Defense Branchline North that would continue after construction of the proposed railroad. For purposes of analysis in this EIS, DOE estimated that approximately four one-way Department of Defense trains would run on this portion of the rail line per week.

2.2.1.2.3 Schurz Alternative Segments

At present, the Department of Defense Branchline runs south directly through Schurz on the Walker River Paiute Reservation. This Rail Alignment EIS refers to this portion of existing rail line as Department of Defense Branchline through Schurz. Under the Mina Implementing Alternative, DOE would remove this portion of the Department of Defense Branchline, and by way of the Schurz alternative segments, the rail alignment would bypass Schurz. Rail line removal activities would include removing all portions of the track and ties, but leaving the rail roadbed in place. DOE is considering four alternative segments to bypass Schurz to the east and connect the proposed railroad to existing Department of Defense Branchline North east of Wabuska. These four alternative segments are referred to as Schurz 1, 4, 5, and 6 and are shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 54 to 154) and on Figure 2-13.

Schurz alternative segment 1 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would trend east and then southeast, roughly parallel to the

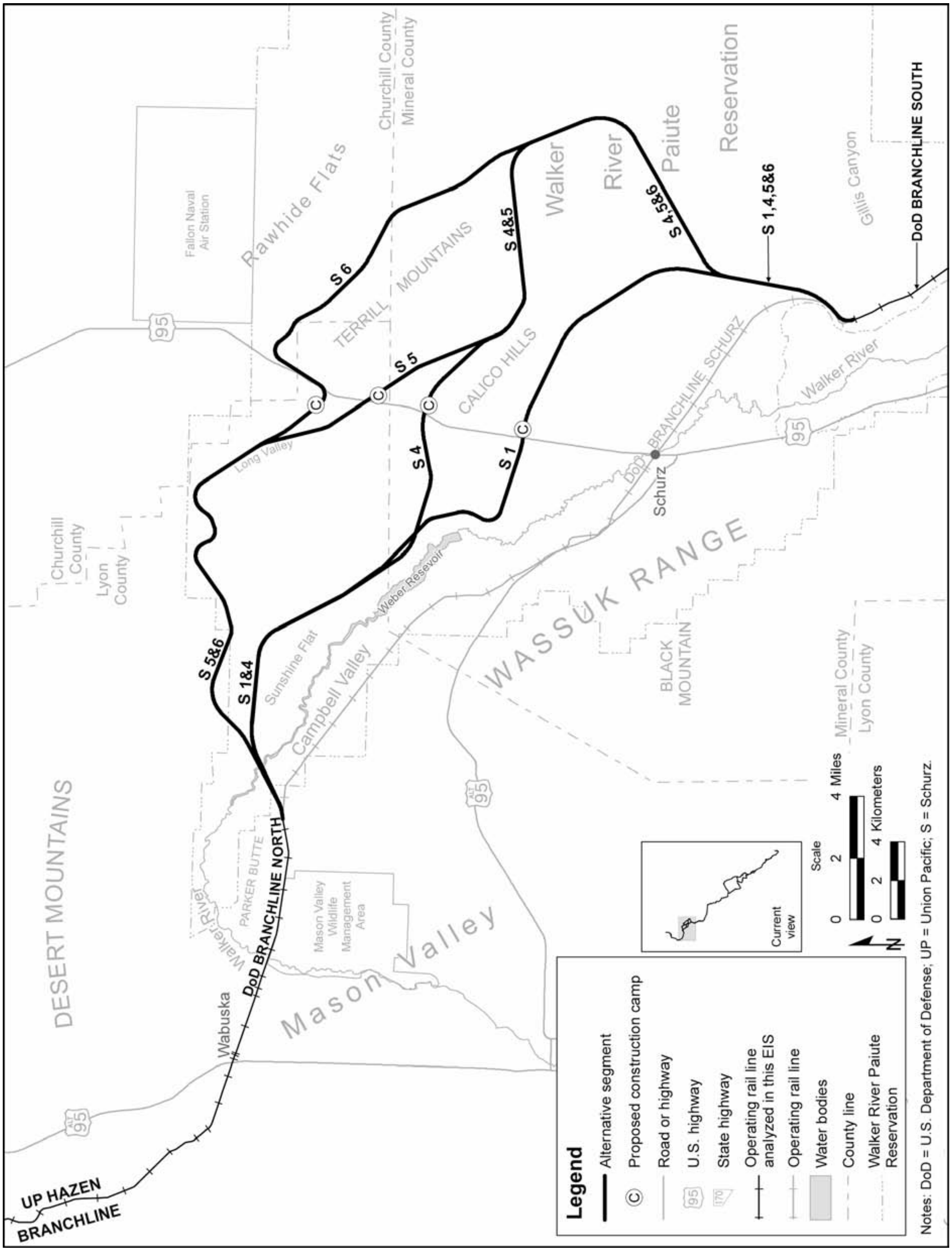


Figure 2-13. Mina rail alignment map area 1.

Walker River, for approximately 10 kilometers (6 miles). From the Walker River, Schurz alternative segment 1 would continue in a southeasterly and then easterly direction for approximately 6 kilometers (4 miles). It would trend to the south through Sunshine Flat for approximately 19 kilometers (12 miles). After crossing U.S. Highway 95 with a ***grade-separated crossing***, the rail line would pass south of the Calico Hills. Schurz alternative segment 1 would continue south for another 6 kilometers before joining the existing Department of Defense Branchline South. Schurz alternative segment 1 would be about 52 kilometers (32 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E).

Schurz alternative segment 4 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would trend east and then southeast, roughly parallel to the Walker River, for approximately 10 kilometers (6 miles). From the Walker River, the rail line would trend generally southeast and east for about approximately 12 kilometers (7.5 miles) and would cross U.S. Highway 95 with a grade-separated crossing. Between the Terrill Mountains and Calico Hills, it would run due east for about 11 kilometers (7 miles). It would then trend southwest for approximately 16 kilometers (10 miles) and would continue in a roughly southern direction for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 4 would be about 64 kilometers (40 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E).

Schurz alternative segment 5 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would run east for approximately 14 kilometers (9 miles). This alternative segment would then turn southeast and travel through Long Valley and across U.S. Highway 95 with a grade-separated crossing. South of the Terrill Mountains, it would turn due east and run for about 11 kilometers (7 miles). It would then trend south and southwest for approximately 16 kilometers (10 miles). It would continue in a roughly southern direction for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 5 would be approximately 71 kilometers (44 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E).

Schurz alternative segment 6 would begin at the end of existing Department of Defense Branchline North, would cross the Walker River, and would run east for approximately 14 kilometers (9 miles). This alternative segment would then turn southeast and travel through Long Valley before turning sharply northeast and crossing U.S. Highway 95 and into Churchill County. After following U.S. Highway 95 for about 4 kilometers (2.5 miles), the rail line would then turn southeast and run along the eastern edge of the Terrill Mountains for approximately 16 kilometers (10 miles) and into Mineral County. It would then trend southwest for approximately 16 kilometers. The rail line would continue south for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 6 would be approximately 72 kilometers (45 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E).

Following construction of one of the Schurz alternative segments, rail traffic on the existing Department of Defense Branchline through Schurz would be diverted to the proposed railroad. For purposes of analysis in this Rail Alignment EIS, DOE estimated that approximately two Department of Defense trains en route to the Hawthorne Army Depot would run on this portion of the rail line per week.

2.2.1.2.4 Department of Defense Branchline South

Department of Defense Branchline South is shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 156 through 175) and on Figure 2-14. It is existing track that starts where the Schurz alternative segments would end, about 13 kilometers (8 miles) south of Schurz. The rail line trends generally south for 10 kilometers (6 miles) before leaving the Walker River Paiute Reservation, and continues generally south for another 24 kilometers (15 miles) on the east side of Walker Lake. Department of Defense Branchline South ends near Hawthorne, where it would join Mina common segment 1. Department of

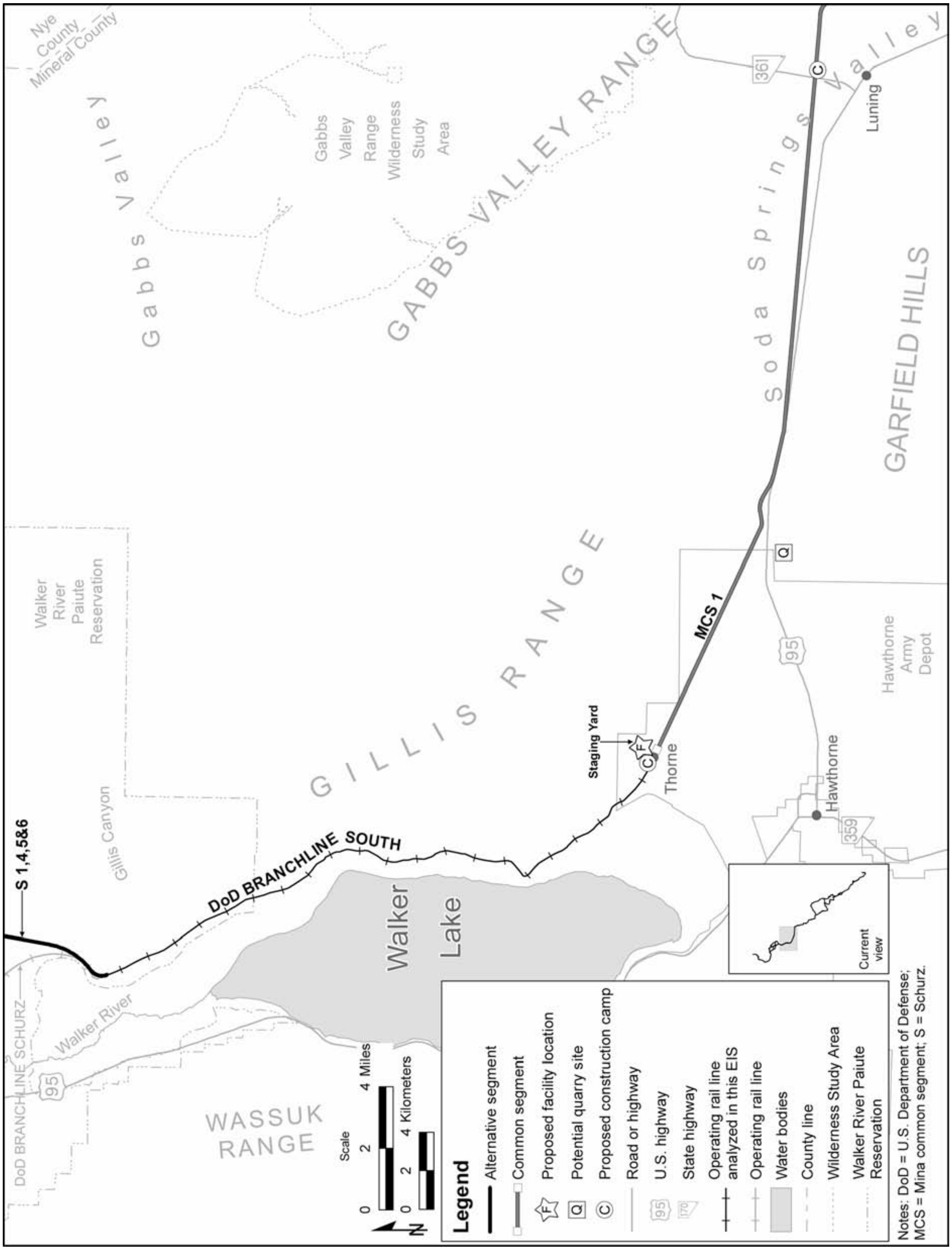


Figure 2-14. Mina rail alignment map area 2.

Defense Branchline South is approximately 35 kilometers (22 miles) long, as shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 156 to 175).

There is existing rail traffic along Department of Defense Branchline South that would continue during and after construction of the proposed railroad. For purposes of analysis in this EIS, DOE estimated that approximately four one-way Department of Defense trains en route to the Hawthorne Army Depot would run on this portion of the rail line per week.

2.2.1.2.5 Mina Common Segment 1 (Soda Spring Valley Area)

Mina common segment 1 is shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 174 through 255) and on Figures 2-15 and 2-16. It would begin north of Hawthorne and would trend southeast before turning east at U.S. Highway 95. It would trend east along U.S. Highway 95 through Soda Springs Valley for approximately 40 kilometers (25 miles). Continuing to parallel U.S. Highway 95, the rail line would cross State Route 361 and turn south for approximately 64 kilometers (40 miles). It would pass Luning and Mina, which are along U.S. Highway 95 and would be approximately 1.5 to 3 kilometers (1 to 2 miles) to the east of the rail alignment. The rail line would then turn east before crossing U.S. Highway 95 with a grade-separated crossing in the area of Blair Junction and continuing for about 1.5 kilometers (1 mile) before joining one of the Montezuma alternative segments. Mina common segment 1 would be approximately 116 kilometers (72 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E).

2.2.1.2.6 Montezuma Alternative Segments

DOE is considering three alternative segments in the Montezuma area, referred to as Montezuma alternative segments 1, 2, and 3 and shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 255 through 416) and on Figures 2-16 and 2-17.

Montezuma alternative segment 1 would begin at the end of Mina common segment 1 just southeast of Blair Junction. It would trend roughly southeast along State Route 265 through part of the Big Smoky Valley and west of the Weepah Hills for approximately 37 kilometers (23 miles), passing to the east of Silver Peak in Clayton Valley. It would then turn to the northwest through Clayton Valley and run through a pass between Clayton Ridge and Paymaster Ridge close to Silver Peak Road. It would then trend south for the next 11 kilometers (7 miles) between Clayton Ridge on the west and Montezuma Peak on the east before turning east for about the next 13 kilometers (8 miles), passing to the south of Montezuma Peak. The rail alignment would again turn roughly south for approximately 11 kilometers, traveling to the west of the Goldfield Hills. It would then travel northwest, cross U.S. Highway 95, and turn south before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 1 would be approximately 117 kilometers (73 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E).

Montezuma alternative segment 2 would begin at the end of Mina common segment 1 just southeast of Blair Junction. It would trend northeast for about 35 kilometers (22 miles) just south of U.S. Highway 95. Northeast of Lone Mountain, it would turn south into Montezuma Valley and run south for 59 kilometers (31 miles) before turning east and crossing U.S. Highway 95 south of Goldfield. It would then trend south for about 37 kilometers (23 miles) before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 2 would be approximately 119 kilometers (74 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E). Montezuma alternative segment 3 would begin at the end of Mina common segment 1 just southeast of Blair Junction. It would trend northeast for about 35 kilometers (22 miles) just south of U.S. Highway 95. Northeast of Lone Mountain, it would turn south into Montezuma Valley and trend south for 37 kilometers (23 miles). North of Goldfield, it would turn west and trend along the northern portion of the Montezuma Range for 12 kilometers (7.5 miles).

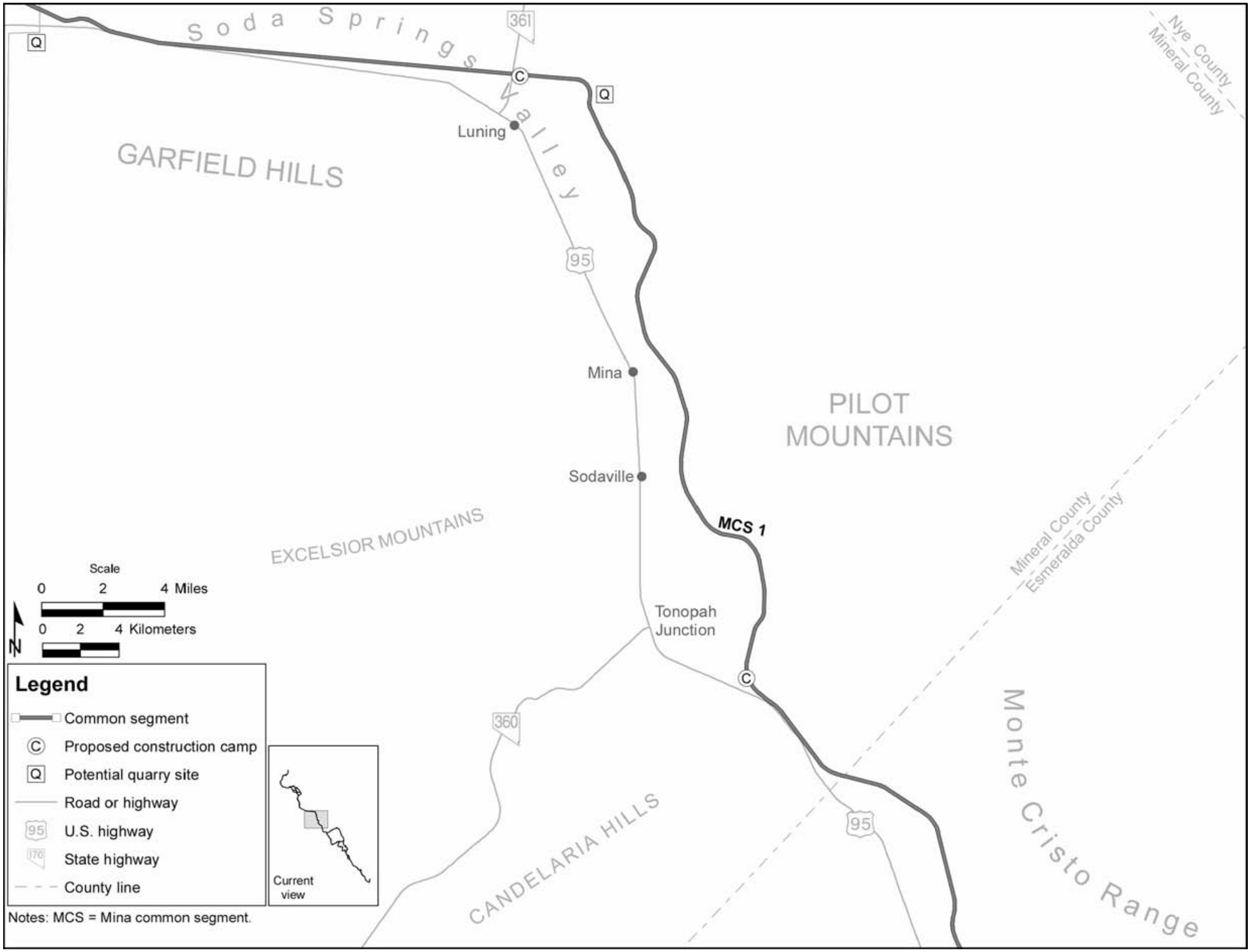


Figure 2-15. Mina rail alignment map area 3.

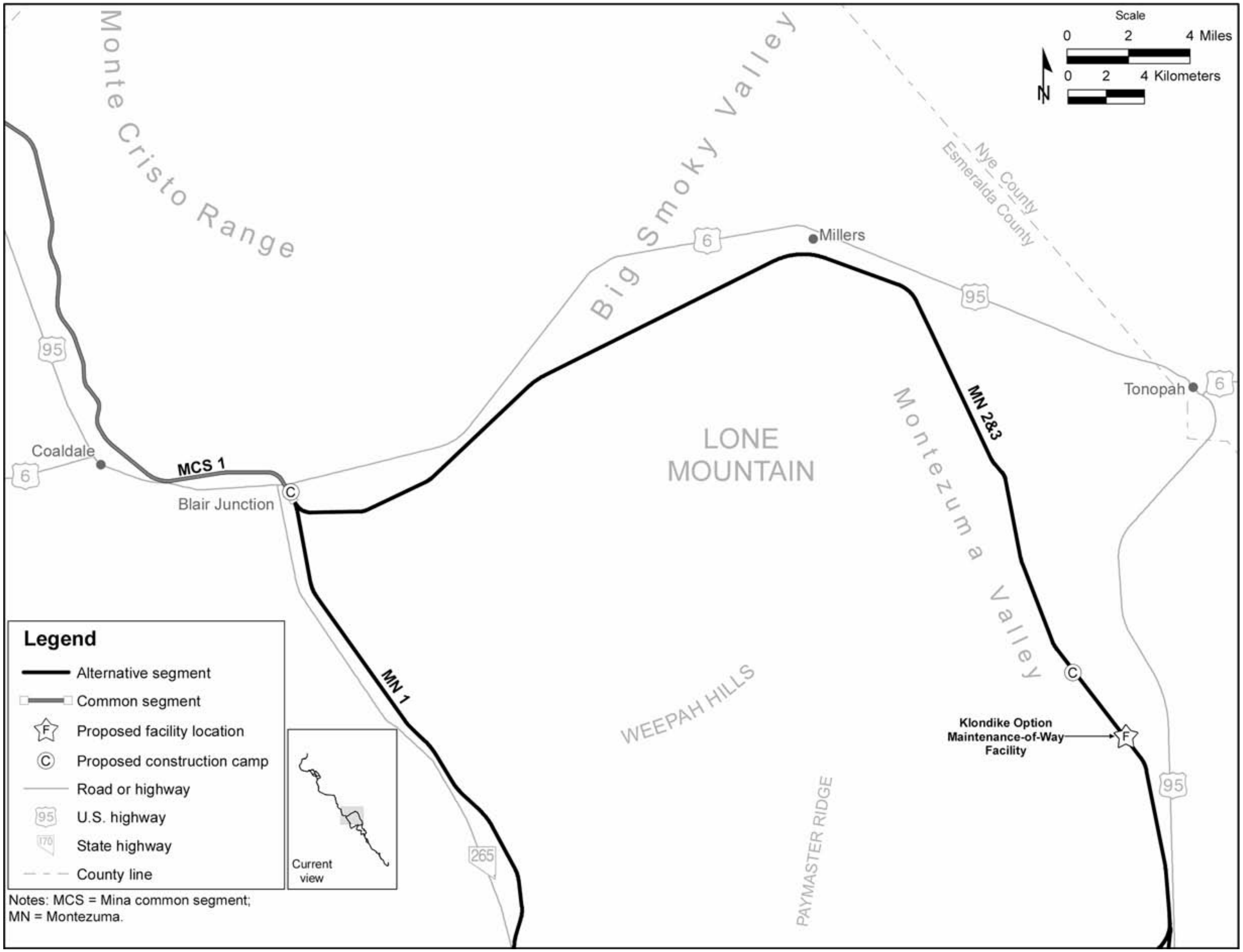


Figure 2-16. Mina rail alignment map area 4.

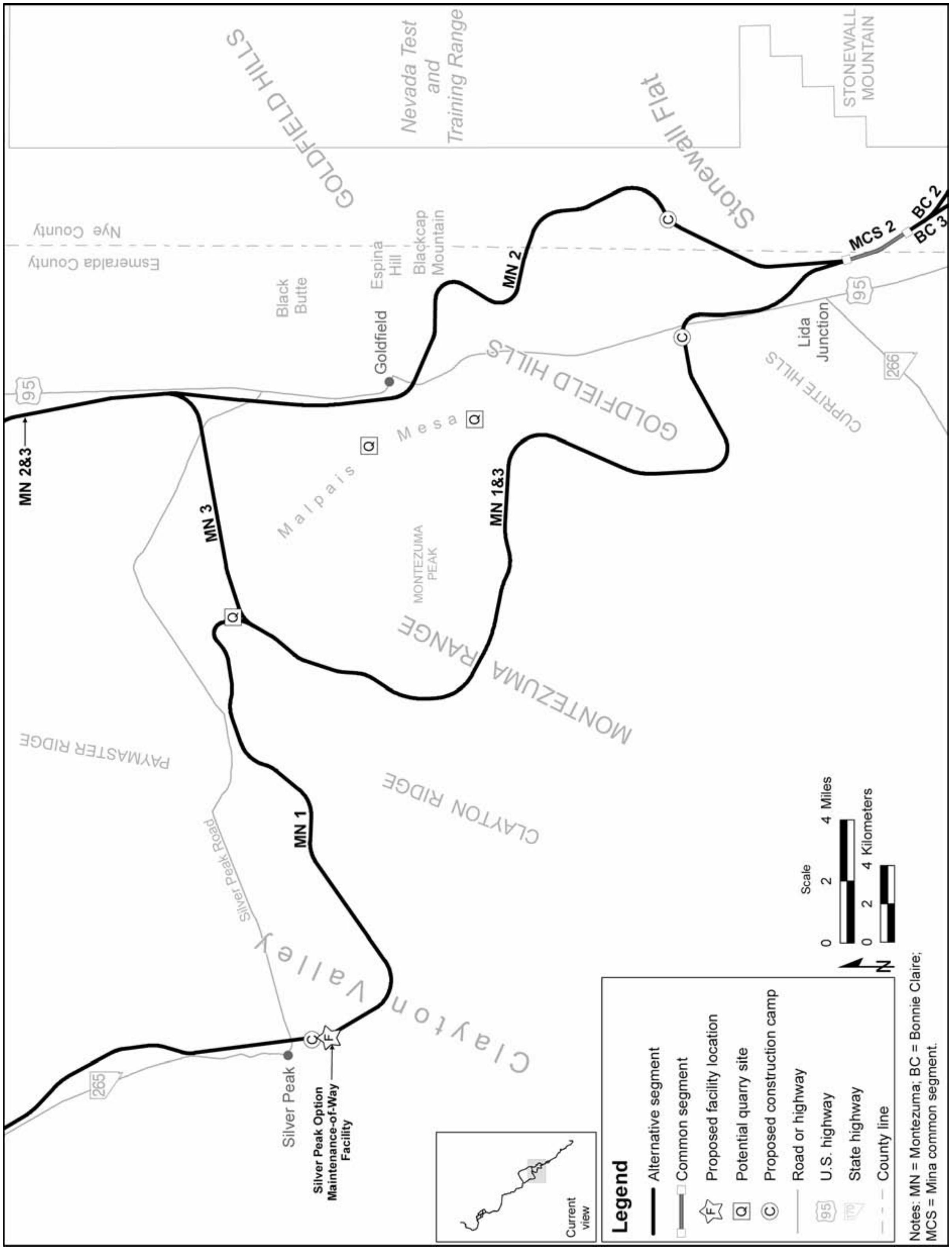


Figure 2-17. Mina rail alignment map area 5.

It would then trend south for the next 11 kilometers (7 miles) between Clayton Ridge on the west and Montezuma Peak on the east before turning east for about the next 13 kilometers (8 miles), passing to the south of Montezuma Peak. The rail alignment would again turn roughly south for approximately 11 kilometers, traveling to the west of the Goldfield Hills. It would then travel northwest, cross U.S. Highway 95, and turn south before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 3 would be approximately 140 kilometers (88 miles) long (DIRS 180872-Nevada Rail Partners 2007, Appendix E).

2.2.1.2.7 Mina Common Segment 2 (Lida Junction Area)

Mina common segment 2 is shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 417 through 418) and on Figures 2-17 and 2-18. It would begin at the end of one of the Montezuma alternative segments and run roughly southeast for about 3.4 kilometers (2.1 miles) before joining one of the Bonnie Claire alternative segments (DIRS 180916-Nevada Rail Partners 2007, p. E-12).

2.2.1.2.8 Bonnie Claire Alternative Segments

DOE is considering two alternative segments in the area north of Scottys Junction, Bonnie Claire alternative segments 2 and 3, which are shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 419 through 441) and on Figure 2-18.

Bonnie Claire alternative segment 3 would begin at the end of Mina common segment 2 about 8 kilometers (5 miles) north of Stonewall Pass, and would trend generally south, paralleling U.S. Highway 95 to the east. After approximately 10 kilometers (6 miles), it would turn southeast and continue for an additional 10 kilometers through Sarcobatus Flat, where it would join common segment 5 approximately 4 kilometers (2.5 miles) north of Scottys Junction near the intersection of State Route 267 and U.S. Highway 95. Bonnie Claire alternative segment 3 would be approximately 19 kilometers (12 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-12).

Bonnie Claire alternative segment 2 would begin at the end of Mina common segment 2 about 8 kilometers (5 miles) north of Stonewall Pass and would trend east toward the Nevada Test and Training Range for about 5 kilometers (3 miles) before turning south for an additional 17 kilometers (11 miles). Bonnie Claire 2 would generally follow the Nevada Test and Training Range boundary and would join common segment 5 in Sarcobatus Flat to the north of Scottys Junction near the intersection of State Route 267 and U.S. Highway 95. Bonnie Claire alternative segment 2 would be approximately 21 kilometers (13 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-12).

2.2.1.2.9 Common Segment 5 (Sarcobatus Flat Area)

Common segment 5 is shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 441 through 467) and on Figures 2-18 and 2-19. This common segment would begin 4 kilometers (2.5 miles) north of Scottys Junction and trend generally southeast through the Sarcobatus Flat area, approximately 100 meters (330 feet) east of U.S. Highway 95 at its closest point. Common segment 5 would end approximately 6 kilometers (4 miles) north of Springdale, where it would connect to one of the Oasis Valley alternative segments. Common segment 5 would be approximately 40 kilometers (25 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-13).

2.2.1.2.10 Oasis Valley Alternative Segments

DOE is considering two alternatives in the Oasis Valley area, Oasis Valley 1 and Oasis Valley 3, which are shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 467 through 479) and on Figure 2-19.

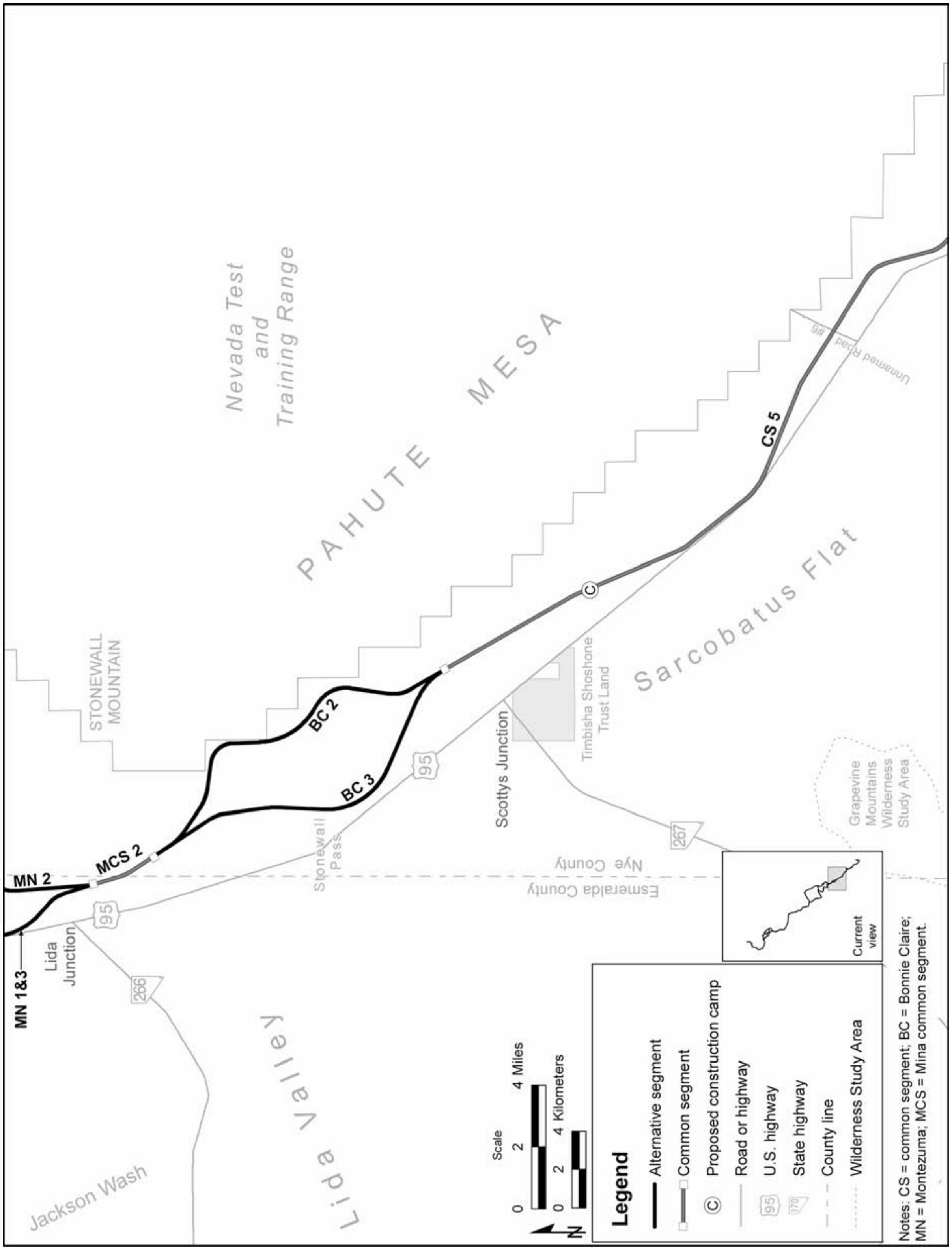


Figure 2-18. Mina rail alignment map area 6.

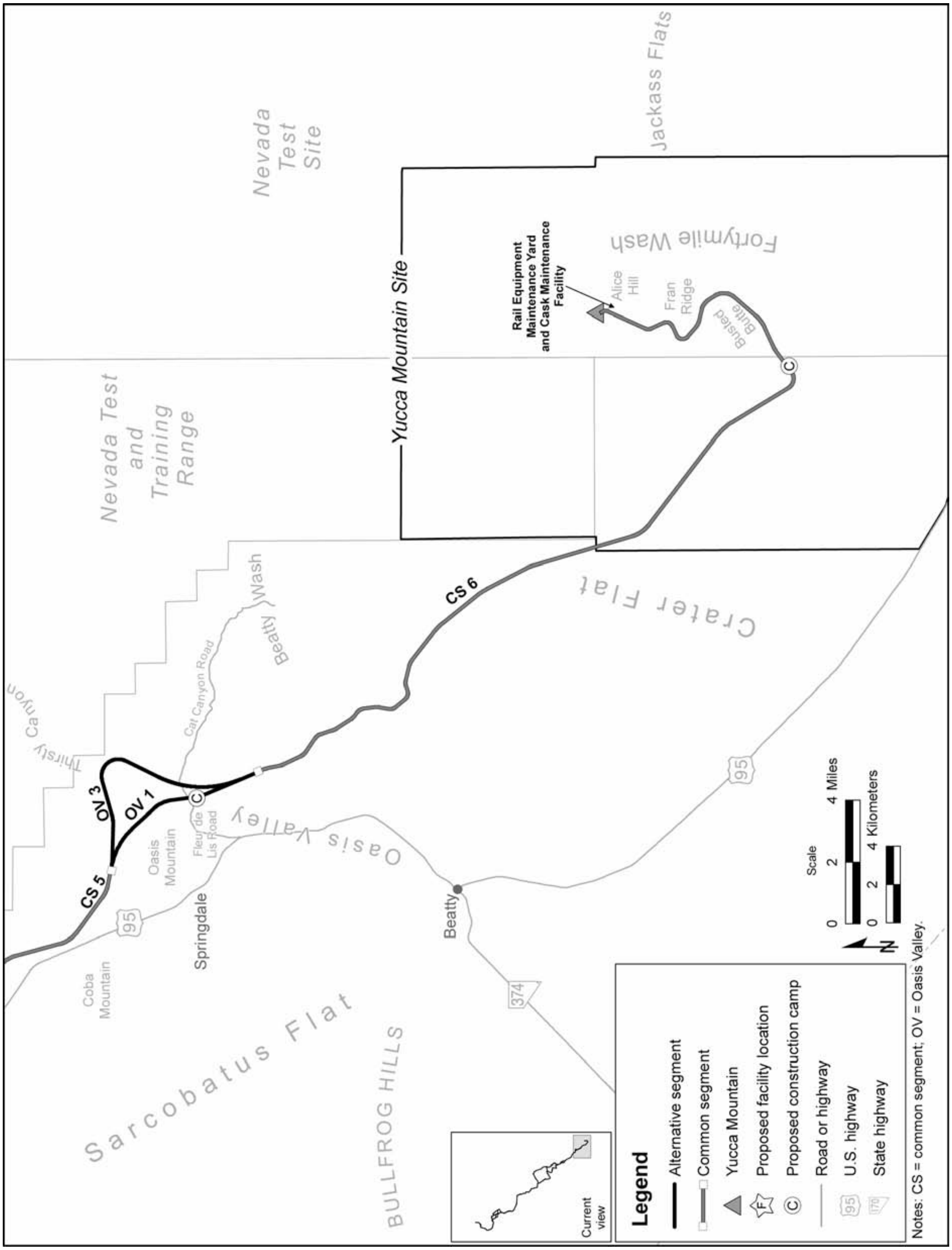


Figure 2-19. Mina rail alignment map area 7.

Oasis Valley alternative segment 1 would begin at the end of common segment 5 approximately 6 kilometers (4 miles) north of Springdale, would run southeast and connect to common segment 6. Oasis Valley 1 would be approximately 10 kilometers (6 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-14).

Oasis Valley alternative segment 3 would begin at the end of common segment 5 approximately 6 kilometers (4 miles) north of Springdale, and would run generally east and then south before crossing Oasis Valley farther to the east than Oasis Valley 1 and connecting to common segment 6. Oasis Valley 3 would be approximately 14 kilometers (9 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-14).

2.2.1.2.11 Common Segment 6 (Yucca Mountain Approach)

Common segment 6, shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 479 through 511) and on Figure 2-19, would begin about 3 kilometers (2 miles) east of U.S. Highway 95. This common segment would trend generally southeast for 40 kilometers (25 miles) from Oasis Valley to Beatty Wash. It would then turn north at the southern end of Busted Butte, running west of Fran Ridge and then trending generally north for an additional 11 kilometers (7 miles) until terminating at the Rail Equipment Maintenance Yard inside the Yucca Mountain Site boundary. Common segment 6 would be approximately 51 kilometers (32 miles) long (DIRS 180916-Nevada Rail Partners 2007, p. E-15).

2.2.2 RAILROAD CONSTRUCTION

DOE anticipates that it would take a minimum of 4 years to construct the proposed railroad under either implementing alternative. As illustrated in Figure 2-20, the construction phase would begin with the construction of water wells, construction camps, and quarries; and with the procurement of concrete ties and rail for track construction and steel for bridge construction. Approximately 1 month after beginning construction and while these previous activities were in progress, construction of the rail roadbed, ***culverts***, bridges, and grade-separated crossings would begin simultaneously at multiple points along the rail alignment. Near the start of year 2, quarries would begin to produce ballast and stockpiling of rails would begin. Shortly thereafter, track construction would begin and would move sequentially along the rail alignment toward Yucca Mountain. Construction would begin on signals and communications structures shortly after the end of year 1 (DIRS 180922-Nevada Rail Partners 2007, Section 7.0).

As shown in Figure 2-20, under the Caliente Implementing Alternative, construction of railroad operations support facilities would begin with construction of the Interchange Yard and the Staging Yard. Next, near the start of year 2, construction of the Cask Maintenance Facility would begin. At the end of year 2, DOE would begin constructing the Maintenance-of-Way Trackside Facility and the Rail Equipment Maintenance Yard. Finally, near the end of year 3, the Department would begin constructing the Maintenance-of-Way Headquarters Facility.

Under the Mina Implementing Alternative, construction of railroad operations support facilities would begin with construction of the Staging Yard. Next, near the start of year 2, DOE would begin constructing the Cask Maintenance Facility. Finally, at the end of year 2, the Department would begin constructing the Maintenance-of-Way Facility and the Rail Equipment Maintenance Yard.

Although DOE anticipates that construction would take a minimum of approximately 4 years, this Rail Alignment EIS accounts for the possibility that it could take longer (up to 10 years) because annual funding levels might not be sufficient to complete construction in 4 years. The construction sequence under a 10-year schedule would be largely the same as for the 4-year schedule, except that under the 10-year schedule construction of the rail roadbed would occur sequentially, starting at the beginning of the rail alignment and moving toward Yucca Mountain.

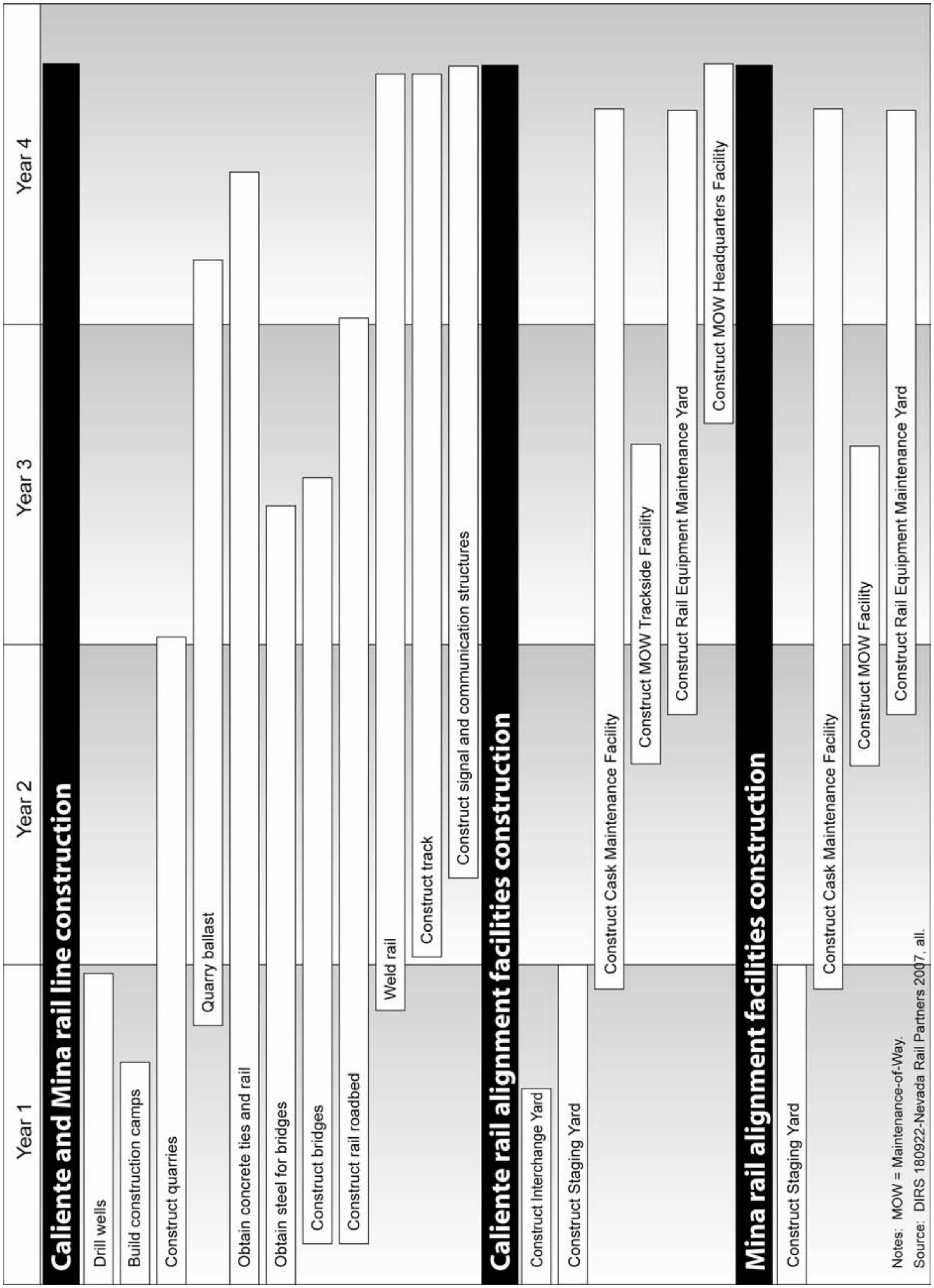


Figure 2-20. Four-year schedule for railroad construction.

Unless otherwise indicated, all construction activities would occur inside the construction right-of-way (nominally 150 meters [500 feet] on either side of the rail alignment centerline, resulting in a ***nominal*** total width of 300 meters [1,000 feet]). In some areas requiring deep cuts or high fills, the construction right-of-way could extend beyond this nominal width. Under the Caliente Implementing Alternative, the total construction footprint resulting from establishing this construction right-of-way would be approximately 164 square kilometers (40,600 acres), but would vary depending on alternative segments. Under the Mina Implementing Alternative, the total construction footprint would be approximately 125 square kilometers (30,900 acres), but would vary depending on alternative segments.

DOE would implement best management practices during this entire construction process (see Chapter 7).

2.2.2.1 Geotechnical Exploration Program

Before constructing the proposed railroad, DOE would conduct a geotechnical exploration program to gather data on subsurface conditions along the rail alignment. These data would support the final design of bridge foundations, embankments, deep cuts, major culverts, potential quarry sites, fills, and excavations. This work would involve collecting geotechnical information by drilling ***boreholes*** at locations along the rail alignment. Under the Caliente Implementing Alternative, there would be approximately 3,200 boreholes; under the Mina Implementing Alternative, there would be approximately 2,100 boreholes. DOE would also obtain any other required permits and approvals, as necessary.

Drilling would be done with portable rigs, assumed for purposes of assessment to be diesel-powered rigs on wheels or skids. The land area disturbed for each drill hole would be approximately 6 by 15 meters (20 by 50 feet). On average, borings would reach a depth of about 15 meters (50 feet) or less; however, some borings might be 30 to 60 meters (100 to 200 feet) deep.

There are various areas along the Caliente and Mina rail alignments that would cross, intersect, or parallel areas with abandoned mines. In these areas, DOE would drill boreholes to sample the subsurface conditions to help indicate the presence of an underground void. If either a borehole or obvious surface subsidence indicated the possible presence of such a void, the Department would conduct further investigations, including additional boreholes, ground-penetrating radar, and/or ***seismic*** analysis, to determine the extent of the feature. In all cases, the Department would develop appropriate engineered solutions to address the situation.

If DOE encountered such features during the construction phase, similar processes, as outlined above, would be employed to determine the appropriate engineering solution. Only if the discovered feature was so extensive that constructing the rail line would be infeasible would the Department consider realignment around the feature.

2.2.2.2 Construction Camps

Construction of the proposed railroad would take place in areas with low population densities and an insufficient workforce. To maintain an adequate workforce during the construction phase, DOE would establish construction camps along the rail alignment to provide housing for construction workers and a logistical base from which to conduct construction activities. These camps would be located approximately every 50 kilometers (30 miles) along the rail alignment. Under the Caliente Implementing Alternative, the Department would establish up to 12 construction camps (Figure 2-21). Under the Mina Implementing Alternative, the Department would establish up to 10 construction camps (Figure 2-22). Along either rail alignment, up to six of these camps could be operational at any one time.

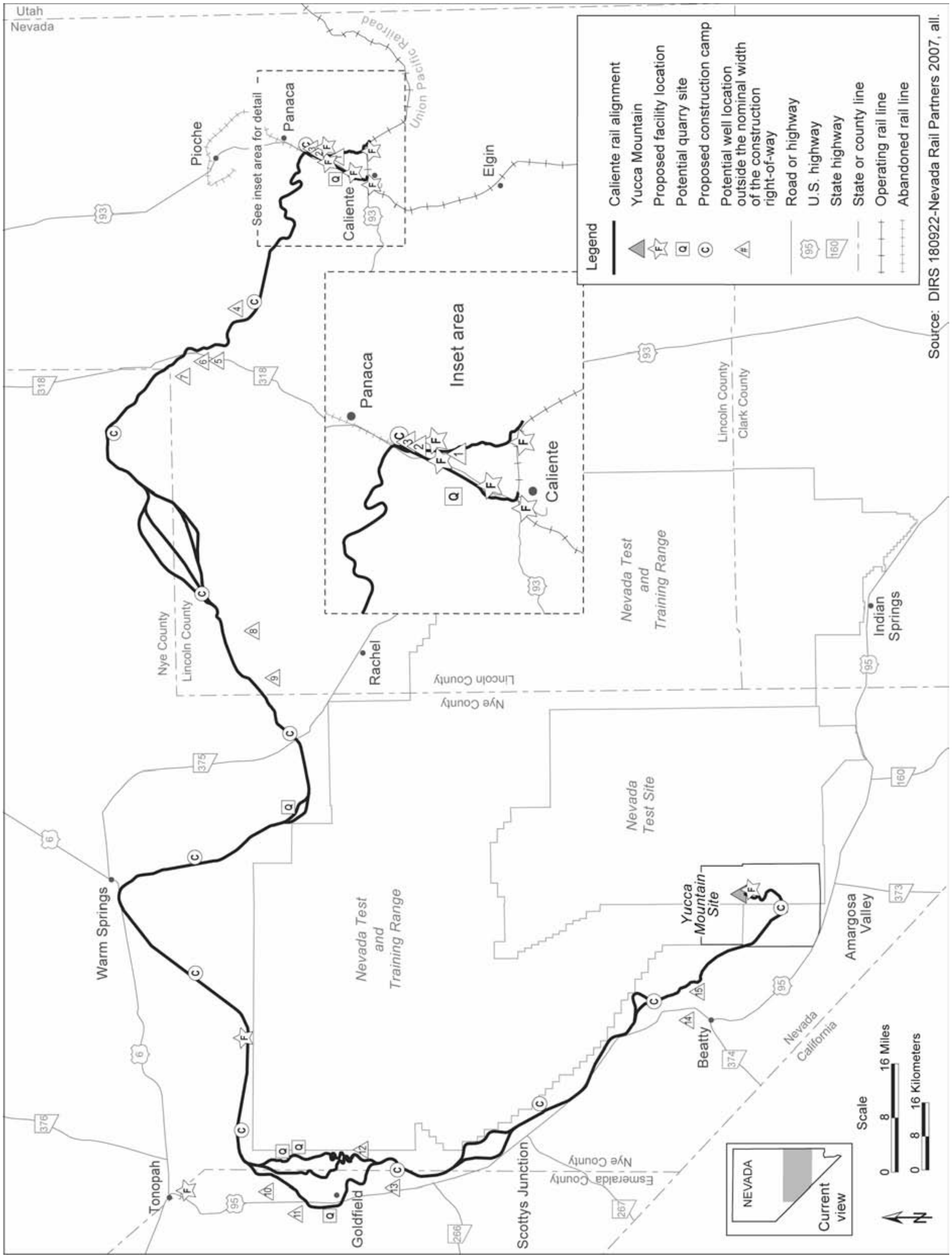


Figure 2-21. Potential quarry, water-well, and construction-camp locations along the Caliente rail alignment.

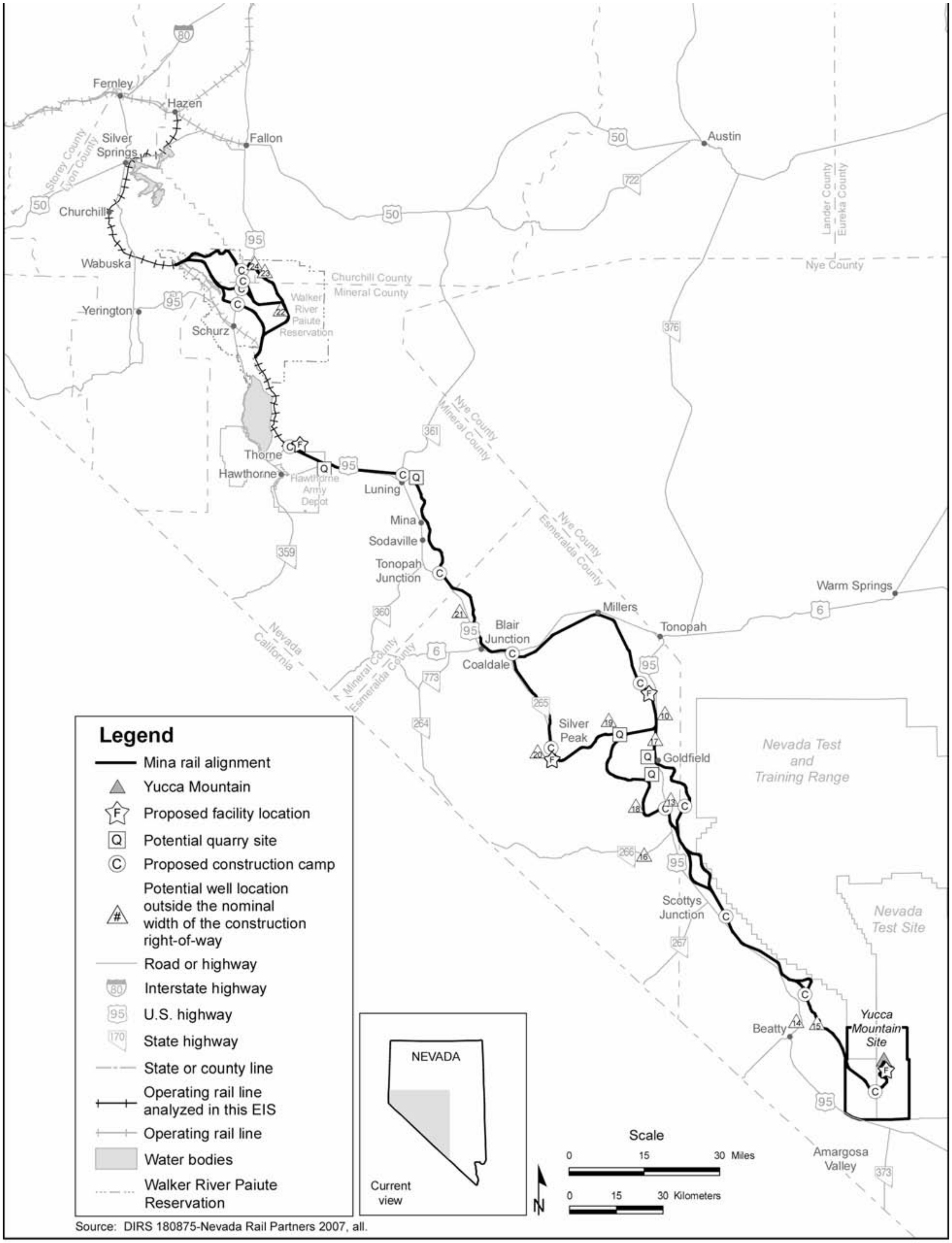


Figure 2-22. Potential quarry, water-well, and construction-camp locations along the Mina rail alignment.

With the exception of construction camp 12, all camps would be operational on an as-needed basis during the rail line construction phase. If needed, DOE might utilize construction camp 12 for repository construction activities beyond the rail line construction phase. However, the design of the camp would not be altered for this purpose.

Each construction camp would be fenced and would occupy approximately 0.10 square kilometer (25 acres). Each site would consist of office space; housing for approximately 360 workers; a utility zone dedicated to power supply; temporary trash storage, ***wastewater treatment*** and potable water treatment areas; a worker support area consisting of first aid facilities and a service station with above-ground storage tanks for construction vehicles and equipment fueling and maintenance; dining facilities; and a material laydown and maintenance area. Figure 2-23 shows the typical site layout for a construction camp. Each camp would be secured and guarded (DIRS 180922-Nevada Rail Partners 2007, Section 4.1). Water demand for the construction camps is anticipated to be approximately 110,000 liters (29,000 gallons) per day per camp and would be met from new wells drilled near each construction camp (DIRS 180922-Nevada Rail Partners 2007, p. 4-6). Water would be stored onsite in tanks for camp use. Each camp would generate approximately 95,000 liters (25,000 gallons) of wastewater per day, which would be processed in a temporary wastewater treatment facility. DOE anticipates that it would use the wastewater effluent (that is, ***gray water***) produced at the wastewater treatment facility along the rail alignment for soil compaction and dust suppression. Power needs would be met at each camp through a substation connecting to the power line that would be laid along the rail line (see Section 2.2.2.7), with backup generators available at each camp for emergencies. Each camp would use approximately 54,000 kilowatt-hours of energy per day (DIRS 180922-Nevada Rail Partners 2007, p. 4-6).

For ease of access, DOE would establish construction camps close to public roads. In most cases, the Department would develop additional access roads to connect the construction camps to these public roads. With the exception of a new roadway that would be constructed to access proposed construction camp 12 (for either the Caliente or the Mina rail alignment), all of these access roads would be developed by improving existing unpaved public roads that would intersect the rail line. Tables 2-8 and 2-9 list the roads the Department would improve to access each construction camp along the Caliente rail alignment and the Mina rail alignment, respectively. Improvements would consist of grading the existing unpaved roads and constructing a gravel surface on the roads when necessary (DIRS 180922-Nevada Rail Partners 2007, pp. 4-2 to 4-9).

The locations and characteristics of access roads are discussed here and in subsequent sections. The locations of all access roads (to water wells, quarry sites, and construction camps) in this Rail Alignment EIS are considered representative and subject to change during the design and construction process.

For purposes of analysis, DOE estimates that railroad construction workers would work a 3-week work cycle, with 2 straight weeks working from the construction camps and 1 week off (DIRS 180922-Nevada Rail Partners 2007, p. 4-5). Construction would occur continuously throughout the year, with multiple crews rotating in and out of the construction camps to ensure continuity.

All railroad construction workers would complete cultural and biological resources sensitivity and protection training to minimize the potential for intentional or unintentional harm to cultural and biological sites. The training would include descriptions of different biological and cultural resources types and their importance, procedures to follow if resources are encountered in the field, and employment-related and legal penalties for not following the requirements. For example, workers could encounter desert tortoises, an ***endangered species***, in the field during construction activities. Personnel would be trained to recognize them and then notify the appropriate authorities of any desert tortoise sightings. DOE would develop procedures that would outline the necessary steps that need to be taken in the event of an encounter with a desert tortoise.

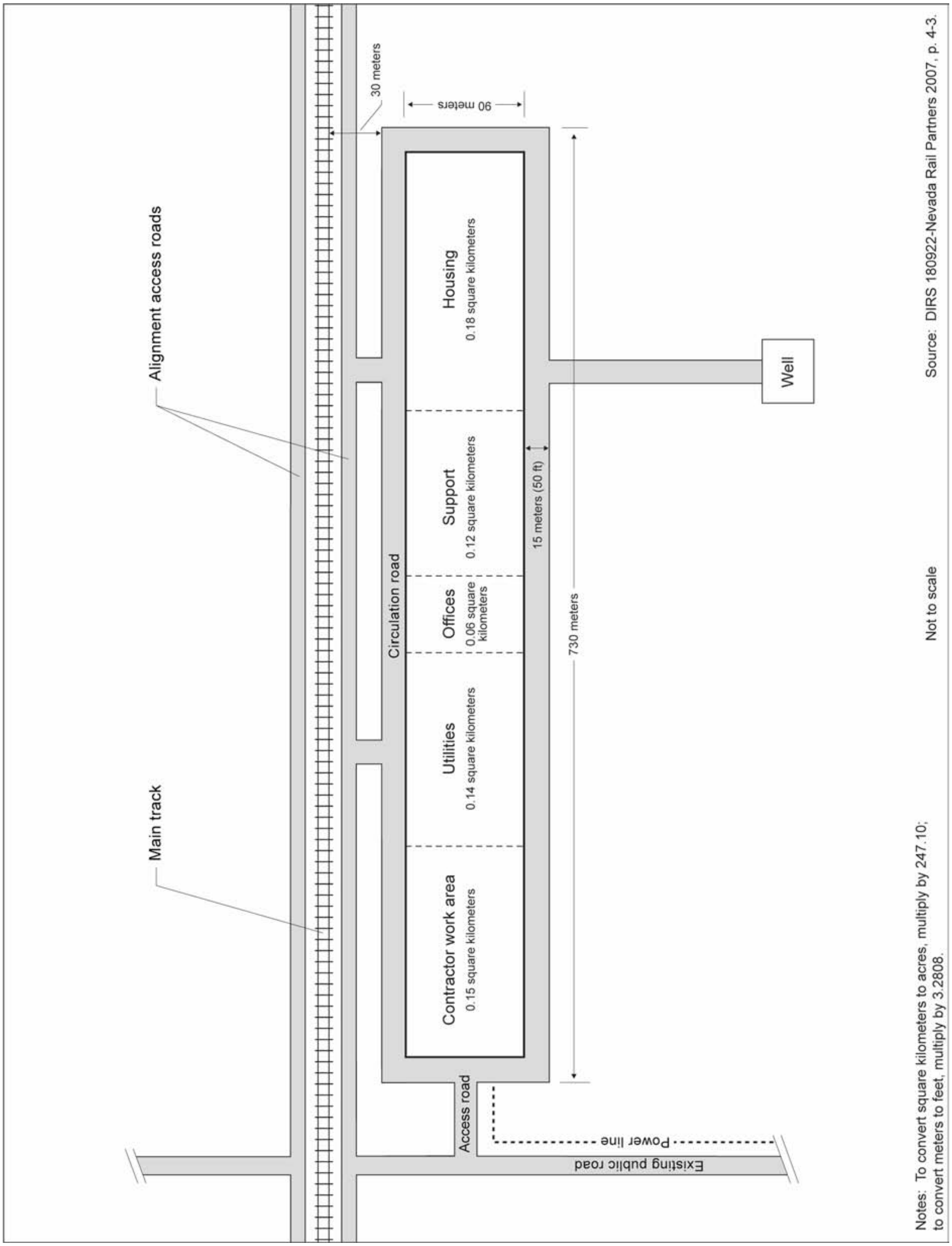


Figure 2-23. Typical construction camp layout.

Table 2-8. Caliente rail alignment construction camp access road locations.[a]

Construction camp number	Segment	Name of roadway to be improved	Estimated length (kilometers)[b,c]	Map Atlas Part A reference[d]
1	Caliente and Eccles alternative segments	Unnamed road	2.4	Plates 21 and 22
2	Caliente common segment 1	Rattlesnake Road	27	Plates 60 and 61
3	Caliente common segment 1	Unnamed road	24	Plates 97 and 98
4a	Garden Valley alternative segment 3	Freiburg Road-Joe Barney Pass Road-Shadow Road	49	Plate 128
4b	Garden Valley alternative segment 1	Freiburg Road-Joe Barney Pass Road-Shadow Road	48	Plate 147
4c	Garden Valley alternative segments 2 and 8	Freiburg Road-Joe Barney Pass Road-Shadow Road	47	Plate 178
5	Caliente common segment 2	No road necessary	0	Plate 210
6	Caliente common segment 3	Unnamed road	24	Plate 249
7	Caliente common segment 3	Unnamed road	18	Plate 281
8	Caliente common segment 3	Unnamed road	15	Plate 314
9	Caliente common segment 4	Unnamed road	9.3	Plate 391
10	Common segment 5	Unnamed road	2.3	Plates 429 and 430
11	Oasis Valley alternative segments 1 and 3[e]	Fleur de Lis Road-Cat Canyon Road	4.3	Plate 464
12	Common segment 6	Unnamed road	19 (0.40 would be new construction)	Plates 491 and 492

a. Source: DIRS 180922-Nevada Rail Partners 2007, Table 4-1.
b. To convert kilometers to miles, multiply by 0.62137.
c. Numbers rounded to two significant figures.
d. Source: DIRS 182843-ICF 2007, Part A.
e. For Oasis Valley alternative segment 3, the required access road would be slightly longer than the distance listed here.

Table 2-9. Mina rail alignment construction camp access road locations[a] (page 1 of 2).

Construction camp number	Segment	Name of roadway to be improved	Estimated length (kilometers)[b,c]	Map Atlas Part B reference[d]
18a	Schurz alternative segment 1	No improvements	0	Plate 75
18b	Schurz alternative segment 4	No improvements	0	Plate 89
18c	Schurz alternative segment 5	No improvements	0	Plate 110
18d	Schurz alternative segment 6	Unnamed road	1.3	Plate 124
17	Department of Defense Branchline South	No improvements	0	Plate 174
16	Mina common segment 1	No improvements	0	Plate 205
	Mina common segment 1	Unnamed road	1.5	Plate 227
15				
14	Mina common segment 1	No improvements	0	Plate 255
13a	Montezuma alternative segment 1	Silver Peak Road	1.9 (0.64 would be shared with the alignment access road)	Plate 275
13b	Montezuma alternative segments 2 and 3	Unnamed road	6.6	Plate 336

Table 2-9. Mina rail alignment construction camp access road locations[a] (page 2 of 2).

Construction camp number	Segment	Name of roadway to be improved	Estimated length (kilometers)[b,c]	Map Atlas Part B reference[d]
9	Montezuma alternative segment 2	Unnamed road	9.3	Plate 366
9a	Montezuma alternative segments 1 and 3	No improvements	0	Plate 411
10	Common segment 5	Unnamed road	2.3	Plate 446
11	Oasis Valley alternative segment 1 and 3[e]	Fleur de Lis Road-Cat Canyon Road	4.4	Plate 477
12	Common segment 6	Unnamed road	19 (0.40 would be new construction)	Plate 503

a. Source: DIRS 180875-Nevada Rail Partners 2007, pp. 4-14 to 4-17.
b. To convert kilometers to miles, multiply by 0.62137.
c. Numbers rounded to two significant figures.
d. Source: DIRS 182844-ICF 2007, Part B.
e. For Oasis Valley alternative segment 3, the required access road would be slightly longer than the distance listed here.

Following the completion of construction, DOE would consult with the BLM regarding abandonment and reclamation of the construction camps. The abandonment process would include dismantling each camp, dismantling the electrical substation, removing the temporary wastewater treatment facility, and reclaiming the land by returning it to as natural a state as practicable.

2.2.2.3 Rail Alignment Access Roads

During the construction phase, DOE would install unpaved access roads parallel to and on both sides of the rail line within the construction right-of-way. These access roads would be utilized primarily to provide construction workers access to rail line construction sites. The roads would be approximately 7.3 meters (24 feet) wide, be graded, and have a gravel surface.

Under the Caliente Implementing Alternative, the rail alignment access roads would parallel the entire length of the rail line except over bridges. Under the Mina Implementing Alternative, the rail alignment access roads would parallel only the newly constructed portions of the rail line. The existing branchlines that are part of the Mina rail alignment would be accessed by existing roads.

The rail alignment access roads could improve land access along most of the rail alignment. While most of the rail alignment would follow or be within a few kilometers of existing unpaved roads and trails that are currently open for public use, the new access roads could be of better quality in some areas than nearby existing roads, increasing the likelihood of use. Recreational use of public land along the access roads (as with other similar roads on public land) would be monitored by the BLM to ensure compliance with its land management goals, as stated in applicable BLM ***resource management plans***.

After the construction phase, the rail alignment access roads would remain in place to provide additional access to the rail line for maintenance and emergency response, and to act as firebreaks. It is important to note that DOE would not maintain the access roads as public roads and the Department would post signs indicating potential users would proceed on the access roads at their own risk.

2.2.2.4 Acquisition of Materials

Water, ballast, ***subballast***, steel for bridges, concrete ties, and rail would be required for construction of the proposed railroad. This section briefly describes acquisition and use of these materials.

2.2.2.4.1 Water

For purposes of analysis, DOE assumed that it would obtain all required water from ***groundwater*** pumped from new water-supply wells the Department would construct along the rail alignment inside, and in selected locations, outside the nominal 300-meter (1,000-foot)-wide construction right-of-way (see Sections 4.2.6 and 4.3.6, Groundwater Resources). DOE is aware that there could be other approaches for obtaining some of the water required for construction, including purchasing or leasing water from established municipalities or other existing permitted water-rights holders. This approach, if used for satisfying part of the total water demand, would result in the need for fewer new water-supply wells than are assumed and described in this Rail Alignment EIS. DOE anticipates obtaining all water from groundwater basins along either rail alignment regardless of the method used. New water-supply wells is the only method for obtaining water that would require new construction; therefore, this EIS analyzes the impacts of obtaining all required water from new water-supply wells to illustrate the maximum impacts of the suite of potential water obtainment activities. Table 2-10 lists construction-water requirements for the Caliente and Mina rail alignments.

The amount of water needed for earthwork compaction would be directly related to the amount of fill required. Most of the water needed during the construction phase would be for earthwork compaction. Although the Caliente and Mina rail alignments are different lengths (the Caliente rail alignment would be about 120 kilometers [75 miles] longer than the Mina rail alignment), the amount of fill for the two alignments would be similar (see Tables 2-24 and 2-25). Therefore, the amount of water needed for earthwork compaction would be similar for the two alignments.

For new well construction, DOE would submit an application to the State of Nevada to appropriate groundwater for use during the railroad construction phase. Table 2-11 lists the number of potential water wells and well sites the Department has identified along the Caliente and Mina rail alignments and the number of wells estimated to be required to satisfy construction-water demand.

Figure 2-21 shows the locations of wells outside the nominal width of the Caliente rail alignment construction right-of-way; Figure 2-22 shows the locations of wells outside the nominal width of the Mina rail alignment construction right-of-way; and Table 2-12 lists the number of well sites at each mapped location on both figures.

A 3-meter (10-foot)-wide unimproved dirt access road and a 10- to 15-centimeter (4- to 6-inch)-diameter water pipeline would be required from the well locations along the rail alignment (both inside and outside the construction right-of-way) to lined and fenced earthen reservoirs located immediately along the rail alignment and would be approximately 930 square meters (10,000 square feet) in area by 3 meters (10 feet) deep. These earthen reservoirs would be constructed to temporarily store the water needed to

Table 2-10. Construction-water requirements.[a]

Water-usage category	Caliente rail alignment (cubic meters)[b,c,d]	Mina rail alignment (cubic meters)[b,c,d]
Earthwork compaction	6,780,00	6,590,000
Construction personnel	460,000	460,000
Dust control along access roads	250,000	250,000
Quarry operations	37,000	37,000
Totals	7,530,000	7,340,000

a. Sources: DIRS 180875-Nevada Rail Partners 2007, Section 4.4.2; DIRS 180922-Nevada Rail Partners 2007, Section 4.4.2.
b. To convert cubic meters to gallons, multiply by 264.17.
c. To convert cubic meters to acre feet, multiply by 0.0008107.
d. Numbers rounded to two significant figures.

Table 2-11. Water wells.

Description	Caliente rail alignment[a]		Mina rail alignment[b]	
	Minimum	Maximum	Minimum	Maximum
Total number of unique well sites (each well site contains one or more potential wells)	94	107	58	74
Total number of potential wells	150	176	77	110
Number of potential well sites inside the nominal width of the construction right-of-way	84	93	51	65
Number of potential well sites outside the nominal width of the construction right-of-way	10	14	7	9

a. Sources: DIRS 176189-Converse Consultants 2006, Appendixes A and C.
b. Sources: DIRS 176189-Converse Consultants 2006, Appendixes A and C; DIRS 180888-Converse Consultants 2007, Appendixes A and C.

meet daily water demand during construction. DOE would determine the exact number of earthen reservoirs based on the number of wells constructed and the location of those wells in relation to one another. After the completion of rail line construction, DOE would fill the reservoirs with soil and reclaim them (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4).

Some wells would continue to operate after the completion of construction to serve as the water source for facility operations (discussed in Section 2.2.4). Well closure would be conducted in compliance with State of Nevada regulations. The well sites and access roads would be reclaimed accordingly (DIRS 180922-Nevada Rail Partners 2007, Section 4.4).

Table 2-12. Number of wells at each mapped well site outside the nominal width of the construction right-of-way (page 1 of 2).

Mapped well sites outside construction right-of-way	Rail line segment	Number of wells at each location	Mapped well sites outside construction right-of-way	Rail line segment	Number of wells at each location
Caliente rail alignment (Figure 2-21)[a]			*Mina rail alignment* (Figure 2-22)[b]		
1	Eccles alternative segment	1	16	Montezuma alternative segments 1 and 3	1
2	Eccles alternative segment	1	18	Montezuma alternative segments 1 and 3	1
3	Caliente and Eccles alternative segments	1	19	Montezuma alternative segment 1	2
4	Caliente common segment 1	1	20	Montezuma alternative segment 1	1
5	Caliente common segment 1	1	21	Mina common segment 1	1
6	Caliente common segment 1	1	22	Schurz alternative segments 4 and 5	1
7	Caliente common segment 1	1	23	Schurz alternative segment 6	1
8	Caliente common segment 2	2	24	Schurz alternative segment 6	1

Table 2-12. Number of wells at each mapped well site outside the nominal width of the construction right-of-way (page 2 of 2).

Mapped well sites outside construction right-of-way	Rail line segment	Number of wells at each location	Mapped well sites outside construction right-of-way	Rail line segment	Number of wells at each location
Caliente rail alignment (Figure 2-21)[a] (continued)			*Mina rail alignment* (Figure 2-22)[b] (continued)		
9	Caliente common segment 2	3			
11	Goldfield alternative segment 4	2			
12	Goldfield alternative segments 1 and 3	6			
Well sites common to both the Caliente and Mina rail alignments (Figures 2-21 and 2-22)[c]					
10	Goldfield alternative segment 1	4			
	Goldfield alternative segment 4	10			
	Montezuma alternative segments 2 and 3	8			
13	Goldfield alternative segment 4 or Montezuma alternative segment 2	7			
14	Common segment 6	4			
15	Common segment 6	1			

a. Source: DIRS 176189-Converse Consultants 2006, Appendixes A and C.
b. Source: DIRS 180888-Parsons Brinkerhoff 2007, Appendixes A and C.
c. Sources: DIRS 176189-Converse Consultants 2006, Appendixes A and C; DIRS 180888-Converse Consultants 2007, Appendixes A and C.

For some wells constructed outside the construction right-of-way, DOE would need access roads from the well location to the rail line. Most of these access roads could be existing roads, which DOE could improve. Improvements might consist of grading or resurfacing the existing unpaved roads. In addition, a few well locations would require new roads (DIRS 180922-Nevada Rail Partners 2007, pp. 4-2 to 4-9). For the Caliente rail alignment, Figure 2-22 shows the locations of wells that would require access roads, and Table 2-13 lists the estimated lengths of the access roads to these wells. For the Mina rail alignment, Figure 2-23 shows the locations of wells that would require access roads and Table 2-14 lists the estimated lengths of the access roads to these wells.

As shown in Table 2-10, approximately 90 percent of the water that would be used during construction would be used for earthwork compaction and control of excavation dust (DIRS 180922-Nevada Rail Partners 2007, p. 4-2). DOE would use standard construction dust-control measures, including routine watering of unpaved surfaces; wet suppression for material storage, handling, and transfer operations; and application of appropriate and approved chemical dust suppressants. The efficiency of these controls varies depending on site characteristics, but typically ranges from a 50- to 80-percent reduction in ***fugitive dust*** emissions (DIRS 103676-Cowher, Muleski, and Kinsey 1988, all).

Table 2-13. Lengths of well access roads – Caliente rail alignment.[a]

Mapped well location	Rail line segment	Name of road to be improved	Road type	Estimated length of road (kilometers)[b,c]
1	Eccles alternative segment	Beaver Dam Road	Existing, unpaved road, and new road	Existing: 1.1 New: 0.27
2	Eccles alternative segment	None	New road	New: 0.27
3	Caliente and Eccles alternative segments	Unnamed road	Existing, unpaved road	Existing: 1.5
4	Caliente common segment 1	Unnamed road	Existing, unpaved road	Existing: 1.4
5	Caliente common segment 1	Unnamed road	Existing, unpaved road	Existing: 1.9
6	Caliente common segment 1	None	New road	New: 1.2
7	Caliente common segment 1	Unnamed road	Existing, unpaved road	Existing: 2.6
8	Caliente common segment 2	McCutchen Spring Road	Existing, unpaved road	Existing: 3.1
9	Caliente common segment 2	Unnamed road	Existing, unpaved road	Existing: 3.9
10	Goldfield alternative segment 4	Unnamed road	Existing, unpaved road	Existing: 4.8
11	Goldfield alternative segment 4	Silver Peak Road	Existing, unpaved road	Existing: 0.50
12	Goldfield alternative segments 1 and 3	Unnamed road	Existing, unpaved road	Existing: 2.4
13	Goldfield alternative segment 4	Unnamed road	Existing, unpaved road, and new road	Existing: 6.1 New: 0.56
14	Common segment 6	Unnamed road	Existing, unpaved road, and new road	Existing: 6.6 New: 1.6
15	Common segment 6	Beatty Wash Road	Existing, unpaved road	Existing: 1.3

a. Source: DIRS 180922-Nevada Rail Partners 2007, Table 4-7.
b. To convert kilometers to miles, multiply by 0.62137.
c. Numbers rounded to two significant figures.

Table 2-14. Lengths of well access roads – Mina rail alignment[a] (page 1 of 2).

Mapped well location	Rail line segment	Name of road to be improved	Road type	Estimated length of road (kilometers)[b,c]
24	Schurz alternative segment 6	None	New road	New: 0.97
23	Schurz alternative segment 6	Unnamed road	Existing, unpaved road	Existing: 2.9
22	Schurz alternative segments 4 and 5	Unnamed road	Existing, unpaved road	Existing: 2.1

Table 2-14. Lengths of well access roads – Mina rail alignment[a] (page 2 of 2).

Mapped well location	Rail line segment	Name of road to be improved	Road type	Estimated length of road (kilometers)[b,c]
21	Mina common segment 1	Unnamed road	Existing unpaved road	Existing: 5.0
20	Montezuma alternative segment 1	Nivioc Road	Existing, unpaved road	Existing: 5.2
19	Montezuma alternative segment 1	Unnamed road	Existing unpaved road	Existing: 5.8
18	Montezuma alternative segments 1 and 3	None	New road	New: 2.4
13	Montezuma alternative segment 2	Unnamed road	Existing unpaved road, and new road	Existing: 6.1 New: 0.56
10	Montezuma alternative segments 2 and 3	Unnamed road	Existing unpaved road	Existing: 4.2
16	Montezuma alternative segments 1 and 3	Unnamed road and State Route 266	Existing unpaved road	Existing: 1.9
14	Common segment 6	Unnamed road	Existing unpaved road, and new road	Existing: 6.6 New: 1.6
15	Common segment 6	Beatty Wash Road	Existing unpaved road	Existing: 1.3

a. Source: DIRS 180875-Nevada Rail Partners 2007, pp. 4-14 to 4-17.
b. To convert kilometers to miles, multiply by 0.62137.
c. Numbers rounded to two significant figures.

2.2.2.4.2 Ballast

Approximately 4.9 metric tons of ballast per meter (1.7 tons of ballast per foot) of track construction would be needed along the rail line. Table 2-15 lists the total ballast requirements for rail line construction along the Caliente and Mina rail corridors.

Under the Caliente Implementing Alternative, the Department would obtain ballast from two potential sources: existing commercial quarries or new quarries developed along the proposed rail alignment. Ultimately, the option utilized would depend on the alternative segments selected. If DOE selected the Caliente alternative segment, the Department anticipates it would obtain ballast needed for the entire rail line from new quarries developed along the rail alignment. However, if DOE selected the Eccles alternative segment, there would not be a suitable quarry location available along this portion of the rail alignment and the Department would obtain ballast from an existing commercial quarry. The Milford Quarry in Utah, approximately 200 kilometers (120 miles) east of Caliente on the Union Pacific Railroad in Milford, Utah, is the nearest active quarry that processes large quantities of ballast. Ballast would be transported by rail from this quarry to the proposed rail line. If the Department selected the Eccles alternative segment, one or two additional quarries would still need to be developed along the rail alignment (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 to 3-6).

Table 2-15. Ballast requirements for rail line construction.

Rail alignment	Ballast required (metric tons)[a,b]
Caliente[c]	3.12 million to 3.19 million
Mina[d]	2.49 million to 2.73 million

a. To convert metric tons to tons, multiply by 1.1023.
b. Numbers rounded to three significant figures.
c. Source: Derived from DIRS 180922-Nevada Rail Partners 2007, p. 3-1.
d. Source: Derived from DIRS 180875-Nevada Rail Partners 2007, p. 3-1.

Ballast is the coarse rock that is placed under the railroad tracks to support the railroad ties and improve drainage along the rail line.

Subballast is a layer of crushed gravel that is used to separate the ballast and roadbed for the purpose of load distribution and drainage.

Table 2-16 lists potential quarry sites along the Caliente and Mina rail alignments. DOE has identified six potential quarry sites at four general locations along the Caliente rail alignment that have adequate quantities and quality of suitable material to produce ballast for rail line construction. If DOE decided to obtain all of the required ballast from new quarries, the Department would develop up to four of the six identified potential quarries (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 to 3-6). Figures 2-24 to 2-27 show the site layouts for each of the potential quarry sites along the Caliente rail alignment. Each quarry site layout outlines the maximum quarry impact area, which is the best estimate of the extent of the area that would be needed to house all of the facilities at each quarry site.

Under the Mina Implementing Alternative, the Department would obtain ballast from new quarries developed along the rail alignment. DOE has identified five potential quarry sites, two of which would be developed on an as-needed basis. Figures 2-28 through 2-32 show the site layouts for each of the potential quarry sites along the Mina rail alignment. Each quarry site layout outlines the quarry impact area, which is the best estimate of the extent of the area that would be needed to house all of the facilities at each quarry site.

Figure 2-33 shows the layout of a typical quarry site. Each quarry would occupy a maximum footprint of approximately 0.97 to 3.8 square kilometers (240 to 930 acres) and would consist of a 24-meter (80-foot)-deep by 0.04-square-kilometer (10-acre) pit, a 12-meter (40-foot)-tall by 0.057-square-kilometer (14-acre) tailings disposal area, and a 0.04-square-kilometer (10-acre) railroad siding to accommodate up to 80 railroad ballast cars. Thirty employees would be needed to operate each quarry during peak years (DIRS 180922-Nevada Rail Partners 2007, Section 3.1.3).

Table 2-16. Potential quarry sites.

Caliente rail alignment[a]		Mina rail alignment[b]	
Up to four sites developed from the following six potential locations:	Maximum quarry impact area (square kilometers)	Two sites developed from the following five potential locations:	Maximum quarry impact area (square kilometers)
Quarry site CA-8B (Caliente alternative segment)	1.6	Garfield Hills quarry site (Mina common segment 1)	1.4
Quarry site NN-9A (South Reveille alternative segment 2 or 3)	2.0	Gabbs Range quarry site (Mina common segment 1)	0.97
Quarry site NN-9B (South Reveille alternative segment 2 or 3)	1.3	North Clayton quarry site (Montezuma alternative segment 1 or 3)	1.8
Quarry site ES-7 (Goldfield alternative segment 4)	1.5	Quarry site ES-7 (Montezuma alternative segment 2)	1.5
Quarry site NS-3A (Goldfield alternative segment 1 or 3)	3.8	Malpais Mesa quarry site (Montezuma alternative segment 1)	2.7
Quarry site NS-3B (Goldfield alternative segment 1 or 3)	1.5		

a. Source: DIRS 180922-Nevada Rail Partners 2007, p. 3-4.
b. Source: DIRS 180875-Nevada Rail Partners 2007, p. 3-4.

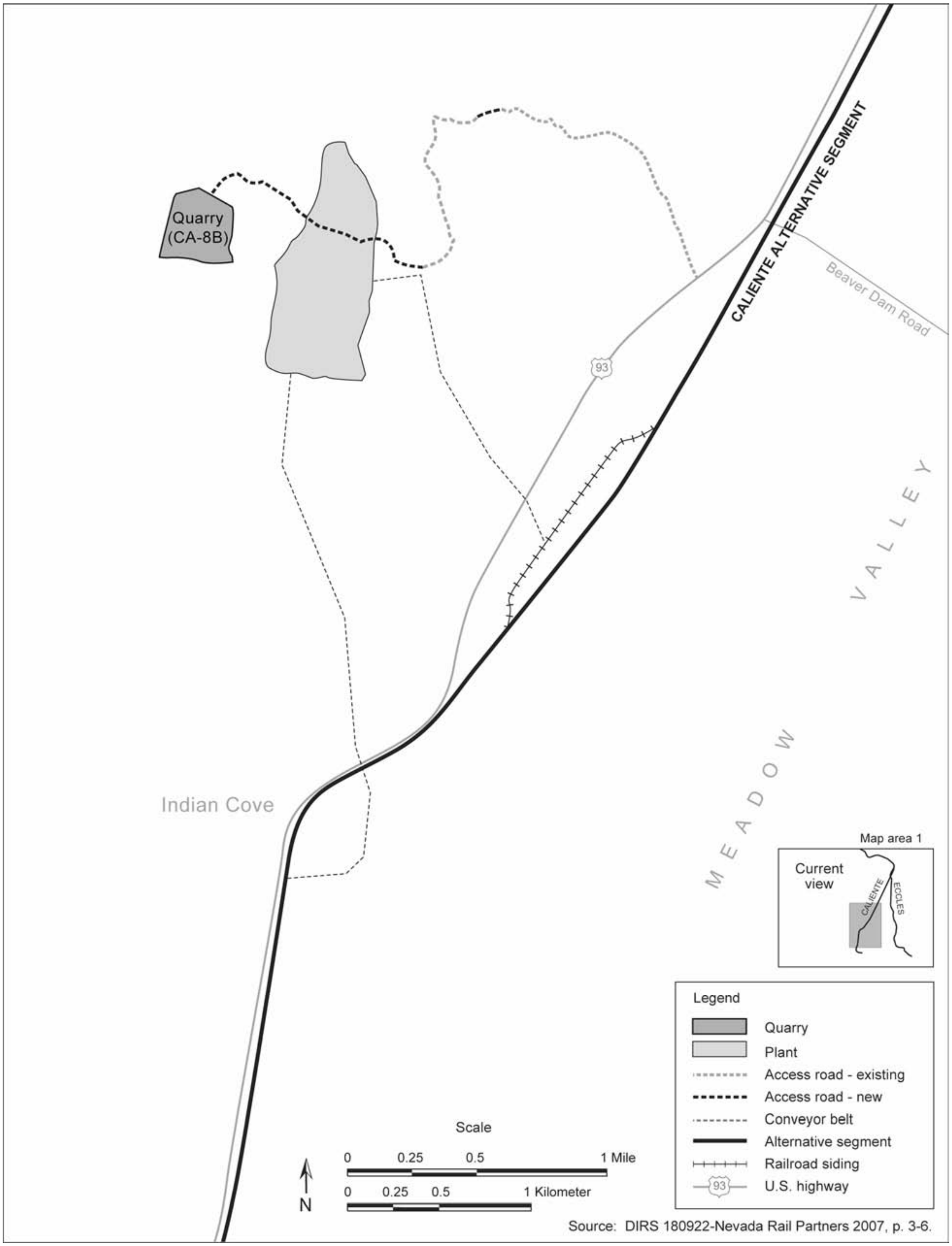


Figure 2-24. Caliente potential quarry site CA-8B northwest of Caliente.

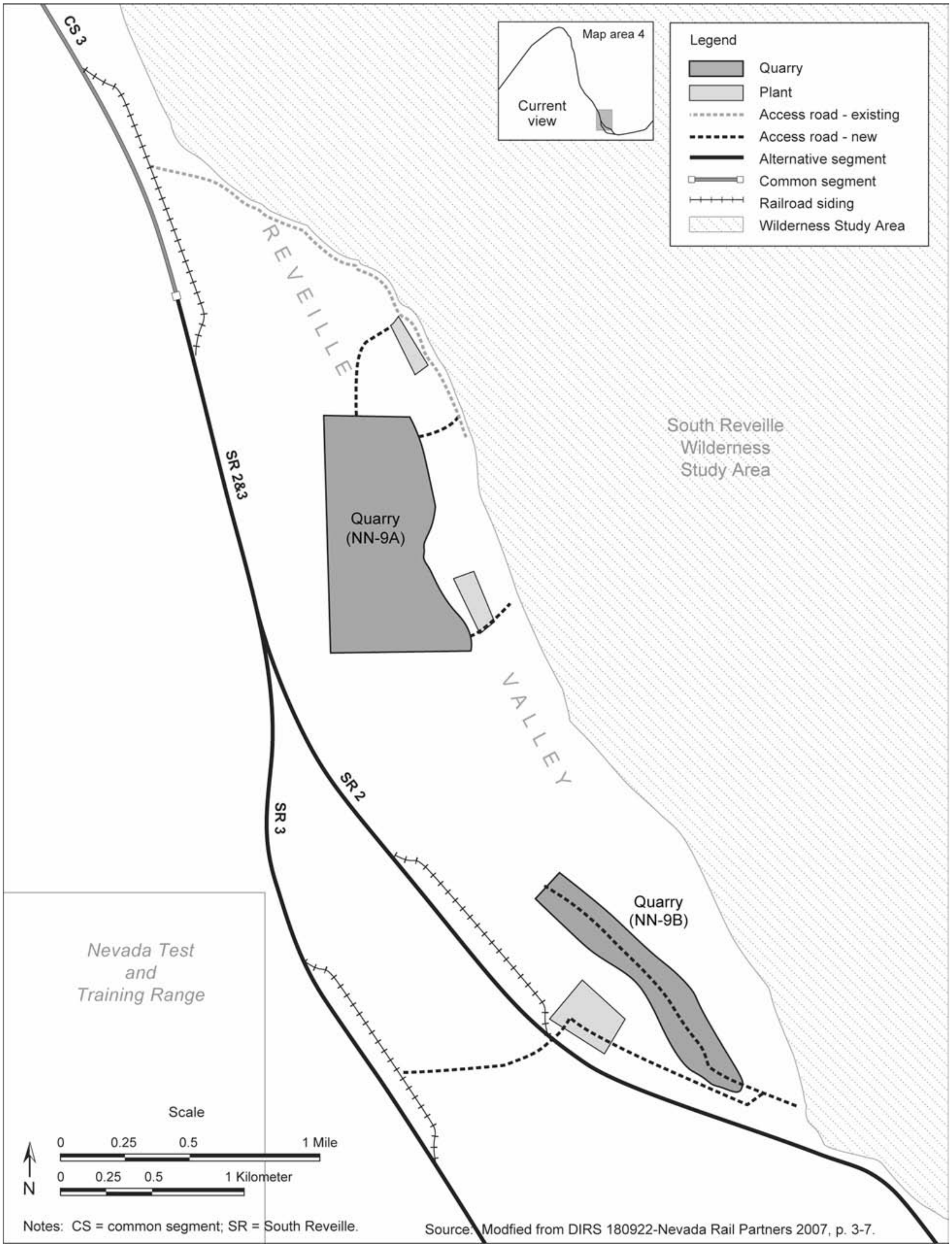


Figure 2-25. Caliente potential quarry sites NN-9A and NN-9B in South Reveille Valley.

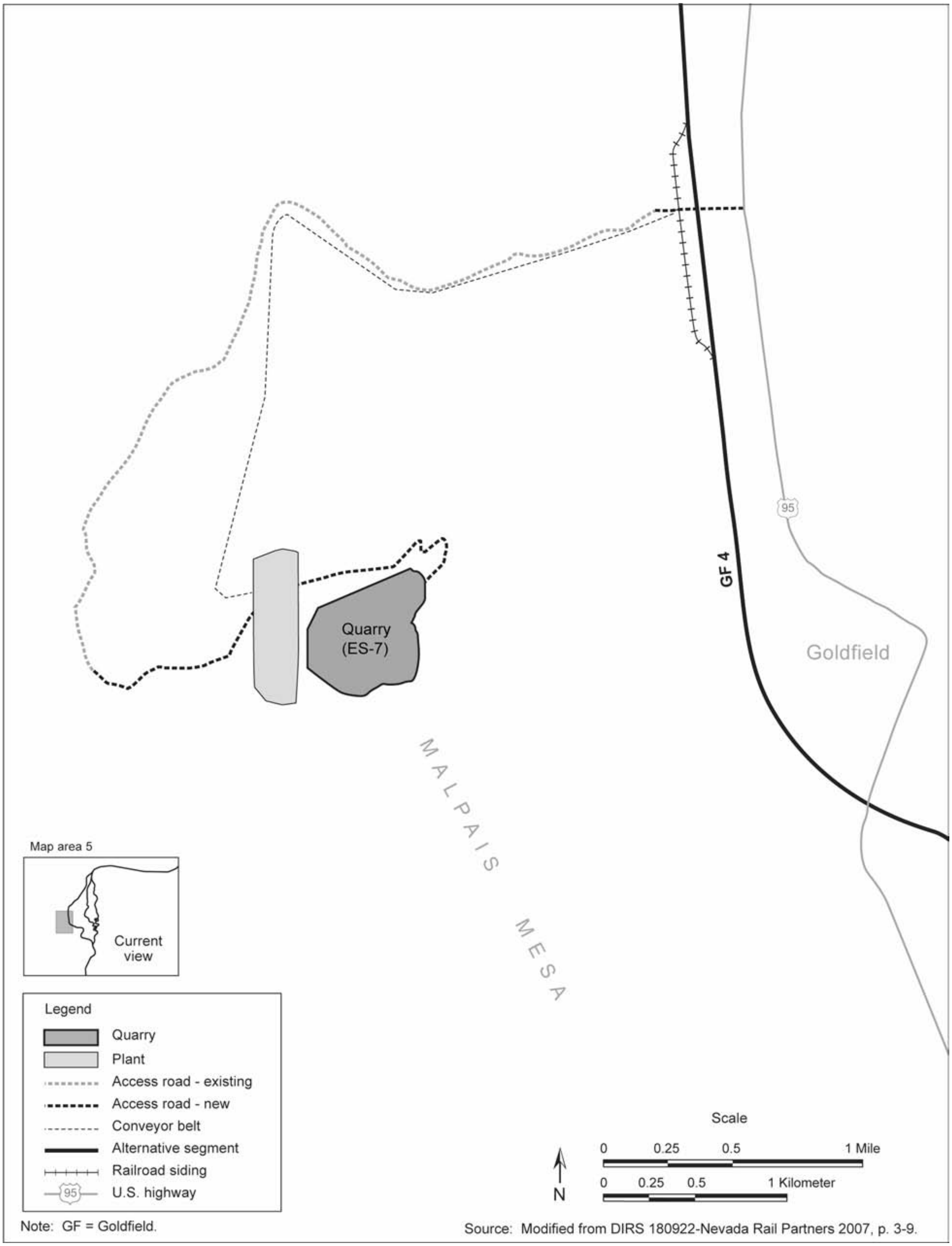


Figure 2-26. Caliente potential quarry site ES-7 west of Goldfield.

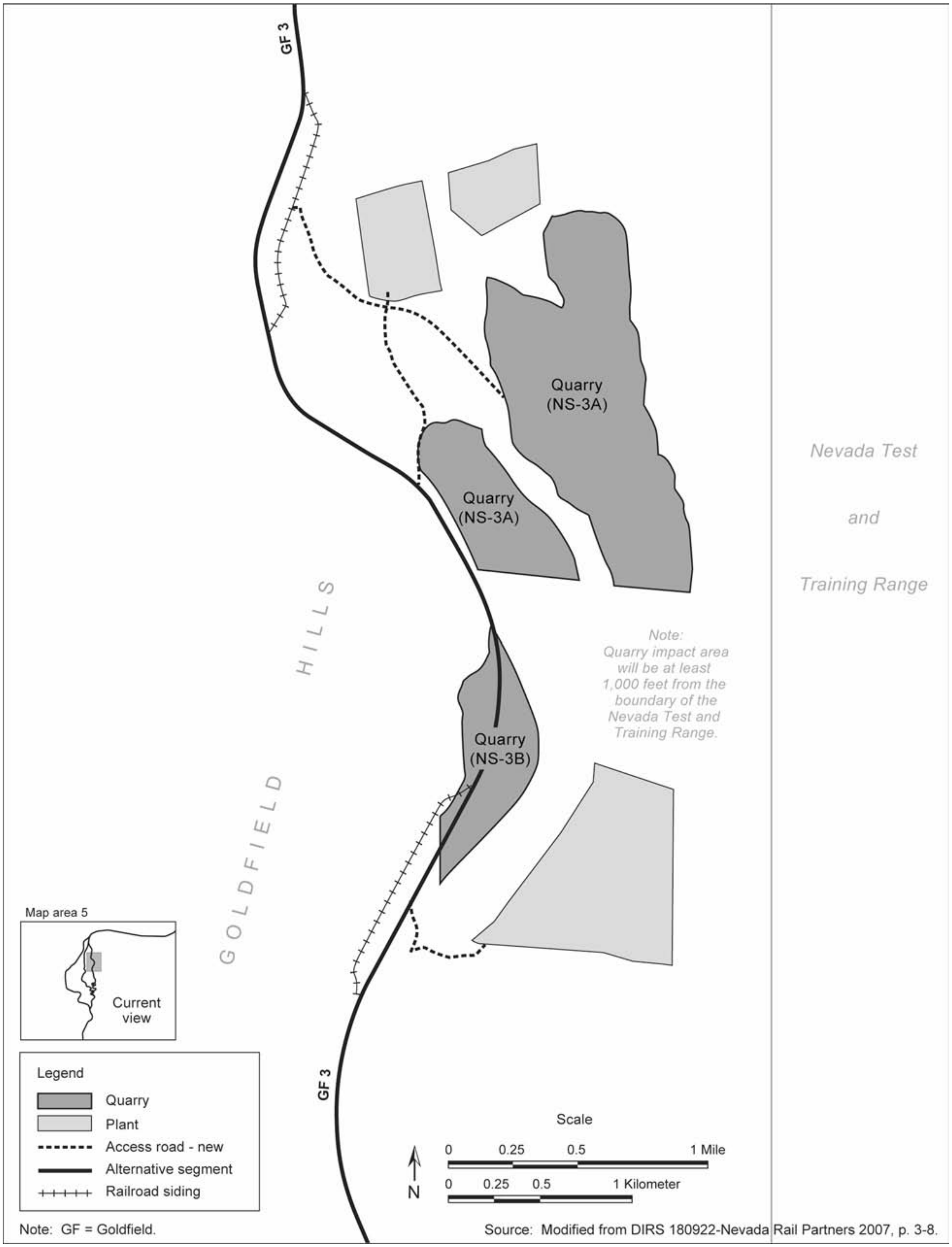


Figure 2-27. Caliente potential quarry sites NS-3A and NS-3B northeast of Goldfield.

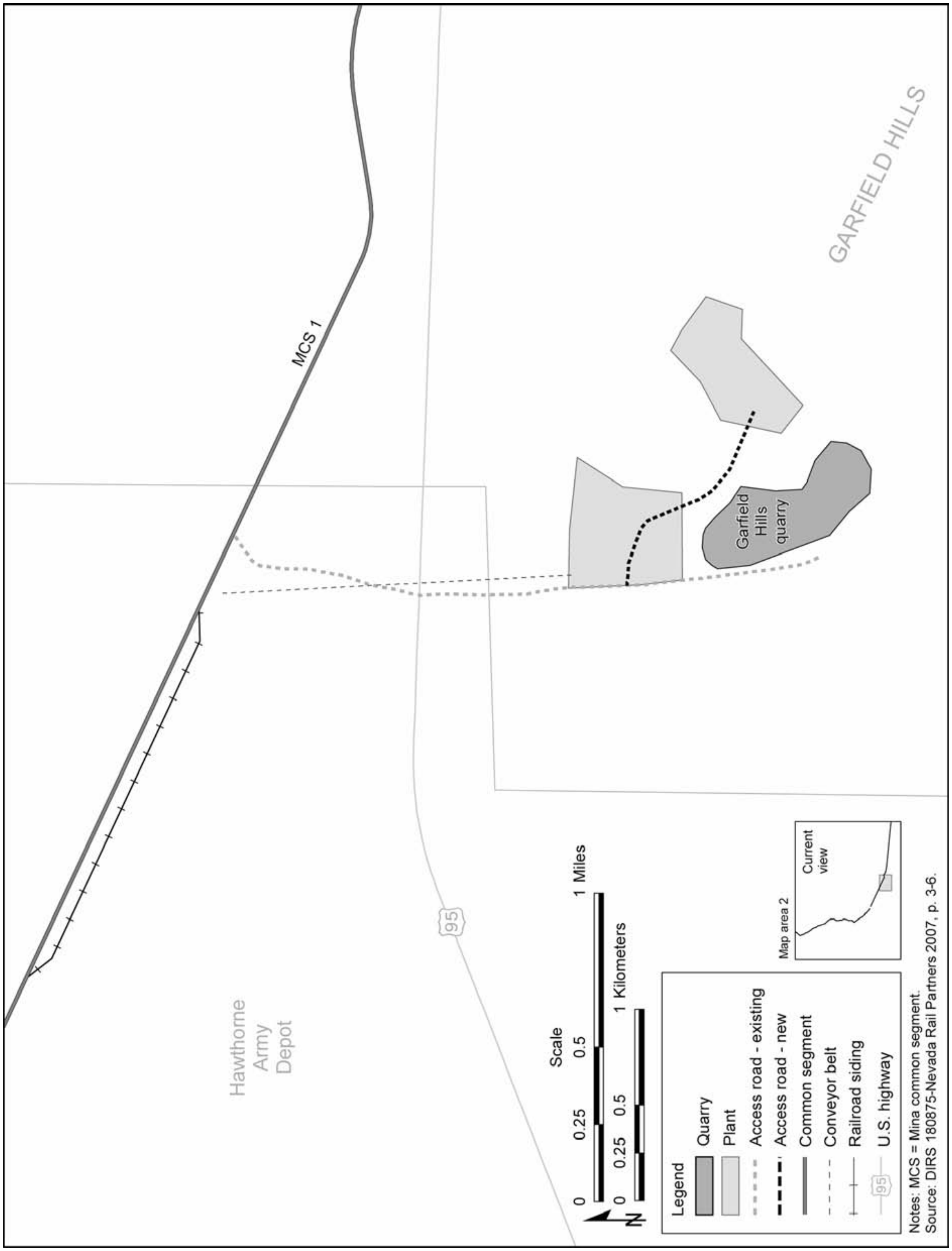
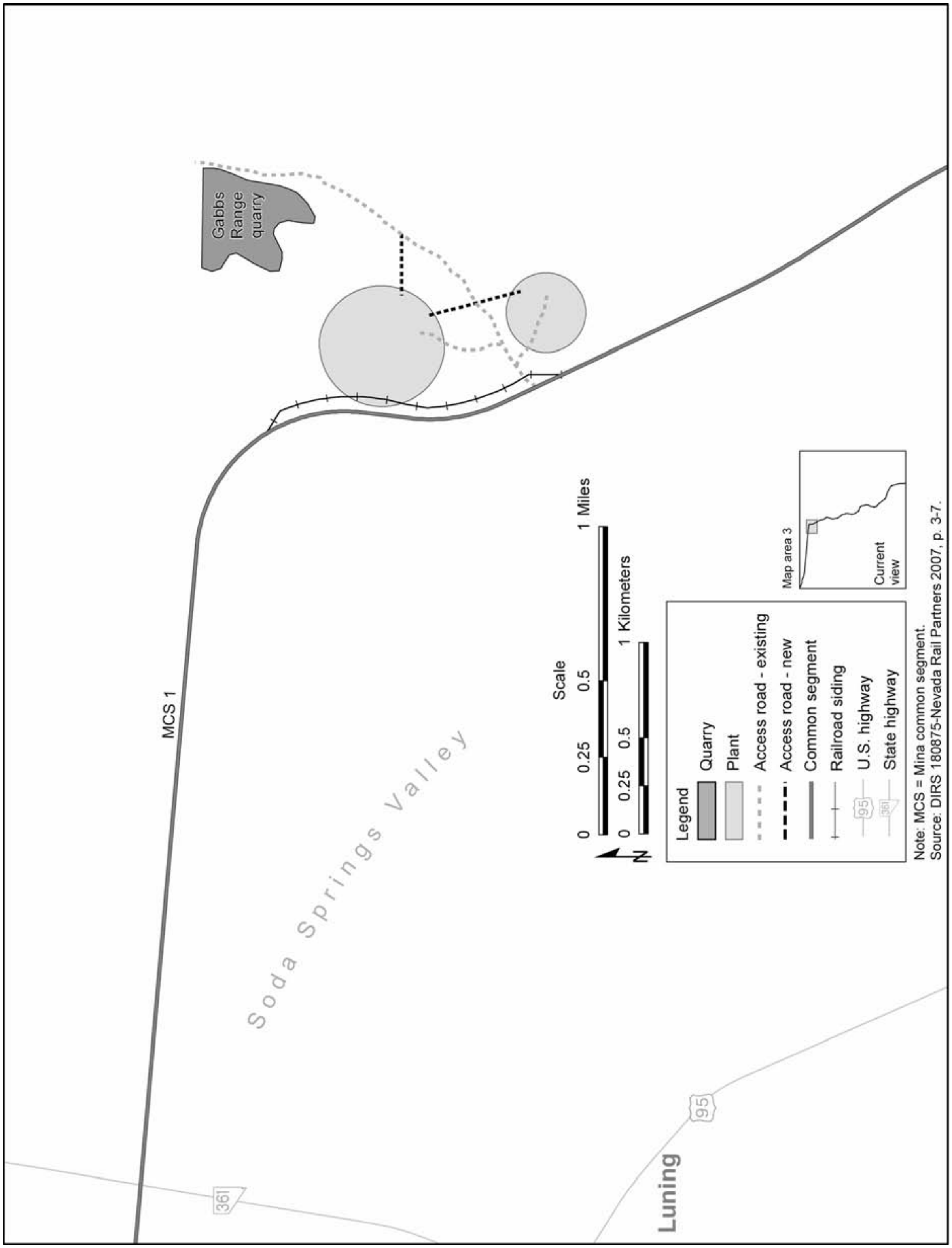


Figure 2-28. Mina potential quarry site at Garfield Hills.



Note: MCS = Mina common segment.
Source: DIRS 180875-Nevada Rail Partners 2007, p. 3-7.

Figure 2-29. Mina potential quarry site at Gabbs Range.

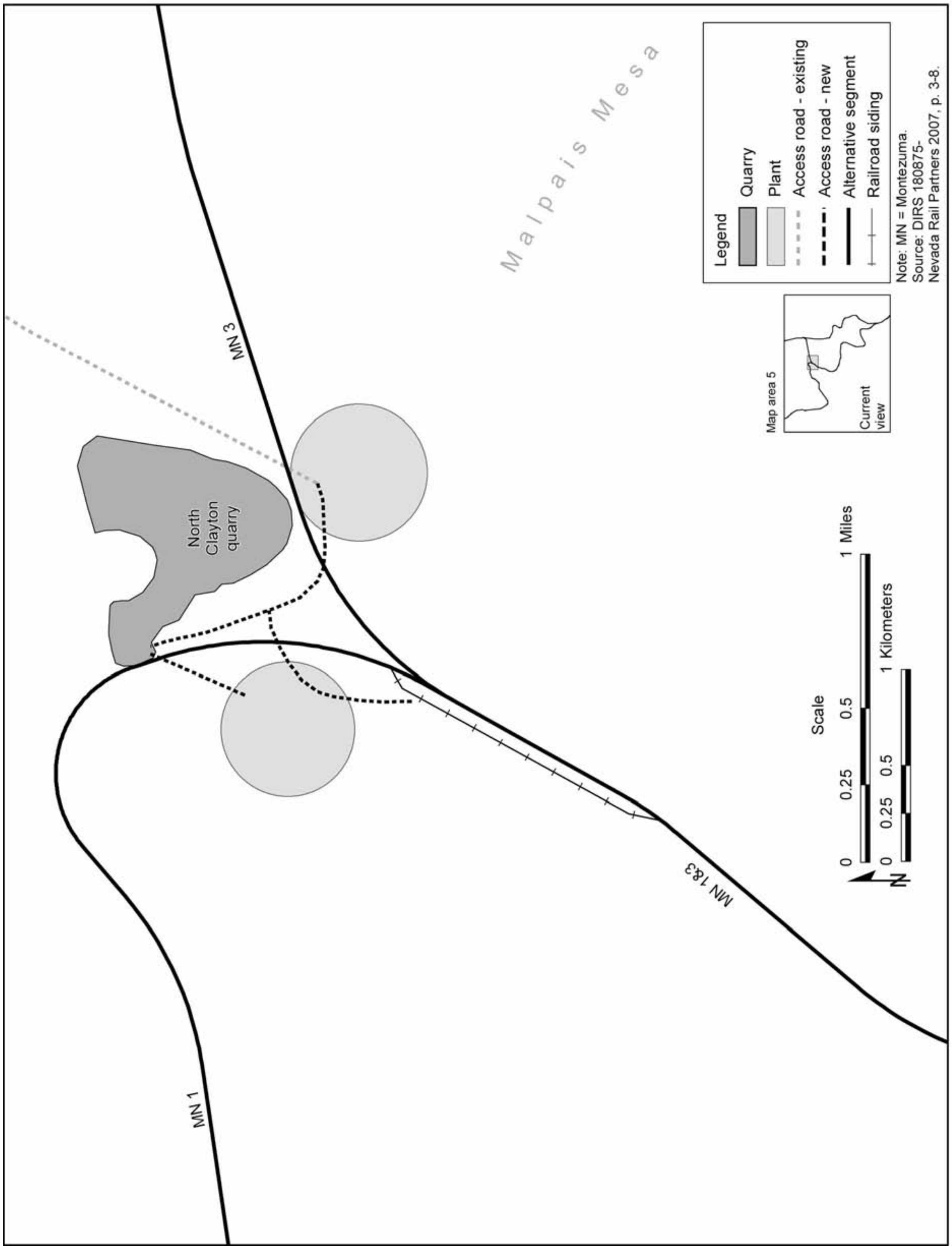


Figure 2-30. Mina potential quarry site at North Clayton.

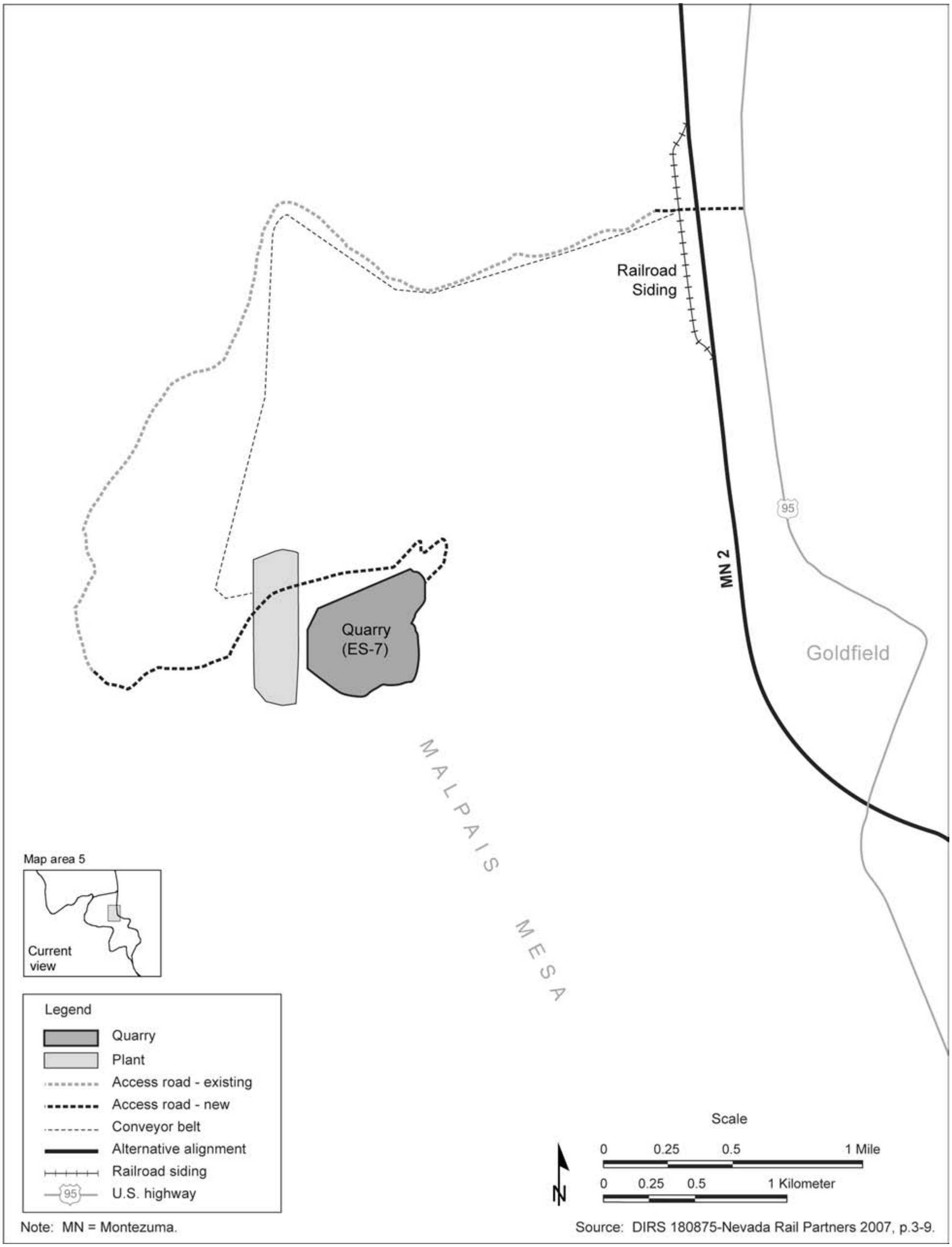


Figure 2-31. Mina potential quarry site ES-7 west of Goldfield.

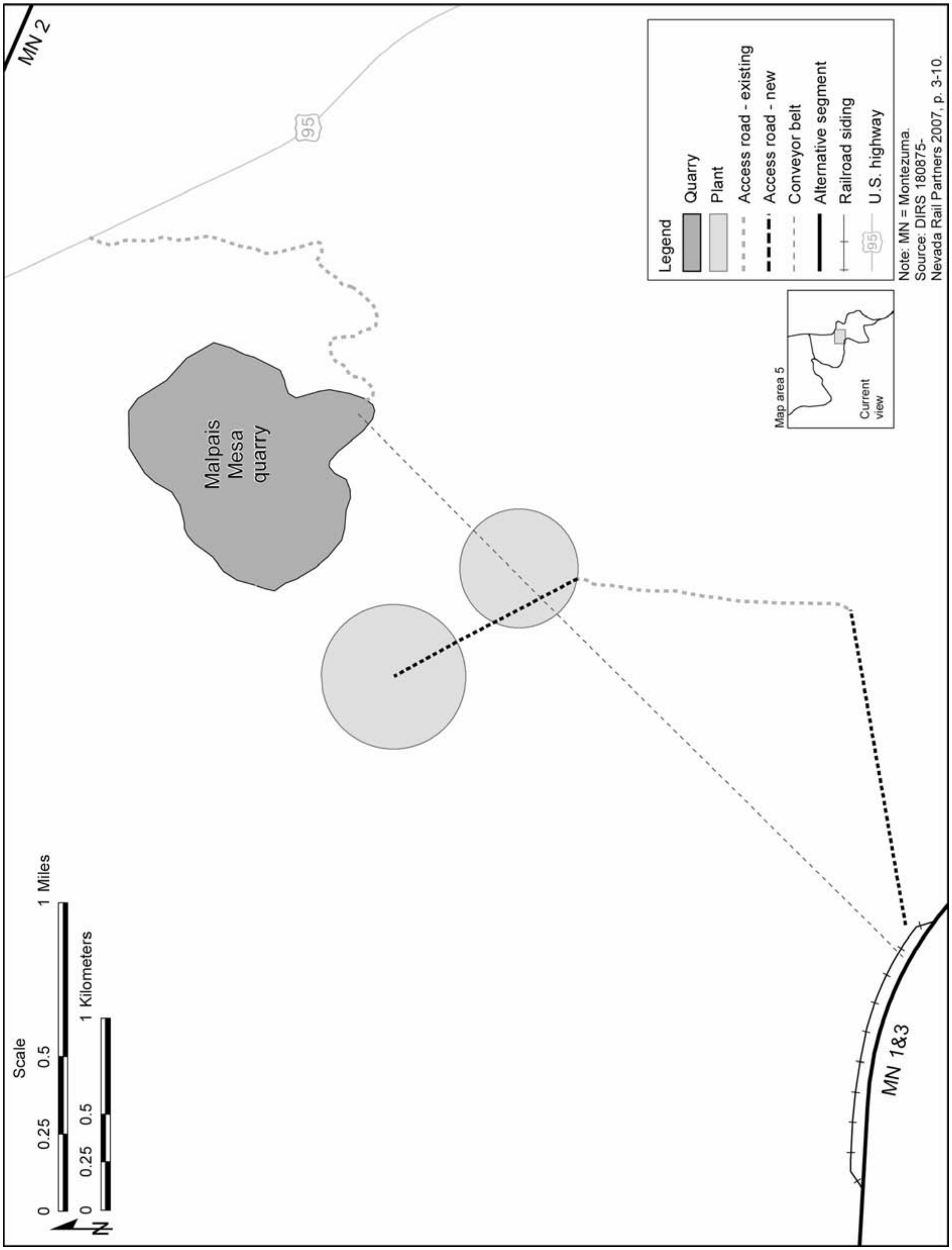
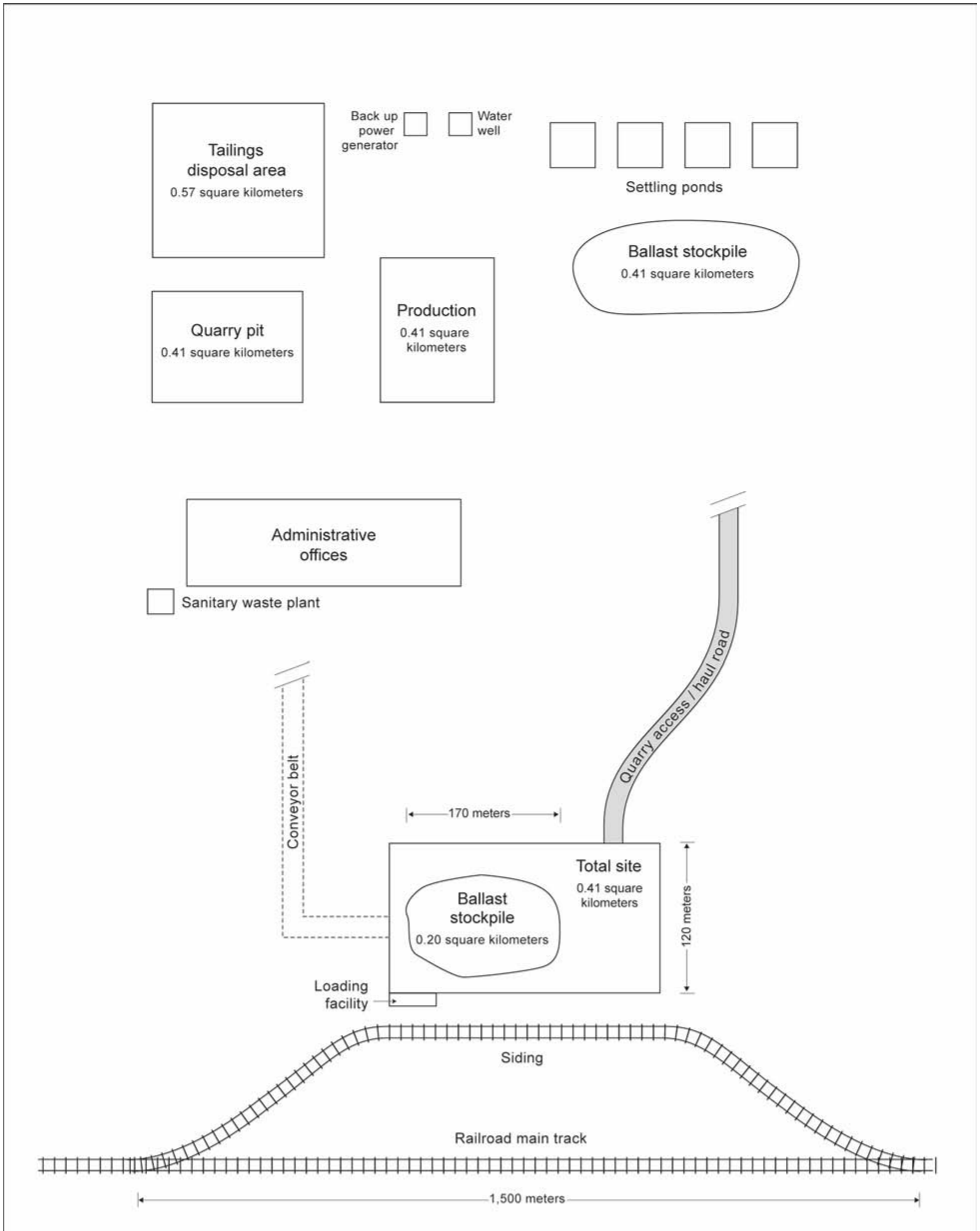


Figure 2-32. Mina potential quarry site at Malpais Mesa.



Notes: To convert square kilometers to acres, multiply by 247.10;
to convert meters to feet, multiply by 3.2808.

Not to scale

Source: DIRS 180922-Nevada Rail Partners 2007, p. 3-3.

Figure 2-33. Typical quarry site.

Each quarry site would require both power and water for operations. Power would be provided by connecting to the local power supply grid and constructing substations on site. Each quarry would be anticipated to use approximately 28,000 kilowatt-hours of electricity per day of operations. In case of emergency, backup power would be available through on-site backup generators. Water needs would be met through wells constructed near the quarry sites. Water needs would vary depending on the specific process selected at each site to wash the excavated rock during the crushing and screening processes, but are estimated to be approximately 140,000 liters (38,000 gallons) of water per day of operations at each quarry site (DIRS 180922-Nevada Rail Partners 2007, Section 3.1.3).

For any new quarry developed along either rail alignment, DOE would need to obtain a ***free-use permit*** from the BLM, which would allow DOE to mine ballast on BLM-administered lands (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 to 3-6).

DOE would haul the quarried ballast by truck or mechanical conveyor from the quarry pit to the railroad siding and then transport it to the track under construction. Rail transportation would be possible because each quarry would be operational only after construction of the rail line had reached the quarry rail sidings (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 to 3-6). DOE would need to construct new or improve existing access roads to each quarry site from the rail line. Improvements would consist of grading the existing unpaved roads and constructing a gravel surface on the roads when necessary. Tables 2-17 and 2-18 list the estimated length of road improvements and new quarry access roads along the Caliente and Mina rail alignments, respectively.

Table 2-17. Caliente rail alignment potential quarry access road locations, types, and lengths.[a]

Potential quarry	Location	Name of road to be improved	Road type	Estimated length of road (kilometers)[b,c]	Map Atlas Part A reference[d]
Caliente CA-8B	Caliente alternative segment	Unnamed road	Existing unpaved road, and new road	Existing (to be improved): 4.3 New: 5.4	Plate 7
South Reveille NN-9A and NN-9B	South Reveille alternative segment 2 or 3	County Road 525	Existing unpaved road, and new road	Existing (to be improved): 15 New: 7.1	NN-9A: Plates 234 and 236 NN-9B: Plates 227, 228, 231, and 232
Goldfield ES-7	Goldfield alternative segment 4	Unnamed road	Existing unpaved road, and new road	Existing (to be improved): 6.6 New: 8.4	Plates 519 through 523
Goldfield NS-3A and NS-3B	Goldfield alternative segment 1 or 3	Unnamed road	Existing unpaved road, and new road	Existing (to be improved): 13 New: 3.5	NS-3A: Plates 369 through 371 NS-3B: Plates 371 and 372

a. Source: DIRS 180922-Nevada Rail Partners 2007, Table 4-1.
b. To convert kilometers to miles, multiply by 0.62137.
c. Numbers rounded to two significant figures.
d. Source: DIRS 182843-ICF 2007, Part A.

Table 2-18. Mina rail alignment potential quarry access road locations, types, and lengths.[a]

Potential quarry	Location	Name of road to be improved	Road type	Estimated length of road (kilometers)[b,c]	Map Atlas Part B reference[d]
Garfield Hills	Mina common segment 1	Garfield Flats Road	Existing unpaved road, and new road	Existing (to be improved): 3.2 New: 3.1	Plates 512 through 514
Gabbs Range	Mina common segment 1	Unnamed road	Existing, unpaved road, and new road	Existing (to be improved): 8.9 (5.6 kilometers is shared with the alignment access road) New: 0.81	Plate 515
North Clayton	Montezuma alternative segment 1 or 3	Powerline Road	Existing unpaved road, and new road	Existing (to be improved): 5.8 New: 3.1	Plates 295 and 380
Goldfield ES-7	Montezuma alternative segment 2	Unnamed road	Existing unpaved road, and new road	Existing (to be improved): 6.6 New: 8.4	Plates 519 through 523
Malpais Mesa	Montezuma alternative segment 1 or 3	Unnamed road	Existing unpaved road, and new road	Existing (to be improved): 5.3 New: 6.8	Plates 516 through 518

a. Source: DIRS 180875-Nevada Rail Partners 2007, pp. 4-14 to 4-17.
b. To convert kilometers to miles, multiply by 0.62137.
c. Numbers rounded to two significant figures.
d. Source: DIRS 182844-ICF 2007, Part B.

2.2.2.4.3 Subballast

Approximately 4.6 metric tons of subballast per meter (1.5 tons of subballast per foot) of track construction would be required. Table 2-19 lists the total subballast requirements for rail line construction along the Caliente and Mina rail alignments.

> A **borrow site** is an area where material (usually soil, gravel, or sand) is excavated for use in engineered embankments

Under the Caliente Implementing Alternative, the Department would obtain subballast primarily from materials excavated during rail roadbed construction and from ***borrow sites*** established inside the rail line construction right-of-way. Additionally, subballast could be produced by crushing rock in quarries or crushing rock from major excavations. Subballast would be trucked along the proposed rail alignment and placed as the final step in the construction of the rail roadbed. DOE would establish borrow sites inside the construction right-of-way, as necessary, during grading and leveling activities and would use suitable excavated material as fill whenever practicable. Any excess material from these activities would be distributed evenly along embankments as non-structural fill (DIRS 180922-Nevada Rail Partners 2007, pp. 3-1 to 3-6).

Under the Mina Implementing Alternative, the Department would obtain subballast from one (or more) of four sources: by utilizing waste rock generated at ballast quarry sites; from materials excavated during rail roadbed construction; from existing borrow sites along the rail alignment; or from the development of new subballast borrow sites along the rail alignment. New subballast borrow sites would be required for construction along the Mina rail alignment because rail roadbed construction would not generate enough material to meet subballast requirements. New subballast borrow sites would be located approximately every 16 to 32 kilometers (10 to 20 miles) along the rail alignment, which would result in the development of approximately 15 to 30 new sites. Figure 2-34 illustrates a typical subballast borrow site.

Table 2-19. Subballast requirements for rail line construction.

Rail alignment	Subballast required (metric tons)[a,b]
Caliente[c]	2.72 million to 2.81 million
Mina[d]	2.18 million to 2.39 million

a. To convert metric tons to tons, multiply by 1.1023.
b. Numbers rounded to three significant figures.
c. Source: DIRS 180921-Nevada Rail Partners 2007, p. A-5.
d. Source: DIRS 180875-Nevada Rail Partners 2007, p. A-6.

2.2.2.4.4 Concrete Ties and Rail

Approximately one concrete tie for every 0.6 meter (2 feet) of track construction would be needed along the entire length of the rail line (DIRS 180922-Nevada Rail Partners 2007, p. 3-1). Concrete ties would be shipped to the Staging Yard by rail and then distributed from there when needed for use.

DOE would obtain rail from commercial sources and weld it into 440-meter (1,440-foot) strings at a portable welding plant located within the construction right-of-way. Under the Caliente Implementing Alternative, this plant would initially be established near Caliente. Under the Mina Implementing Alternative, this plant would initially be established near Hawthorne. In either case, the welding plant would later be relocated at 80- to 160-kilometer (50- to 100-mile) increments along the rail alignment as construction progressed. Once ready for use, the strings would be transported by rail to the construction sites (DIRS 180922-Nevada Rail Partners 2007, p. 3-2).

2.2.2.4.5 Bridge Steel and Concrete

For either the Caliente or the Mina rail alignment, existing commercial manufacturers would supply the steel required for bridges. The bridge steel would be transported to the construction site by rail or by truck.

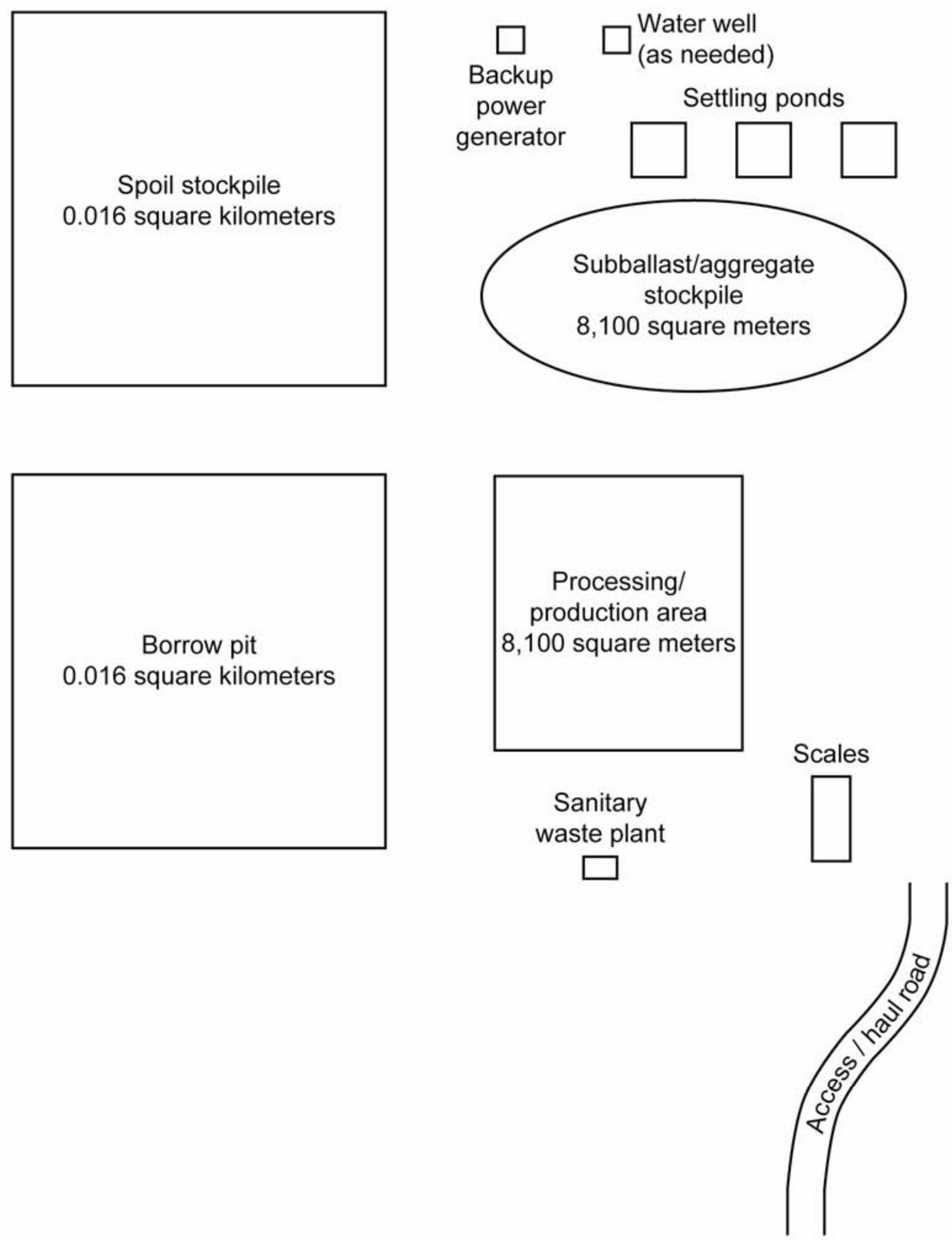
DOE would obtain concrete for site placement activities at bridge construction sites from portable concrete batch plants established near construction sites. Precast concrete bridge elements would be manufactured at existing commercial sources off the project site and trucked to bridge construction sites.

2.2.2.5 Bridge, Culvert, and Grade Crossing Construction

DOE would start constructing bridges, large culverts, and grade-separated crossings before other infrastructure because these features would take longer to construct. DOE would analyze the construction and use of bridges and culverts case-by-case and could utilize culverts whenever feasible.

Tables 2-20 and 2-21 list the approximate number of bridges and large culverts (those with a diameter greater than 0.91 meter [3 feet]) proposed for each alternative segment and common segment along the Caliente rail alignment and Mina rail alignment, respectively. Numerous smaller culverts would also be utilized along the rail alignment, but would not be identified until a later design stage. Fewer bridges and culverts would be required for the Mina rail alignment because it would only pass through two mountain ranges (versus seven for the Caliente rail alignment) and would pass through more flat areas.

Construction of bridges and culverts across areas of intermittent water flow would minimize physical changes to drainage channels. Most of the bridges would be short-span, precast concrete bridges. These



Note: To convert square kilometers to acres, multiply by 247.10;
to convert meters to feet, multiply by 3.2808.
Not to Scale.

Source: Modified from DIRS 180875-Nevada Rail Partners 2007, p. 3-2.

Figure 2-34. Typical subballast borrow site.

Table 2-20. Bridges and culverts for a rail line along the Caliente rail alignment.[a]

Rail line segment	Number of bridges	Range of estimated total bridge lengths (meters)[b]	Number of large culvert[c] installation locations
Caliente alternative segment	10 precast concrete 1 plate girder	23 to 210	0
Eccles alternative segment	8 precast concrete 1 plate girder	23 to 150	8
Caliente common segment 1	36 precast concrete	27 to 310	25
Garden Valley alternative segment 1	15 precast concrete	22 to 260	8
Garden Valley alternative segment 2	15 precast concrete	18 to 240	4
Garden Valley alternative segment 3	20 precast concrete	7.3 to 190	8
Garden Valley alternative segment 8	15 precast concrete	40 to 250	0
Caliente common segment 2	25 precast concrete	22 to 96	15
South Reveille alternative segment 2	12 precast concrete	37 to 98	1
South Reveille alternative segment 3	14 precast concrete	27 to 98	3
Caliente common segment 3	55 precast concrete	19 to 270	16
Goldfield alternative segment 1	11 precast concrete	30 to 61	3
Goldfield alternative segment 3	16 precast concrete	18 to 150	5
Goldfield alternative segment 4	18 precast concrete	18 to 160	2
Caliente common segment 4	2 precast concrete	64 to 120	0
Bonnie Claire alternative segment 2	10 precast concrete	43 to 200	7
Bonnie Claire alternative segment 3	9 precast concrete	46 to 160	26
Common segment 5	19 precast concrete	16 to 180	19
Oasis Valley alternative segment 1	6 precast concrete	61 to 230	7
Oasis Valley alternative segment 3	5 precast concrete	46 to 140	9
Common segment 6	23 precast concrete 1 plate girder	29 to 310	4

a. Source: DIRS 180872-Nevada Rail Partners 2007, Appendix C.
b. To convert meters to feet, multiply by 3.2808.
c. Large culverts are all culverts greater than 0.91 meter (3 feet) in diameter.

Table 2-21. Bridges and culverts for a rail line along the Mina rail alignment[a] (page 1 of 2).

Rail line segment	Number of bridges	Range of estimated total bridge lengths (meters)[b]	Number of large culvert[c] installation locations
Schurz alternative segment 1	1 precast concrete and plate girder	300	0
Schurz alternative segment 4	1 precast concrete and plate girder	300	0
Schurz alternative segment 5	1 precast concrete and plate girder	300	0
Schurz alternative segment 6	1 precast concrete 1 precast concrete and plate girder	61 to 300	0

Table 2-21. Bridges and culverts for a rail line along the Mina rail alignment[a] (page 2 of 2).

Rail line segment	Number of bridges	Range of estimated total bridge lengths (meters)[b]	Number of large culvert[c] installation locations
Mina common segment 1	0	Not applicable	0
Montezuma alternative segment 1	0	Not applicable	1
Montezuma alternative segment 2	9 precast concrete	43 to 140	2
Montezuma alternative segment 3	0	Not applicable	1
Mina common segment 2	0	Not applicable	0
Bonnie Claire alternative segment 2	10 precast concrete	43 to 200	7
Bonnie Claire alternative segment 3	9 precast concrete	46 to 160	26
Common segment 5	19 precast concrete	16 to 180	19
Oasis Valley alternative segment 1	6 precast concrete	61 to 230	7
Oasis Valley alternative segment 3	5 precast concrete	46 to 140	9
Common segment 6	23 precast concrete 1 plate girder	29 to 310	4

a. Source: DIRS 180872-Nevada Rail Partners 2007, Appendix G.
b. To convert meters to feet, multiply by 3.2808.
c. Large culverts are all culverts greater than 0.91 meter (3 feet) in diameter.

would be shipped to the construction sites in pieces and assembled on site. Figure 2-35 shows a schematic of a typical precast concrete bridge. In a few places, DOE would construct ***plate girder bridges*** instead of precast concrete bridges. In addition to the bridges listed in Tables 2-20 and 2-21, on common segment 6 of both the Caliente and the Mina rail alignments, DOE would construct one longer, specially designed bridge across Beatty Wash. This bridge would span 313 meters (1,027 feet) at an elevation of 52 meters (170 feet) and would take approximately 2 years to construct (DIRS 180922-Nevada Rail Partners 2007, p. 7-1). Figure 2-36 shows a schematic of the planned bridge.

Culverts are features that would be built into the rail roadbed to allow water to flow under the rail line. Intense, short-duration rainfalls in the area of the Caliente and Mina rail alignments can cause high peak flows that include relatively large volumes of sediment. These sediment-laden flows create a need for drainage structures where the flows would cross the proposed rail line. Culverts and bridges can be incorporated into track construction to manage rainfall and sediment flow. When flow rates would be higher than 28,000 liters (1,000 cubic feet) per second, bridges might be the most desirable alternative to accommodate sediment and rain flow. Where very wide and shallow depths of flow would occur during a ***100-year flood*** event, or the flow would be divided into multiple natural channels that would cross the rail line, multiple culverts could be constructed, along with some small bridges where the main flow would occur (DIRS 180918-Nevada Rail Partners 2007, p. ii).

To maintain access to existing private and public roads across the proposed rail line, DOE would install grade crossings where the rail line would cross a roadway (see Tables 2-22 and 2-23). In places where the rail line would cross a highway (for example, U.S. Highways 93 and 95, and State Routes 318 and 375), the routes would be grade-separated. Where the rail line would cross paved public roadways,

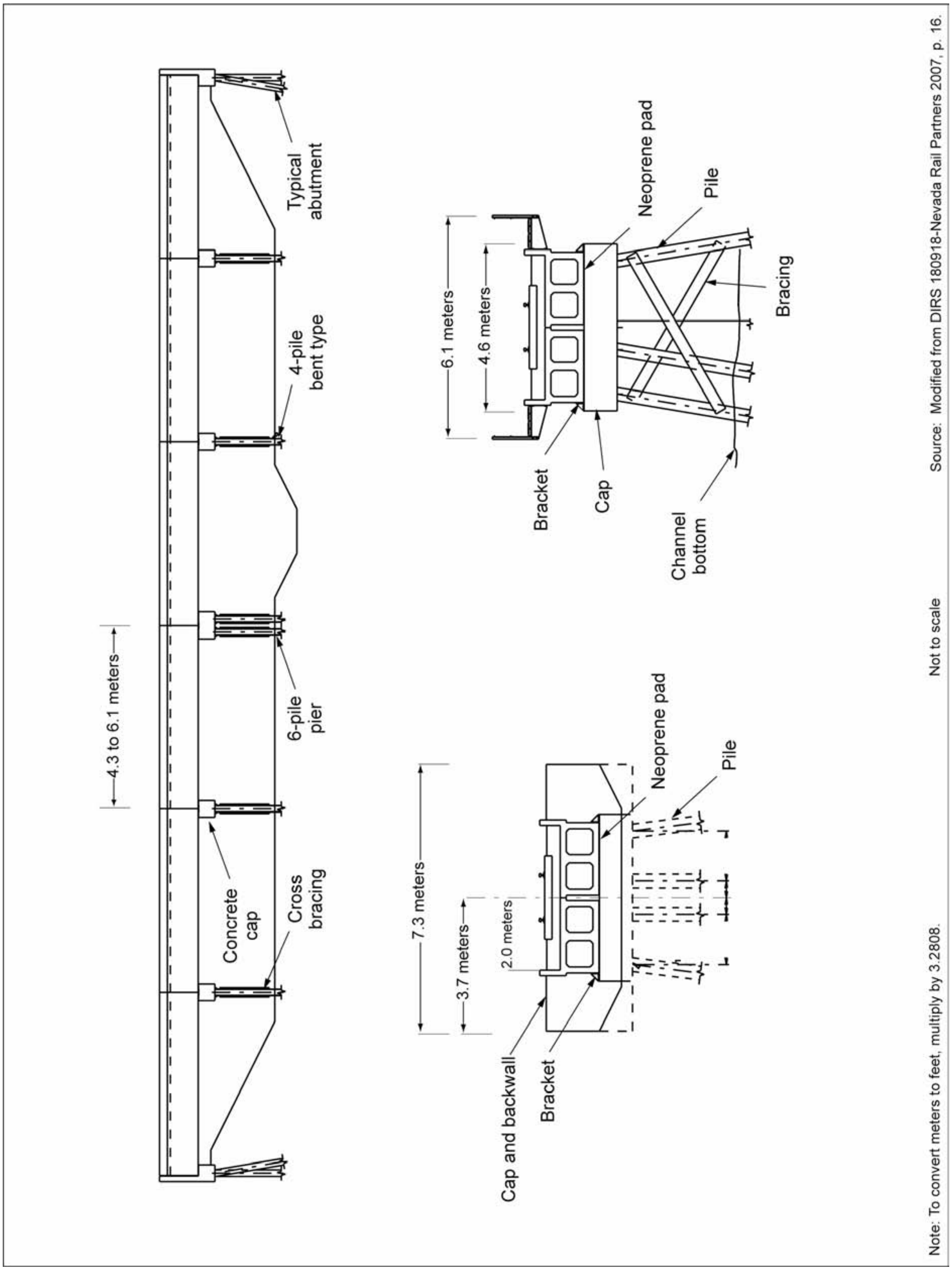


Figure 2-35. Cross-section of a typical bridge.

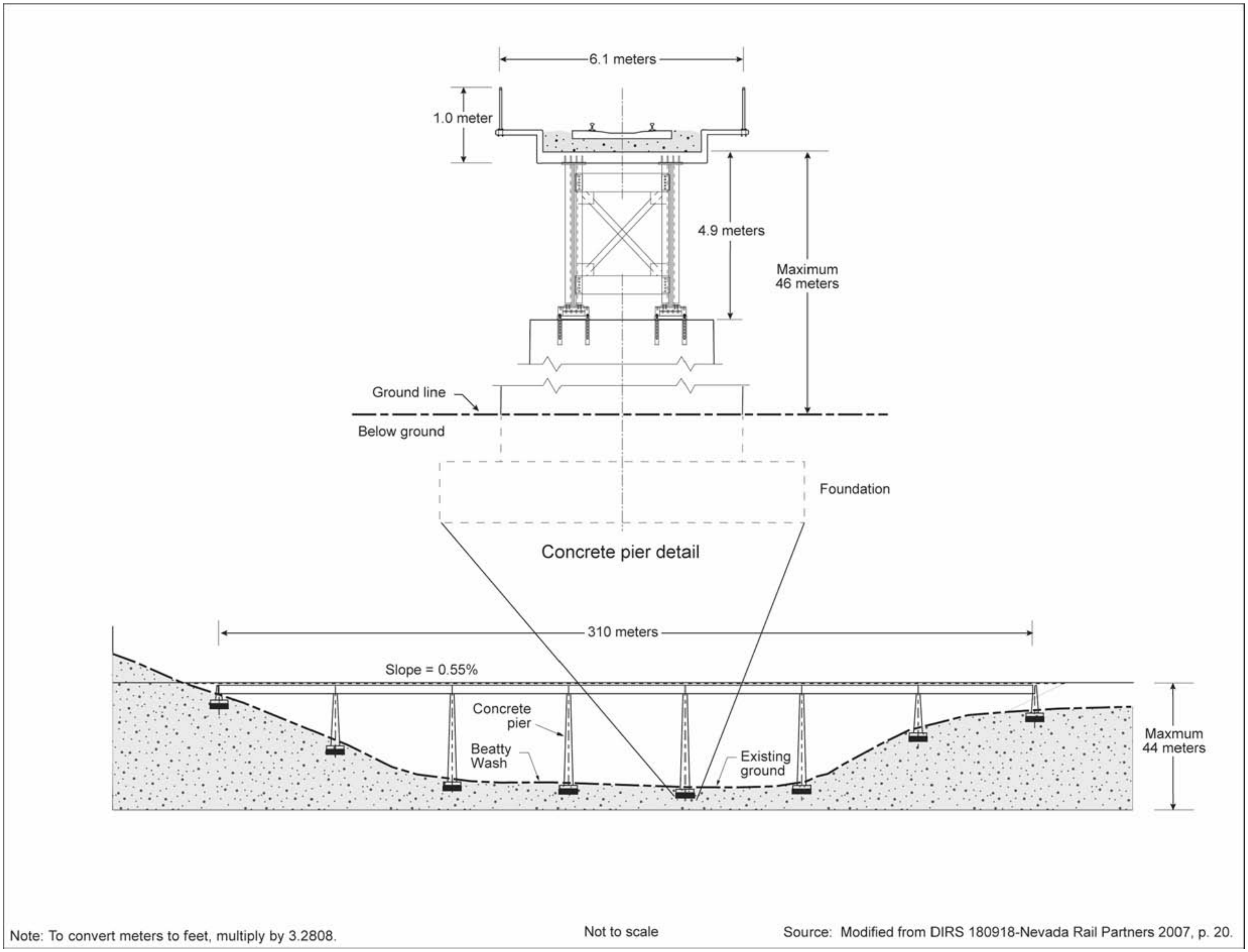


Figure 2-36. Cross-section of a planned bridge across Beatty Wash.

the routes would cross ***at-grade*** and active warning devices, such as flashing lights and gates, would be installed. Where the rail line would cross unpaved roads and private crossings, DOE would install passive warning devices such as crossbucks and stop signs (DIRS 180923-Nevada Rail Partners 2007, p. 6-9). At locations where several road crossings would occur in close proximity (generally over a distance of 0.8 kilometer [0.5 mile] or less) some minor rerouting and consolidation of crossings could occur but would not prevent crossing of the rail line. The regulatory authority to make decisions regarding roads, road closures, and rail line crossings rests with the BLM and county and local governments. DOE would work in close consultation with these groups to assure access is maintained. Tables 2-22 and 2-23 list proposed grade-separated crossings along the Caliente and Mina rail alignments, respectively.

Table 2-22. Grade-separated crossings along the Caliente rail alignment.[a]

Rail line segment	Road[b]	Type of crossing
Caliente alternative segment	U.S. Highway 93	Grade-separated: highway over railroad
Eccles alternative segment	U.S. Highway 93	Grade-separated: highway over railroad
Caliente common segment 1	State Route 318	Grade-separated: railroad over highway
Caliente common segment 2	State Route 375	Grade-separated: highway over railroad
Goldfield alternative segment 4	U.S. Highway 95 (#1)	Grade-separated: railroad over highway
	U.S. Highway 95 (#2)	Grade-separated: railroad over highway

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix D.
b. Does not include off-road-vehicle crossings.

Table 2-23. Grade-separated crossings along the Mina rail alignment.[a]

Segment	Road[b]	Type of crossing
Schurz alternative segment 1	U.S. Highway 95	Grade-separated: highway over railroad
Schurz alternative segment 4	U.S. Highway 95	Grade-separated: highway over railroad
Schurz alternative segment 5	U.S. Highway 95	Grade-separated: highway over railroad
Schurz alternative segment 6	U.S. Highway 95	Grade-separated: railroad over highway
Mina common segment 1	State Route 361	Grade-separated: highway over railroad
	U.S. Highway 6/95	Grade-separated: highway over railroad
Montezuma alternative segment 1	U.S. Highway 95	Grade-separated: highway over railroad
Montezuma alternative segment 2	U.S. Highway 95	Grade-separated: highway over railroad
Montezuma alternative segment 3	U.S. Highway 95	Grade-separated: highway over railroad

a. Sources: DIRS 180872-Nevada Rail Partners 2007, Appendix D; DIRS 180916-Nevada Rail Partners 2007, Appendix D.
b. Does not include off-road-vehicle crossings.

2.2.2.6 Rail Roadbed Construction

Before any track could be placed, DOE would have to construct a suitable rail roadbed. The rail roadbed would form the base upon which the ballast, concrete ties, and rail would be laid. Figure 2-37 shows a cross-section of the design of the track and rail roadbed. Under the Caliente Implementing Alternative with a 4-year construction schedule, construction of the rail roadbed would begin simultaneously at multiple points along the rail alignment; however, under a 10-year construction schedule, rail roadbed construction would start near Caliente and progress toward Yucca Mountain. Under the Mina

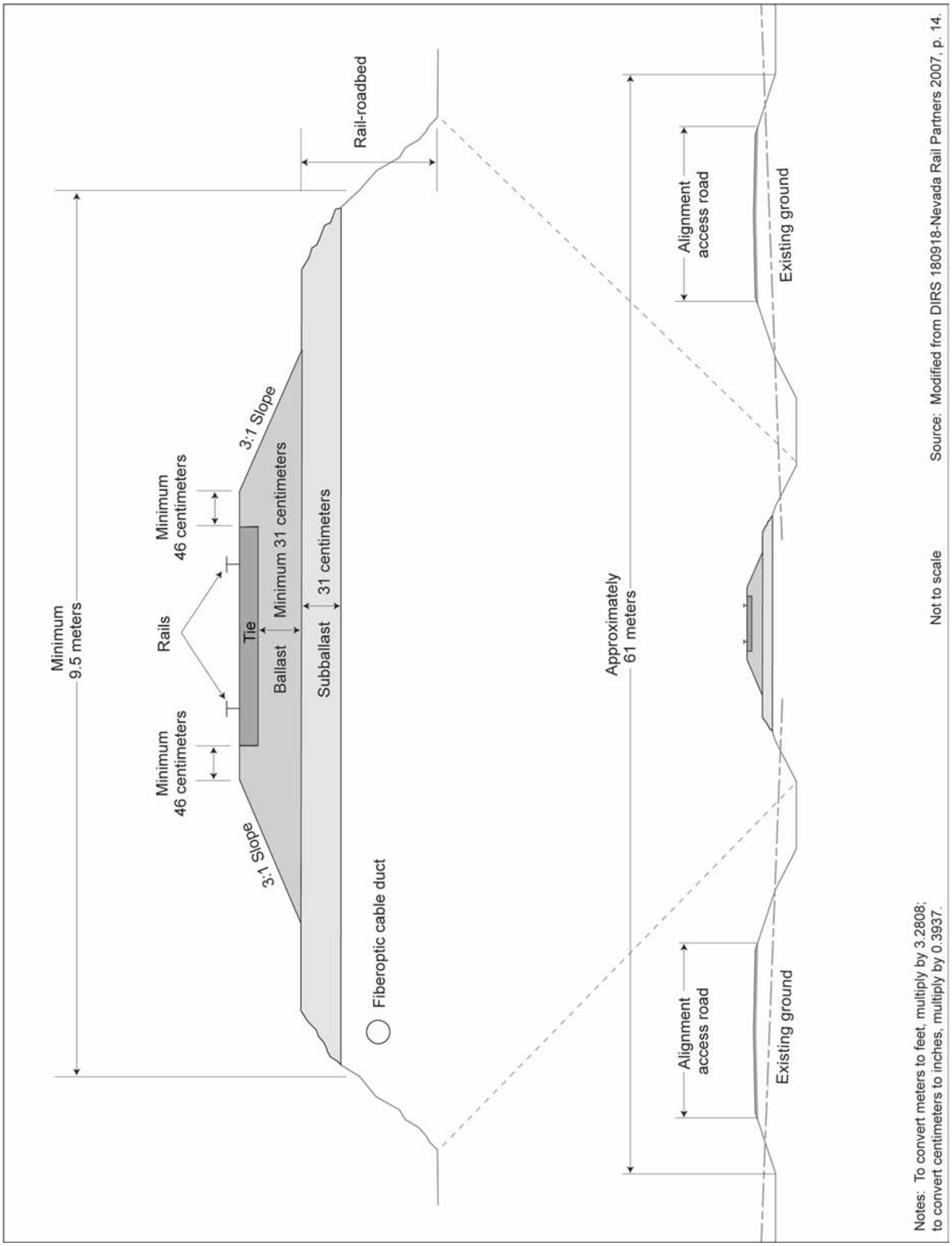


Figure 2-37. Cross-section of a typical rail and roadbed design.

Implementing Alternative, construction would follow the same progression as the Caliente rail alignment under either the 4- or 10-year schedule; however, under a 10-year construction schedule, rail roadbed construction would start near Wabuska and progress toward Yucca Mountain. Along either alignment, the rail roadbed would be constructed along the centerline of the proposed rail line (DIRS 180922-Nevada Rail Partners 2007, p. 7-1).

Construction of the rail roadbed would require clearing, excavating earth and rock on previously undisturbed lands, and removing and stockpiling topsoil where needed. Construction would require both cuts and fills. Figure 2-38 illustrates a typical cut area and a typical fill area. Tables 2-24 and 2-25 list the proposed level of disturbance, volume of cuts, and volume of fills for each segment of the Caliente rail alignment and the Mina rail alignment, respectively. The volume of cuts generated would vary depending on the rock type or material where the cut occurred.

Typical heavy-duty construction equipment (including front-end loaders, bulldozers, graders, water wagons, compactors, excavators, drill rigs, cranes, scrapers, generators, compressors, dump trucks, and other diesel-powered and gas-powered support equipment) would be used for drilling, blasting, clearing, excavation, screening, and crushing work (DIRS 180922-Nevada Rail Partners 2007, p. 7-1). To establish a stable rail roadbed for the track, construction crews would excavate some areas and fill others, as determined by terrain features. Suitable material excavated from one area would be used in an area that would require fill material, unless the distance was excessive. In such a case, DOE would establish a borrow site adjacent to the area requiring fill material and would dispose of the unused excavated material along the embankments of the rail line. In most cases, borrow and disposal sites would be inside the construction right-of-way.

Under the Mina Implementing Alternative, portions of the rail line would be built on existing rail roadbeds. A short portion of Schurz alternative segments 4, 5, and 6, Mina common segment 1, and Montezuma alternative segments 2 and 3 all contain existing rail roadbeds that would be suitable for construction of the proposed railroad.

Table 2-24. Construction disturbance – Caliente rail alignment[a,b] (page 1 of 2).

Rail line segment	Earthwork: cut (million cubic meters)[c]	Earthwork: fill (million cubic meters)	Surface area disturbed (square kilometers)[d]
Caliente alternative segment	0.48	0.17	1.5
Eccles alternative segment	1.83	0.99	1.9
Caliente common segment 1	9.33	5.89	11
Garden Valley alternative segment 1	0.28	0.84	2.9
Garden Valley alternative segment 2	0.72	0.53	3.1
Garden Valley alternative segment 3	0.50	0.53	3.2
Garden Valley alternative segment 8	0.89	0.64	3.2
Caliente common segment 2	1.19	0.52	4.1
South Reveille alternative segment 2	0.51	0.22	1.5
South Reveille alternative segment 3	0.33	0.15	1.7
Caliente common segment 3	2.33	1.93	9.7
Goldfield alternative segment 1	3.07	1.94	4.5
Goldfield alternative segment 3	2.29	4.51	4.9
Goldfield alternative segment 4	1.87	3.33	4.9
Caliente common segment 4	0.23	0.20	1.0

Table 2-24. Construction disturbance – Caliente rail alignment[a,b] (page 2 of 2).

Rail line segment	Earthwork: cut (million cubic meters)[c]	Earthwork: fill (million cubic meters)	Surface area disturbed (square kilometers)[d]
Bonnie Claire alternative segment 2	0.46	0.95	1.9
Bonnie Claire alternative segment 3	0.24	0.70	1.9
Common segment 5	0.45	1.01	3.1
Oasis Valley alternative segment 1	0.051	0.55	0.97
Oasis Valley alternative segment 3	0.12	1.03	1.3
Common segment 6	5.88	2.94	5.3

a. Sources: DIRS 180916-Nevada Rail Partners 2007, Appendix E; DIRS 180921-Nevada Rail Partners 2007, Appendix B.
b. Numbers are rounded to two significant figures or three significant figures if the number is more than 1 million.
c. To convert cubic meters to cubic yards, multiply by 1.308.
d. To convert square kilometers to acres, multiply by 247.10.

Table 2-25. Construction disturbance – Mina rail alignment.[a,b]

Rail line segment	Earthwork: cut (million cubic meters)[c]	Earthwork: fill (million cubic meters)	Surface area disturbed (square kilometers)[d]
Department of Defense Branchline North	0.0	0.043	0.16
Schurz alternative segment 1	1.25	1.54	4.6
Schurz alternative segment 4	3.49	4.33	6.1
Schurz alternative segment 5	6.38	4.86	6.9
Schurz alternative segment 6	4.82	6.85	6.5
Department of Defense Branchline South	0.0	0.043	0.16
Mina common segment 1	0.70	5.15	10
Montezuma alternative segment 1	4.80	7.61	11
Montezuma alternative segment 2	2.30	4.51	9.7
Montezuma alternative segment 3	3.65	3.85	12
Mina common segment 2	0.0	0.099	0.28
Bonnie Claire alternative segment 2	0.46	0.95	1.9
Bonnie Claire alternative segment 3	0.24	0.70	1.9
Common segment 5	0.45	1.01	3.1
Oasis Valley alternative segment 1	0.051	0.55	0.97
Oasis Valley alternative segment 3	0.12	1.03	1.3
Common segment 6	5.88	2.94	5.3

a. Sources: DIRS 180874-Nevada Rail Partners 2007, Appendix B; DIRS 180916-Nevada Rail Partners 2007, Appendix E; DIRS 180921-Nevada Rail Partners 2007, Appendix B.
b. Numbers are rounded to two significant figures or three significant figures if the number is more than 1 million.
c. To convert cubic meters to cubic yards, multiply by 1.308.
d. To convert square kilometers to acres, multiply by 247.10.

2.2.2.7 Power Distribution Line

Under either the Caliente or the Mina Implementing Alternative, the Department would build a distribution line for electric power along the entire length of the rail alignment. The purpose of this distribution line would be to provide electric power to equipment needed for normal operation of the

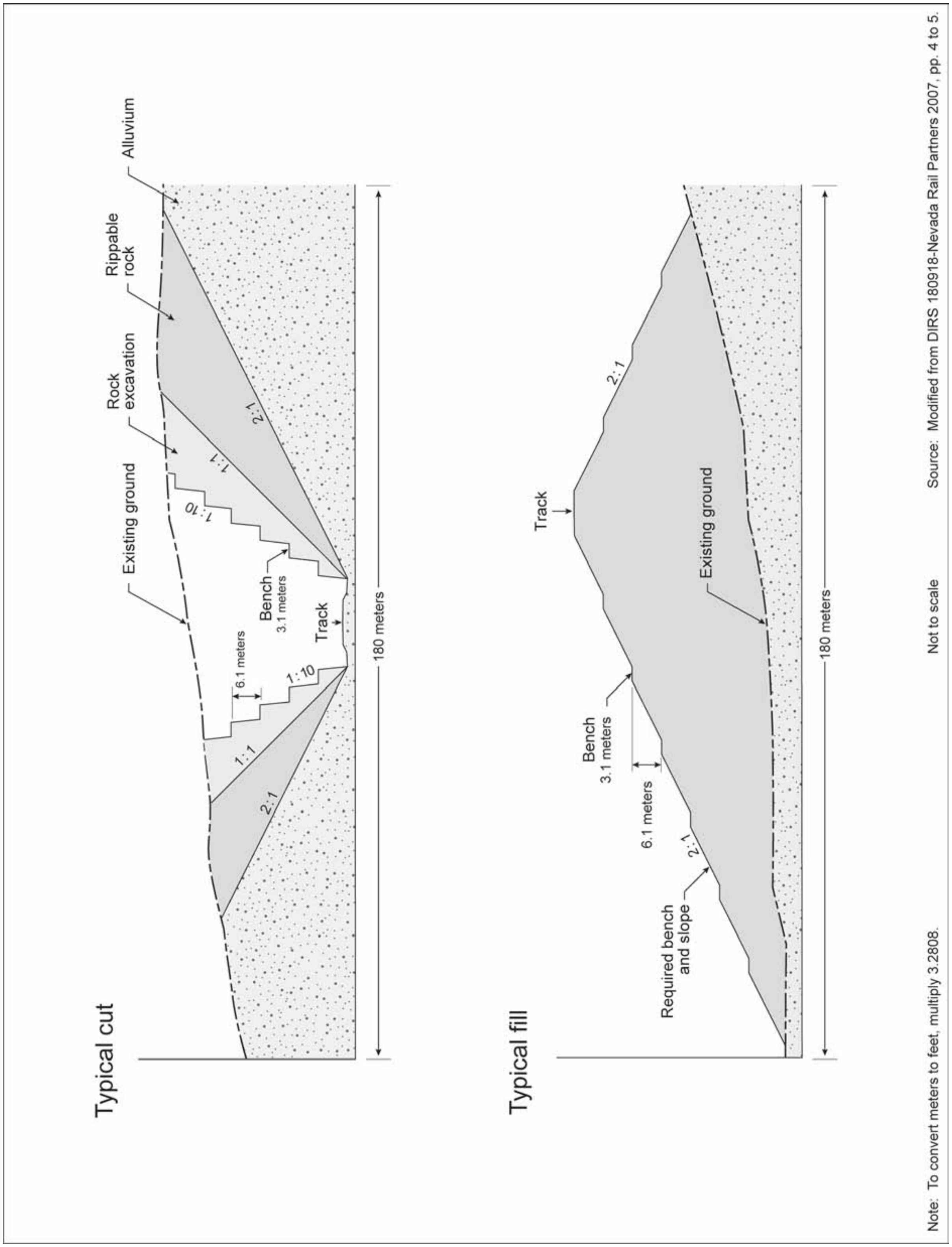


Figure 2-38. Cross-sections of a representative cut and representative fill area along the rail alignment.

railroad, such as signals and switches, and to be able to provide the capacity to meet expected power loads for facilities and operation of the railroad.

An underground high-voltage 25-kilovolt distribution line would be placed inside a trench that would be laid within the rail roadbed as it was prepared for the rail line. DOE would use the same trench to accommodate a fiber-optic line that would be the backbone for a signals and communication system for the railroad (as discussed in Section 2.2.2.9). This trench could be encased in concrete when further protection was needed. Bridge crossings would be accomplished by attaching a conduit for the distribution line to the bridge. Power to the distribution system would be fed from five locations where existing high-voltage transmission lines intersected the rail alignment. At these intersections, DOE would construct electric substations to feed the 25-kilovolt distribution line from the 115-kilovolt and/or 138-kilovolt transmission lines inside the construction right-of-way. These substations would occupy a fenced area of 15-by-15 meters (50-by-50 feet). Along the Mina rail alignment, the underground distribution line would be buried along existing Department of Defense Branchlines North and South.

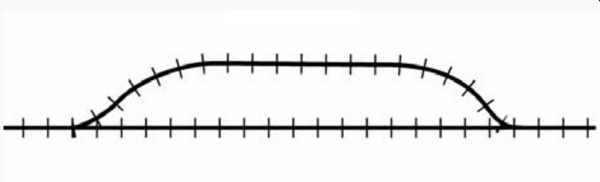
This underground distribution line could be considered as existing in sections, each end being fed at 25-kilovolts from a substation from each transmission-line intersection. If more transmission-line intersections were later identified beyond the five initially planned, shorter sections (under 80 kilometers [50 miles]) and lower line losses would allow a lower operating voltage of 13.5 kilovolts to become feasible. A 13.5-kilovolt distribution line would be more desirable from engineering and cost perspectives. Where DOE needed power to operate railroad systems, the Department would place step-down transformers trackside within 3-by-3 meter (10-by-10 foot) fenced areas.

2.2.2.8 Track Construction

Under the Caliente Implementing Alternative, track construction would begin at the start of the proposed railroad near Caliente and move west and then south along the rail alignment until it reached the Rail Equipment Maintenance Yard. Under the Mina Implementing Alternative, track construction would begin near Wabuska and move south until it reached the Rail Equipment Maintenance Yard.

Track construction would consist of placing concrete ties, rail, and ballast on top of the rail roadbed. First, concrete ties would be placed on the subballast; then DOE would use special rail equipment to unload and secure 440-meter (1,440-foot) rail strings onto the concrete ties with rail fasteners; and finally, DOE would unload ballast from rail ballast cars and dump the ballast evenly on the skeleton track in successive passes. The Department would use special equipment to raise and line the track with 7 to 10 centimeters (3 to 4 inches) of ballast on successive passes until the total depth of the ballast was a minimum of 30 centimeters (12 inches) under the ties (DIRS 180922-Nevada Rail Partners 2007, pp. 7-1 and 7-2). Figure 2-38 shows a typical cross section of the rail and underlying rail roadbed.

A **siding** is a track that runs parallel to the main line for a short distance and is used for passing and overtaking trains to prevent backups and keep traffic flowing.



Along both the Caliente and Mina rail alignments, DOE would construct sidings approximately every 40 kilometers (25 miles) so that trains running in opposite directions could pass one another. This spacing would result in approximately 12 sidings along the rail line. Sidings would be placed inside the operations right-of-way (nominally 61 meters [200 feet] on either side of the rail line centerline). Under the Caliente Implementing Alternative, sidings would range in length from approximately 2,100 to 3,700 meters (7,000 to 12,000 feet) (DIRS 180922-Nevada Rail Partners 2007, p. 2-3). Under the Mina Implementing Alternative, sidings would range in length from 2,100 to 5,800 meters (7,000 to 19,000 feet). In both cases, sidings would be designed to accommodate a maximum train length of 1,700 meters (5,500 feet). Along the Mina rail alignment, DOE would also install sidings along existing Department of Defense Branchlines North and South.

In some locations in Garden Valley where the presence of the newly constructed rail line would be incompatible with BLM management objectives for visual resources, DOE could construct low, rolling, earthwork berms with soils and vegetation that match the surroundings to mask the linear track from viewers.

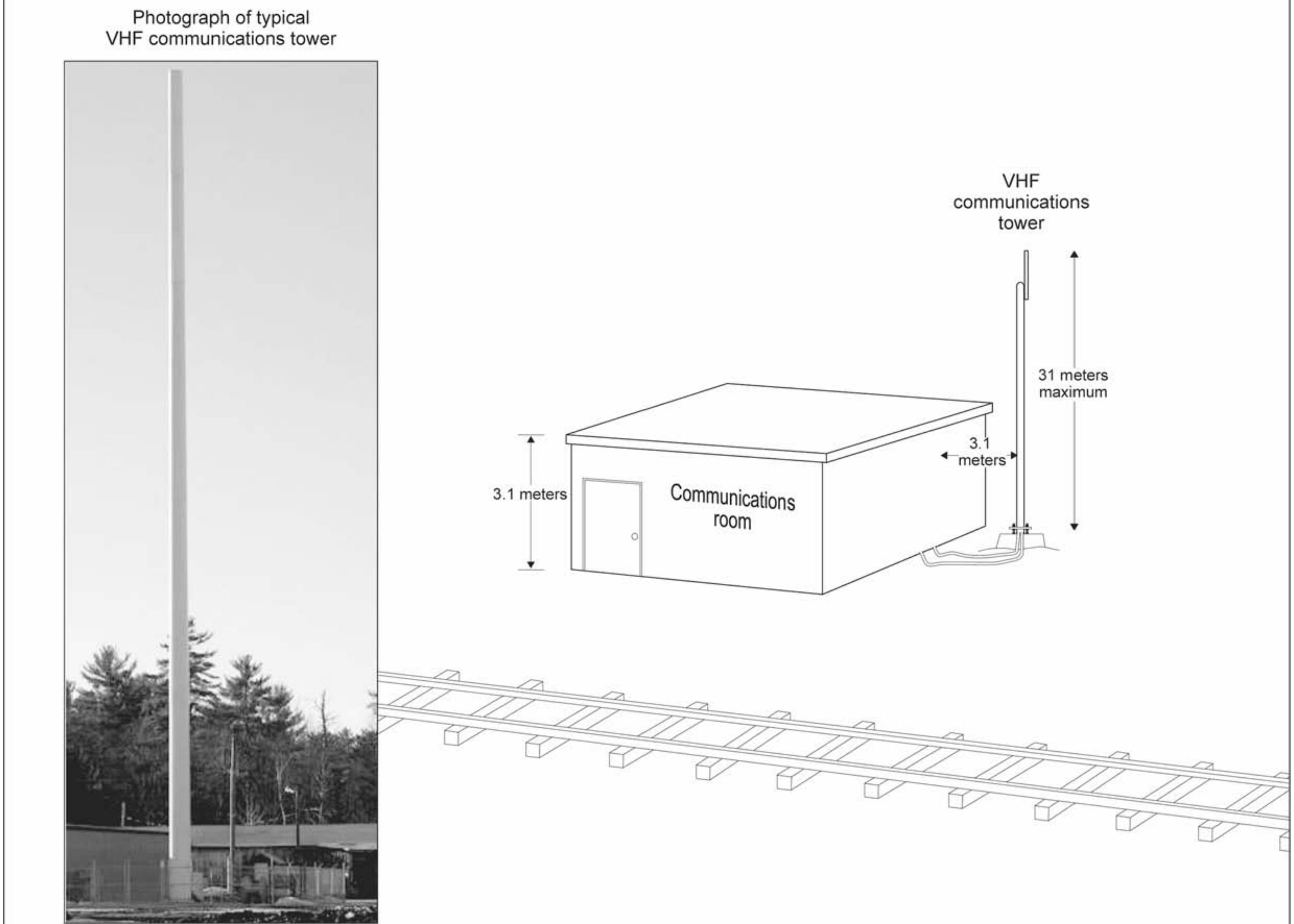
2.2.2.9 Signals and Communication Construction

Along both the Caliente and Mina rail alignments, DOE would install a communications system utilizing a fiber-optic communications cable, very-high-frequency (VHF) radio, satellite radios, and possibly satellite or cellular telephones. These systems would facilitate communications between the train operator, the Nevada Railroad Control Center (see Section 2.2.3.1.3), maintenance personnel, and ***signal blocks***. The backbone of the communications system would be the fiber-optic communications cable. This cable, which would be buried along the entire length of the rail line, would provide a common high-speed communication medium for communications applications and the control systems. To ensure continuous communications along the entire length of the Mina rail alignment, DOE would also bury this cable along existing Department of Defense Branchlines North and South.

DOE would position communications towers at the beginning, end, and approximately every 16 to 32 kilometers (10 to 20 miles) along the rail line. These towers would be approximately 23 to 30 meters (75 to 100 feet) tall, would be fenced, and would enable VHF radio communication between railroad personnel working in remote locations along the rail line. Figure 2-39 shows an example of a typical remote communications facility (DIRS 180923-Nevada Rail Partners 2007, Section 6.0).

In the case of a complete failure of the VHF radio communications system, communications would continue through a dispatch radio system utilizing satellite radios. DOE would install these backup systems in maintenance equipment, in its locomotives, and at the Nevada Railroad Control Center. In addition, DOE is considering outfitting all relevant personnel with satellite telephones, which would allow communication to continue if both the VHF and satellite radio systems failed.

DOE would use a railroad control signaling system to maintain safe train separation during operation of the proposed railroad. The proposed centralized traffic control system is a typical railroad system that uses electronic track circuits to control signal blocks and authorize train movements. DOE would install 4.6-meter (15-foot)-tall ***wayside signals*** along the rail line to control train movements. At ***at-grade crossings*** with paved public roadways, DOE would install active warning devices in the form of flashing lights, gates, and barriers. At at-grade crossings with unpaved roadways and private crossings, DOE would install passive warning devices (signs only). In addition, the signaling system would have the capability to warn the train operators about broken rails, rockslides, and certain equipment defects (DIRS 180923-Nevada Rail Partners 2007, Section 6.0).



Notes: VHF = very high frequency; to convert meters to feet, multiply by 3.2808.   Not to scale   Source: Modified from DIRS 180923-Nevada Rail Partners 2007, pp. 6-5 and 6-6.

Figure 2-39. An example of a typical remote communications facility.

2.2.2.10 Restoration of Areas Disturbed During Construction

Under the Caliente Implementing Alternative, DOE would construct the railroad in accordance with BLM rights-of-way; under the Mina Implementing Alternative, DOE would construct the railroad in accordance with BLM and/or Bureau of Indian Affairs rights-of-way. During and following construction, DOE would implement a program to:

- Identify the methods of restoration required on lands disturbed during the construction phase
- Restore and revegetate disturbed lands not required for railroad operations
- Monitor restoration programs and remediate revegetated areas as required

This program would meet DOE and BLM requirements for the restoration of disturbed sites. As part of the program, DOE would conduct reclamation inventories and develop site-specific restoration plans prior to construction. Cacti and yucca (Joshua Trees) would be salvaged, as required by State of Nevada law, prior to ground-clearing activities, maintained at nurseries, and replanted after construction was complete. DOE would stockpile topsoil on site and manage it to prevent erosion and maintain soil viability, as appropriate. Chapter 7 describes restoration programs in more detail.

2.2.2.11 Commissioning of Train Operations

The final step in railroad construction would be the commissioning of train operations. Each time a section of the track was completed and the signals and communications systems installed and tested, integrated testing would commence utilizing train equipment to validate that all components were operating as designed. Successful testing would result in final jurisdictional inspection and commissioning of the railroad for normal operations by the appropriate regulatory body.

2.2.3 RAILROAD OPERATIONS AND MAINTENANCE

Under the Proposed Action, the railroad would be expected to operate for up to 50 years for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials to Yucca Mountain. DOE would operate and maintain the railroad in accordance with applicable regulations, guidelines, and standards of the Federal Railroad Administration, the Union Pacific Railroad, and the Association of American Railroads.

Operation of the proposed railroad would begin immediately after construction was completed. At that time, the railroad would be available to deliver materials to support construction of the repository. Maintenance of the proposed railroad would be an ongoing process that would be concurrent with the operations phase of both the railroad and the repository. Following the final shipment of spent nuclear fuel, high-level radioactive waste, and other materials to the repository, DOE could abandon the railroad (including its facilities) (see Section 2.2.5) or could make them available to local communities or the private sector for other uses.

Unless otherwise noted, all descriptions of railroad operations and maintenance activities apply to both the Caliente and Mina rail alignments.

2.2.3.1 Railroad Operations

The proposed railroad would operate dedicated trains carrying spent nuclear fuel and high-level radioactive waste and trains carrying other materials, which could include construction materials, diesel fuel, and repository equipment. During the operations phase, DOE would use the railroad to transport approximately 9,500 casks of spent nuclear fuel and high-level radioactive waste, and approximately

29,000 railcars of construction materials, diesel fuel, and supplies for the repository and facilities. The frequency of trains going to the repository would vary slightly, but would average 17 one-way trains per week (see Table 2-4) (calculated from DIRS 175036-BSC 2005, Table 4.2).

Under the Mina Implementing Alternative, the region-of-influence for analyses of potential impacts on ***air quality***, noise and vibration, socioeconomics, and occupational and public health and safety would include railroad operations along the Mina rail alignment and the existing Union Pacific Railroad Hazen Branchline (that is, the entire length of the rail line from Hazen to Yucca Mountain). At present, the Union Pacific Railroad and the Department of Defense operate a few trains per week along the existing branchlines. This rail traffic would continue after DOE constructed the proposed railroad. From Hazen to Wabuska, there are approximately four one-way Union Pacific Railroad trains per week that operate on the Hazen Branchline. From Hazen to Hawthorne, there are approximately four one-way Department of Defense trains per week that operate on the Hazen Branchline and the Department of Defense Branchlines (DIRS 180154-Sullivan 2007, all).

2.2.3.1.1 Operation of Spent Nuclear Fuel and High-Level Radioactive Waste Trains

Under the Proposed Action, Union Pacific Railroad trains carrying casks of spent nuclear fuel and high-level radioactive waste would arrive in Nevada via the Union Pacific Railroad Mainline and would proceed directly to the Staging Yard (see Section 2.2.4.1.1.2). Under the Caliente Implementing Alternative, trains would arrive at the proposed railroad on the Union Pacific Railroad Mainline near Caliente and proceed to the Staging Yard along either the Caliente or the Eccles alternative segment. Under the Mina Implementing Alternative, trains would arrive on the Union Pacific Railroad Mainline near Hazen and proceed to the Staging Yard via the Union Pacific Railroad Hazen Branchline, the Department of Defense Branchline North, one of the Schurz alternative segments, and the Department of Defense Branchline South.

Once at the Staging Yard, Union Pacific Railroad locomotives would uncouple from ***cask cars*** and return to the mainline. The cask cars would be inspected in accordance with Federal Railroad Administration regulations (49 CFR Part 232 and 49 CFR Part 215). Qualified inspectors would conduct all inspections, which would include an inspection of the suspension system, car body, draft system, air brakes and wheels. DOE would maintain records of these inspections. Following completion of the inspections, cask cars would be coupled to dedicated railroad cask trains (DIRS 180923-Nevada Rail Partners 2007, Section 7.2).

The dedicated cask trains on the proposed railroad would consist of two or three 4,000-horsepower diesel-electric locomotives followed by a ***buffer car***; one to five cask cars followed by another buffer car; and one ***escort car*** carrying security personnel. A typical ***DOE spent nuclear fuel***/high-level radioactive waste train carrying three loaded cask cars would weigh approximately 1,300 metric tons (1,400 tons) (see Table 2-26) (DIRS 180923-Nevada

> A **buffer car** is a railcar that would be placed at the front of a cask train between the locomotive and the first cask car and at the back of the train between the last cask car and the escort car.
>
> A **cask car** is a railcar that would be used to transport casks of spent nuclear fuel or high-level radioactive waste.
>
> An **escort car** is a passenger car that would carry security personnel.

Table 2-26. Train components, weights, and lengths.[a]

Component	Weight (metric tons)[b]	Length (meters)[c]	Number
Locomotive (DOE and Navy)	140 to 180	23	2 to 3
DOE cask and cask car	240	18 to 27	1 to 5
Naval cask and cask car	355	18 to 27	1 to 12
Buffer car (DOE and Navy)	72	18[d]	2
Escort car (DOE and Navy)	72 to 119	24[e]	DOE trains: 1 Navy trains: 1 to 2

a. Source: DIRS 180923-Nevada Rail Partners 2007, Section 5.2.2.
b. To convert metric tons to tons, multiply by 1.1023.
c. To convert meters to feet, multiply by 3.2808.
d. Buffer cars could be up to 23 meters long, but as analyzed in this Rail Alignment EIS, are assumed to be 18 meters long.
e. Escort cars could range in length from 18 to 26 meters long, but as analyzed in this Rail Alignment EIS, are assumed to be 24 meters long.

Rail Partners 2007, Section 4.3). Figure 2-40 shows an artist's conception of a repository train. Naval spent nuclear fuel trains would typically include two or three locomotives, one to 12 cask cars, a buffer car in front of the first cask car and after the last cask car, and one to two escort cars.

Following the inspection process and the assembly of dedicated cask trains, trains would depart the Staging Yard and proceed along the proposed railroad to the Rail Equipment Maintenance Yard (see Section 2.2.4.3.1). In accordance with U.S. Department of Transportation regulations (49 CFR 174.14), railcars with spent nuclear fuel or high-level radioactive waste casks would have to be moved within 48 hours of arriving at the Staging Yard (DIRS 180923-Nevada Rail Partners 2007, Section 5.1).

Trains would require fewer than 10 hours for the trip between the Staging Yard and the Rail Equipment Maintenance Yard (DIRS 180923-Nevada Rail Partners 2007, Section 5.1). The federal hours-of-service regulations (49 CFR Part 228) limit train and engine crews to 12 hours on duty. If the trip were to exceed 12 hours, a crew-change point and local crew-welfare arrangements would be required. Although 49 CFR Part 228 would not apply to the Proposed Action, DOE would adopt the regulation's policies regarding a crew's maximum hours on duty.

The Rail Equipment Maintenance Yard would serve as the termination point of the proposed railroad and the staging area for delivery of loaded cask cars to be accepted at the Yucca Mountain Repository. Once at the Rail Equipment Maintenance Yard, casks would be transferred to the geologic repository operations area for removal of the spent nuclear fuel or high-level radioactive waste. A railroad crew would bring cask cars from the Rail Equipment Maintenance Yard to the boundary of the geologic repository operations area.

After casks were unloaded at the repository, the empty casks would be transferred back to railroad control. Before casks were returned to the Staging Yard for shipment where needed to sites across the United States, the empty casks might be sent to the Cask Maintenance Facility (see Section 2.2.4.3.2). Cask Maintenance Facility personnel would perform testing, inspections, maintenance, minor decontamination, and routine repair of the casks.

Sections 3.2.10 and 4.2.10 (Caliente rail alignment) and 3.3.10 and 4.3.10 (Mina rail alignment), Occupational and Public Health and Safety, discuss the ***affected environment*** and potential occupational health and safety impacts for operation of the Cask Maintenance Facility. DOE would ensure worker radiological health and safety by maintaining compliance with the requirements outlined in 10 CFR 835 and/or 10 CFR 20. Chapter 6 discusses regulations that would apply to the Cask Maintenance Facility.

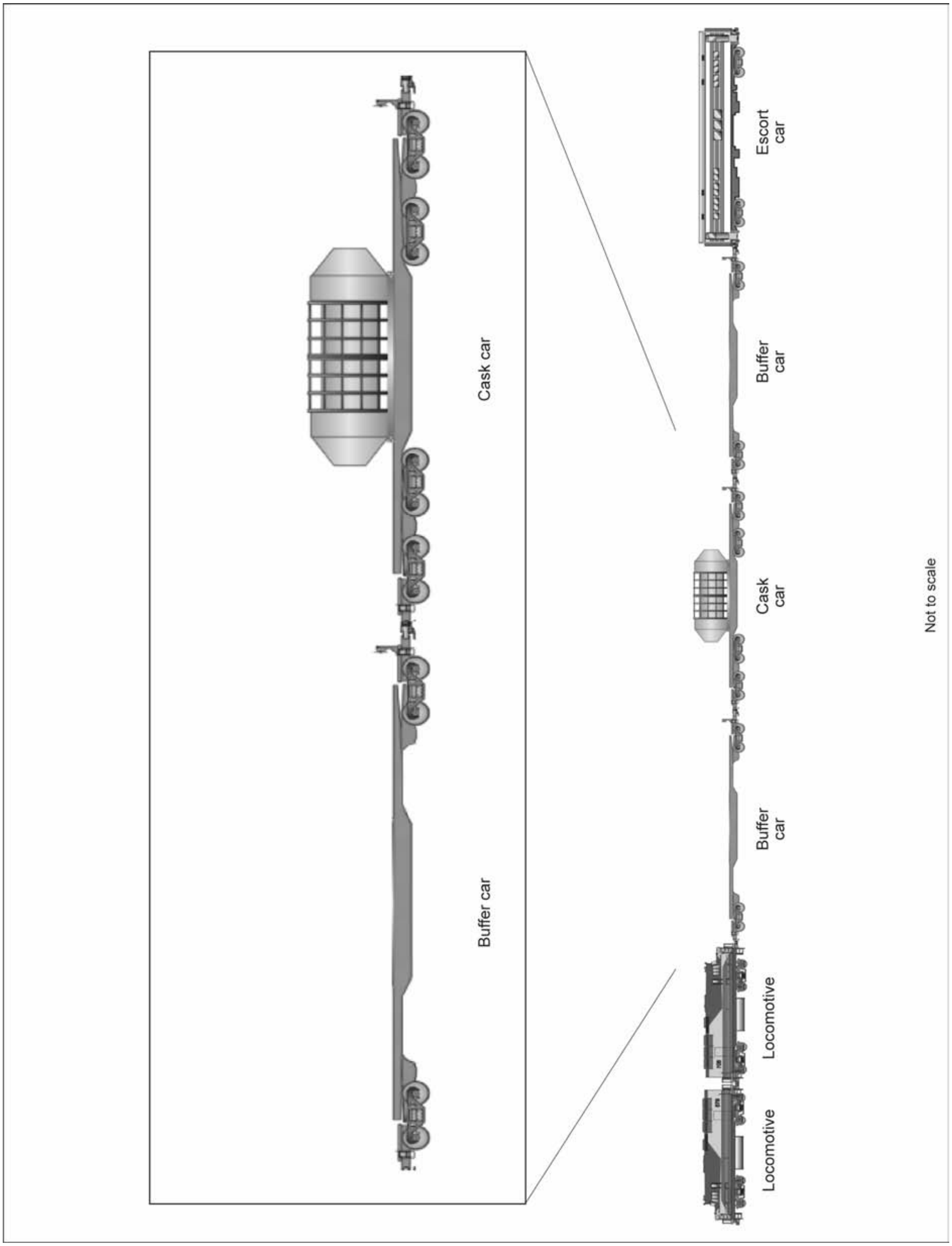


Figure 2-40. Artist's conception of a repository train carrying one cask.

2.2.3.1.2 Operations of Trains Carrying Other Materials

Under the Caliente Implementing Alternative, freight trains carrying construction and other materials (such as fuel oil and empty ***waste packages***) would arrive in Nevada via the Union Pacific Railroad Mainline and proceed directly to the Interchange Yard (see Section 2.2.4.1.1.1). Once at the Interchange Yard, Union Pacific Railroad locomotives would uncouple from their freight cars on the interchange tracks and continue on their route. Locomotives would move from the Staging Yard to the Interchange Yard, be coupled with the freight cars, and train crews would bring them to the Staging Yard for further administrative processing and inspection. From the Staging Yard, locomotives would transport the materials along the rail line to the Rail Equipment Maintenance Yard. Rail cars for return to the Union Pacific Railroad would be handled in the reverse order (DIRS 180923-Nevada Rail Partners 2007, Section 5.0).

Waste packages would consist of two thick metal cylinders, one nested within the other. The inner cylinder would be made of stainless steel to provide structural strength. The outer cylinder would be made of a nickel alloy that is highly resistant to corrosion.

Under the Mina Implementing Alternative, freight trains carrying construction and other materials would arrive in Nevada via the Union Pacific Railroad Mainline and proceed to the Staging Yard at Hawthorne via the Union Pacific Railroad Hazen Branchline, Department of Defense Branchline North, one of the Schurz alternative segments, and Department of Defense Branchline South. DOE does not plan a separate Interchange Yard along the Mina rail alignment because there is enough space to house the interchange tracks and the Staging Yard in the same location. Once at the Staging Yard, casks would go through administrative processing and inspection. From the Staging Yard, locomotives would transport the materials along the rail line to the Rail Equipment Maintenance Yard.

The same level of security necessary for railcars carrying spent nuclear fuel or high-level radioactive waste would not be necessary for railcars carrying construction or other materials. Therefore, no escort cars would be required for trains transporting construction or other materials.

2.2.3.1.3 Coordination of Shipments

The Nevada Railroad Control Center, in coordination with the DOE National Transportation Operations Center, would control the operation of the proposed railroad. Both of these facilities would be either at the Rail Equipment Maintenance Yard (see Section 2.2.4.3.1) or at the Staging Yard (see Section 2.2.4.1.1.2 [Caliente rail alignment] and Section 2.2.4.2.1 [Mina rail alignment]). The National Transportation Operations Center would oversee the shipment of casks from sites throughout the United States to the proposed railroad. All train movements, rail operations, and emergency response operations along the proposed railroad would be coordinated from the Nevada Railroad Control Center, which would have a link to both the National Transportation Operations Center and the geologic repository operations area. Section 2.2.4.3.3 describes the Nevada Railroad Control Center and the Nation Transportation Operations Center in more detail (DIRS 180923-Nevada Rail Partners 2007, Section 6.1).

DOE would use a satellite-based transportation tracking and communication system to track rail shipments of spent nuclear fuel and high-level radioactive waste to the repository. This system would provide government personnel (for example, DOE, Nuclear Regulatory Commission, and state and tribal governments) with information about shipments to the repository and would enable routine communications between government escorts accompanying shipments and the National Transportation Operations Center (DIRS 180923-Nevada Rail Partners 2007, Section 6.1). Communications between government escorts accompanying shipments, the National Transportation Operations Center, and rail carriers handling the shipments would occur in a variety of ways, as required in support of normal operations and in response to off-normal or emergency situations.

2.2.3.1.4 Coordination with State and Local Governments

Under Nuclear Regulatory Commission interim guidance, NUREG 0561, *Requirements for Physical Protection of Irradiated Reactor Fuel in Transit* (10 CFR 73.37), DOE would make available to state governors specific information about shipments, such as departure times and locations during travel.

Section 180(c) of the Nuclear Waste Policy Act (NWPA, as amended [42 U.S.C. 10101]) requires DOE to provide technical assistance and funding to states and American Indian tribes for training public safety officials and tribes in jurisdictions through which it plans to transport spent nuclear fuel and high-level radioactive waste. The training, including drills and exercises, would include procedures for the safe routine transportation of these materials, and ***accident*** and emergency response procedures. DOE would provide carriers with shipping papers containing emergency information, including contacts and telephone numbers, which would be readily available during transport for inspection by appropriate officials, and would provide clearly identifiable markings, labels, and placards of hazardous contents.

DOE is developing the policy and procedures for implementing this assistance and would institute these plans before it began shipments to the repository. In the event of an incident involving a shipment of spent nuclear fuel or high-level radioactive waste, the dispatcher in the Nevada Railroad Control Center would notify local authorities and the National Transportation Operations Center.

Chapter 6 provides a more detailed description of applicable laws and regulations.

2.2.3.2 Maintenance

2.2.3.2.1 Railroad Maintenance

Under the Caliente Implementing Alternative, most of the maintenance and inspections required to operate a safe and reliable railroad would be performed out of the Maintenance-of-Way Facilities, which consist of the Maintenance-of-Way Trackside Facility (see Section 2.2.4.1.2.1), Maintenance-of-Way Headquarters Facility (see Section 2.2.4.1.2.2), and two Satellite Maintenance-of-Way Facilities (see Section 2.2.4.1.2.3). Staff at the Headquarters Facility would plan and schedule all maintenance and inspection activities originating from the trackside and satellite facilities in coordination with the Nevada Railroad Control Center. Maintenance activities would be scheduled to minimize the impact on planned train movements (DIRS 180923-Nevada Rail Partners 2007, Section 10.0).

The Maintenance-of-Way Trackside Facility would serve as the base of operations for most maintenance activities on the proposed railroad. The two Satellite Maintenance-of-Way Facilities, which would be located at the Staging Yard and the Rail Equipment Maintenance Yard, would be the dispatch points for routine maintenance along the first third (in the case of the Staging Yard location) and the final third (in the case of the Rail Equipment Maintenance Yard location) portions of the rail line. The primary maintenance and inspection functions of these facilities would include track inspection; signal testing and inspection; minor rail, tie, and turnout replacement; and routine ballasting and surfacing tasks. Additional maintenance to be performed on an as-needed basis would include:

- Ultrasonic rail testing (performed annually) to detect internal flaws such as cracks in the rail
- Rail grinding to maintain the structural integrity of the rail, reduce noise, and prevent wear and tear to the trains
- Weed and brush control (annually or as needed)

- Vehicle and equipment maintenance (as needed)
- Track surfacing (as needed) to maintain a level and aligned track

> **Hi-rail trucks** are vehicles capable of traveling on roads or on railroad tracks.

Maintenance crews would access the work area using ***hi-rail trucks***, rail mounted machinery (such as a tamper or track liner), or maintenance trains, all of which would originate from the Maintenance-of-Way Headquarters Facility, the Maintenance-of-Way Trackside Facility, or one of the two Satellite Maintenance-of-Way Facilities. During rail line construction, DOE would install unpaved roads parallel to the rail line inside the construction right-of-way. The Department would leave these rail alignment access roads in place to provide additional access to the rail line for maintenance and emergency response, and to act as firebreaks. Because all maintenance would be performed using on-rail vehicles or trains, no bridges would need to be constructed for access roads (DIRS 180923-Nevada Rail Partners 2007, Section 10.0).

In the case of a maintenance train dispatched for activities that would extend for more than 1 day, the maintenance train would be moved to the nearest siding to allow line traffic to pass. Slow-order running (that is, reduced speed limit) could be necessary for the trains running through the area undergoing track maintenance. Maintenance trains might consist of a locomotive and crew cars with provisions, and human habitability systems, such as toilets. Power for lighting, cooling, and refrigeration would be provided from the locomotive; external lighting and equipment would be powered using diesel generators (DIRS 180923-Nevada Rail Partners 2007, Section 10.0).

DOE would implement an asset protection program based on American Railway Engineering and Maintenance-of-Way Association guidelines and industry practices. Examples include:

- Detectors to determine if any wheel bearings are overheating, which could cause the train to derail.
- Impact detectors to indicate that a wheel is warped or has flat spots. Wheels having these defects can shatter or damage miles of rail due to excessive impacts.
- Dragging-detection equipment to indicate if objects are dragging under the train, which could damage the track structure.

In addition to maintenance activities, the staff at the Maintenance-of-Way Headquarters Facility would be responsible for responding to any minor rail accident or derailment. They would coordinate response activities to recover locomotives, railcars, casks, or other equipment that might have derailed. In the event of an accident requiring additional capability, an outside contractor would be retained to assist with any repair or recovery activities (DIRS 180923-Nevada Rail Partners 2007, Section 10.0).

Under the Mina Implementing Alternative, the functionalities described above for the Maintenance-of-Way Trackside Facility and the Maintenance-of-Way Headquarters Facility would be combined and housed in a single Maintenance-of-Way Facility. All maintenance activities would be performed out of this facility and two Satellite Maintenance-of-Way Facilities, one at the Staging Yard and one at the Rail Equipment Maintenance Yard. Maintenance activities along the Mina rail alignment would include maintaining the existing Department of Defense Branchlines as needed (DIRS 180876-Nevada Rail Partners 2007, Section 10.0).

2.2.3.2.2 Maintenance of the Fleet of Locomotives and Railcars

Locomotive maintenance would be an ongoing activity that would occur at the locomotive light repair shop at the Rail Equipment Maintenance Yard. This facility would be responsible for servicing, cleaning, fueling, washing, inspecting, provisioning, and maintaining locomotives and buffer cars. Heavy repair of locomotives would be performed, on a scheduled basis and for any major breakdowns, at an offsite commercial locomotive repair facility. Escort cars would be maintained at the escort car service shop, which would be at the Rail Equipment Maintenance Yard. This facility would be responsible for cleaning the cars, restocking supplies, and servicing toilets. Cask cars and buffer cars would be maintained at the Rail Equipment Maintenance Yard.

2.2.4 RAILROAD OPERATIONS SUPPORT FACILITIES

The Proposed Action includes the construction and operation of several facilities that would be required for operation of the proposed railroad. Under the Caliente Implementing Alternative, these would include, as described in Table 2-27 and shown in Figure 2-41:

- Facilities at the Interface with the Union Pacific Railroad Mainline (Staging and Interchange Yards)
- Maintenance-of-Way Facilities (Headquarters Facility, Trackside Facility, and Satellite Facilities)
- Rail Equipment Maintenance Yard
- Cask Maintenance Facility
- Nevada Railroad Control Center and National Transportation Operations Center

Under the Mina Implementing Alternative, facilities would include, as described in Table 2-27 and shown in Figure 2-42:

- Staging Yard
- Maintenance-of-Way Facility
- Satellite Maintenance-of-Way Facilities
- Rail Equipment Maintenance Yard
- Cask Maintenance Facility
- Nevada Railroad Control Center and National Transportation Operations Center

For both the Caliente and Mina rail alignments, the Rail Equipment Maintenance Yard would be in the same location and would have the same functions.

Sections 2.2.4.1 and 2.2.4.2 describe the functions, sizes, and possible locations of these facilities along the Caliente and Mina rail alignments. DOE would construct these facilities at the same time it is constructing the rail line, and would coordinate facilities construction with rail line construction. DOE would use typical heavy construction equipment and employ best management practices during construction of these railroad facilities.

2.2.4.1 Caliente Rail Alignment Facilities

2.2.4.1.1 Facilities at the Interface with the Union Pacific Railroad Mainline

2.2.4.1.1.1 Interchange Yard. The purpose of the Interchange Yard would be to allow the exchange of railcars containing construction and other materials between the Union Pacific Railroad and the proposed railroad. It would consist of three tracks constructed along the existing Union Pacific Railroad Mainline (DIRS 180919-Nevada Rail Partners 2007, p. 4-1). Under the Caliente Implementing Alternative, the Department would locate the Interchange Yard either at the beginning of the Eccles alternative segment (see Figure 2-43 and Map Atlas [DIRS 182843-ICF 2007, Part A, Plate 2]) or the beginning of the Caliente alternative segment (see Figure 2-44 and Map Atlas [DIRS 182843-ICF 2007, Part A, Plates 12 and 13]).

Table 2-27. Railroad operations support facilities – Caliente and Mina rail alignments (page 1 of 2).

Facility	Location	General function	Number of employees required for operations
Facilities along the Caliente rail alignment (see Section 2.2.4.1)			
Facilities at the Interface with the Union Pacific Railroad Mainline (see Section 2.2.4.1.1)			
Interchange Yard	Caliente or Eccles alternative segment Lincoln County	Handling point for the exchange of railcars containing construction and other materials between the Union Pacific Railroad Mainline and the proposed railroad	0 (employees would be based at the Staging Yard)
Staging Yard	Caliente alternative segment: Indian Cove or Upland option Eccles alternative segment: Eccles-North Lincoln County	Transfer point for cask trains and other materials delivered to the proposed railroad from around the country	50 (including employees for the Nevada Railroad Control Center and National Transportation Operations Center if at the Staging Yard)
Maintenance-of-Way Facilities (see Section 2.2.4.1.2)			
Maintenance-of-Way Headquarters Facility	Approximately 8 kilometers[a] south of Tonopah; or, anywhere along U.S. Highway 95 between the analyzed location south of Tonopah and the intersection of Goldfield alternative segment 4 and U.S. Highway 95 Esmeralda County	Coordination center for all maintenance activities along the proposed railroad	10
Maintenance-of-Way Trackside Facility	Approximately 50 kilometers southeast of Tonopah along Caliente common segment 3, or anywhere along Caliente common segment 3 between the analyzed location and the start of the Goldfield alternative segments Nye County	Base of operations for most maintenance activities along the rail alignment	40
Satellite Maintenance-of-Way Facility	Staging Yard and Rail Equipment Maintenance Yard Lincoln County and Nye County	Dispatch point for maintenance activities along the first third and final third of the rail line	0 (employees housed at the Maintenance-of-Way Trackside and Headquarters Facilities)
Facilities along the Mina rail alignment (see Section 2.2.4.2)			
Staging Yard	Mina common segment 1 near Hawthorne Mineral County	Transfer point for casks and other materials delivered to the proposed railroad from around the country Handling point for the exchange of railcars containing construction and other materials between the Union Pacific Railroad and the proposed railroad	40

Table 2-27. Railroad operations support facilities – Caliente and Mina rail alignments (page 2 of 2).

Facility	Location	General function	Number of employees required for operations
Facilities along the Mina rail alignment (see Section 2.2.4.2)			
Maintenance-of-Way Facility	Montezuma alternative segment 1, Silver Peak option Montezuma alternative segments 2 and 3, Klondike option Esmeralda County	Coordination center and base of operations for all maintenance activities along the proposed railroad	40
Satellite Maintenance-of-Way Facility	Staging Yard and Rail Equipment Maintenance Yard Mineral County and Nye County	Dispatch point for maintenance activities along the first third and final third of the rail line	0 (employees based a the Maintenance-of-Way Facility)
Facilities common to both the Caliente and Mina rail alignments (see Section 2.2.4.3)			
Rail Equipment Maintenance Yard	Less than 1.6 kilometers south of the southern boundary of the geologic repository operations area Nye County	Termination point for the proposed railroad and the staging area for the delivery of loaded cask cars and other materials to the repository receiving and inspection area	40 (including employees for the Nevada Railroad Control Center and National Transportation Operations Center if located at the Rail Equipment Maintenance Yard)
Cask Maintenance Facility	Collocated with the Rail Equipment Maintenance Yard Nye County	Processing location for all transportation casks, including inspection, certification, maintenance and decontamination	30
Nevada Railroad Control Center and National Transportation Operations Center (see Section 2.2.3)	Collocated with the Rail Equipment Maintenance Yard or the Staging Yard Nye County, Lincoln County, or Mineral County	Nevada Railroad Control Center would control operations along the proposed railroad; the National Transportation Operations Center would coordinate the national shipment of casks and other materials to the proposed railroad	15

a. To convert kilometers to miles, multiply by 0.62137.

The Interchange Yard at Caliente would be in the City of Caliente across from the former Union Pacific Railroad Caliente station. The site is flat, open, and not occupied by any structures. Site preparation for the Interchange Yard at Caliente would be minimal.

The Interchange Yard at Eccles would be approximately 8 kilometers (5 miles) east of the City of Caliente. It would be constructed immediately adjacent to the Union Pacific Railroad Mainline within the confines of Clover Creek (DIRS 180919-Nevada Rail Partners 2007, p. 4-2). Clover Creek drains an area of about 970 square kilometers (240,000 acres) east of the site. Drainage through the site is from east to west, toward Meadow Valley and Caliente. Construction of the Interchange Yard at Eccles would require portions of Clover Creek to be filled to elevate the site out of the ***floodplain***. For construction of the interchange tracks, the fill would extend approximately 15 to 23 meters (50 to 75 feet) into the creek for a length of approximately 1,400 meters (4,600 feet) along the creek. For construction of the interchange siding, the fill would extend approximately 7.6 meters (25 feet) into the ***ephemeral creek*** bed for a length of approximately 900 meters (3,000 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks. DOE would perform this work in compliance with Section 404 of the Clean Water Act permitting requirements and all applicable federal and state regulations.

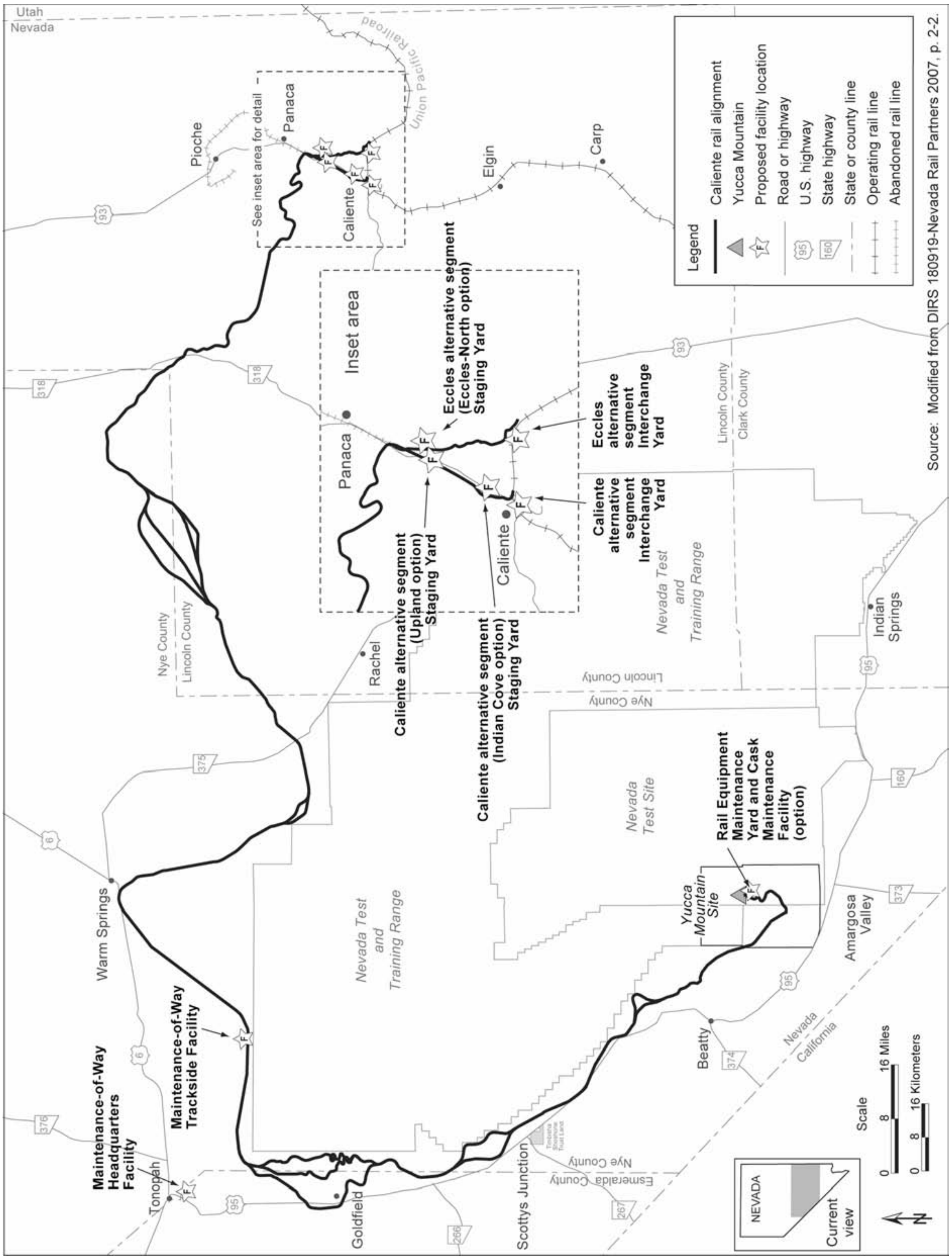


Figure 2-41. Proposed facilities along the Caliente rail alignment.

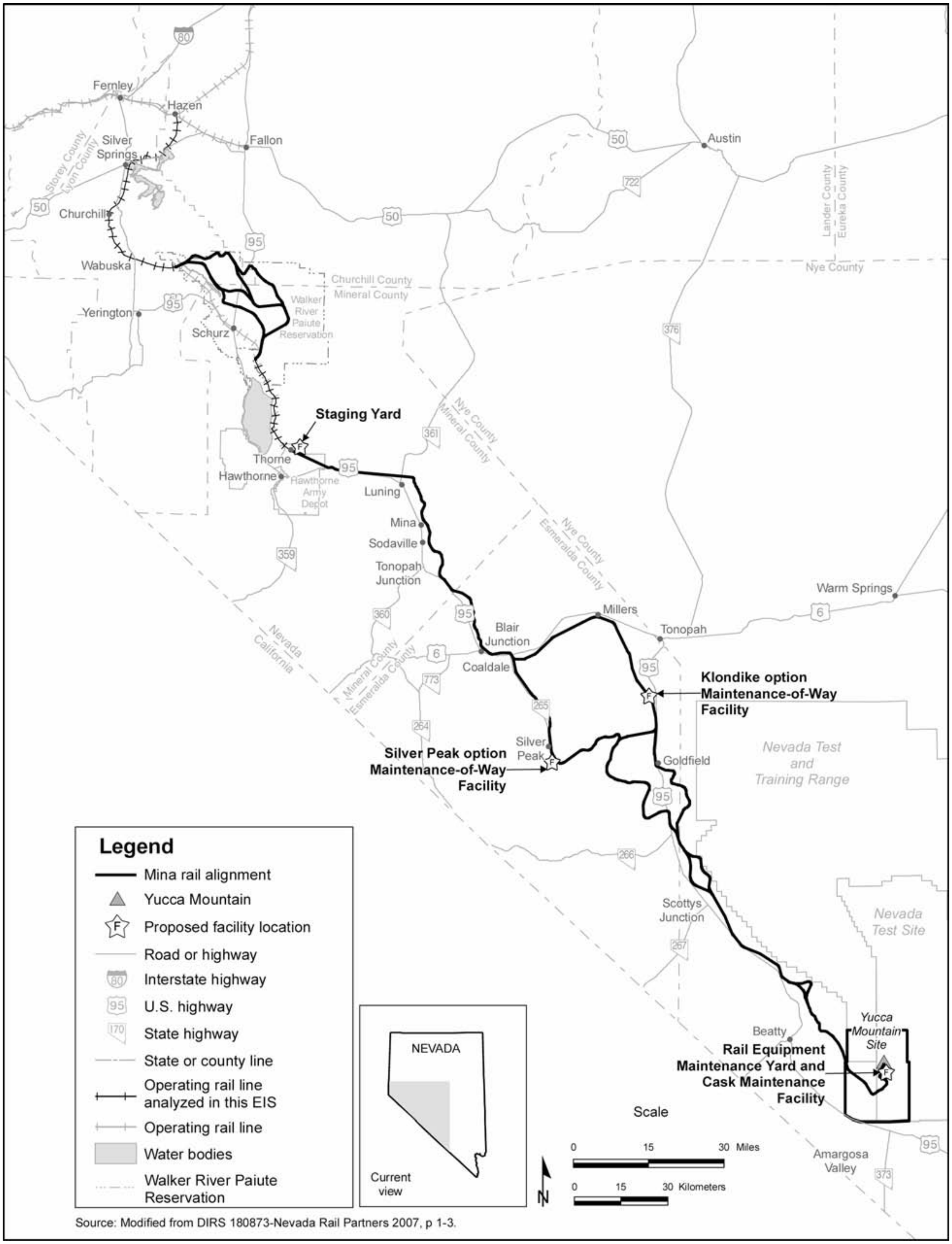


Figure 2-42. Proposed facilities along the Mina rail alignment.

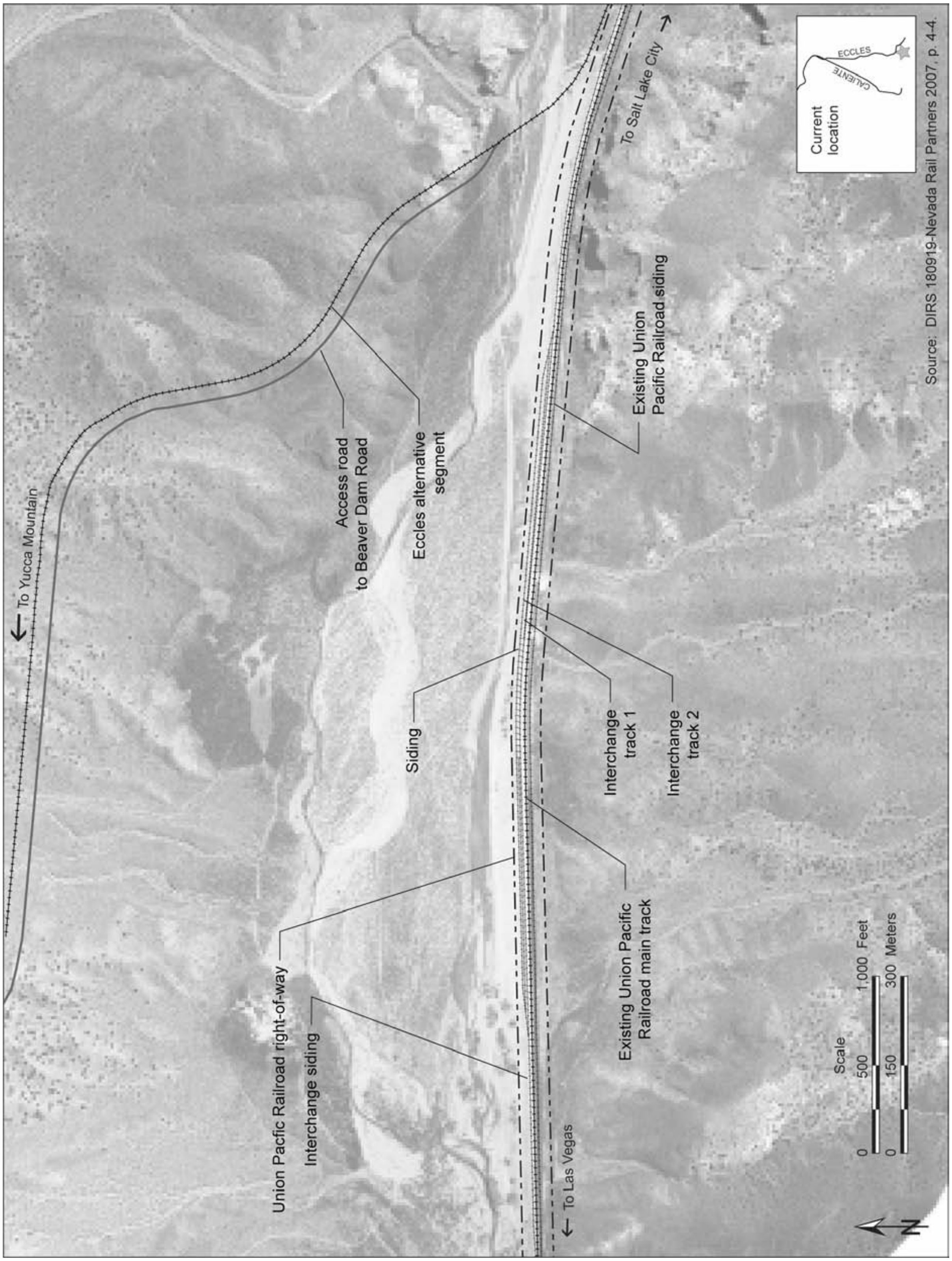
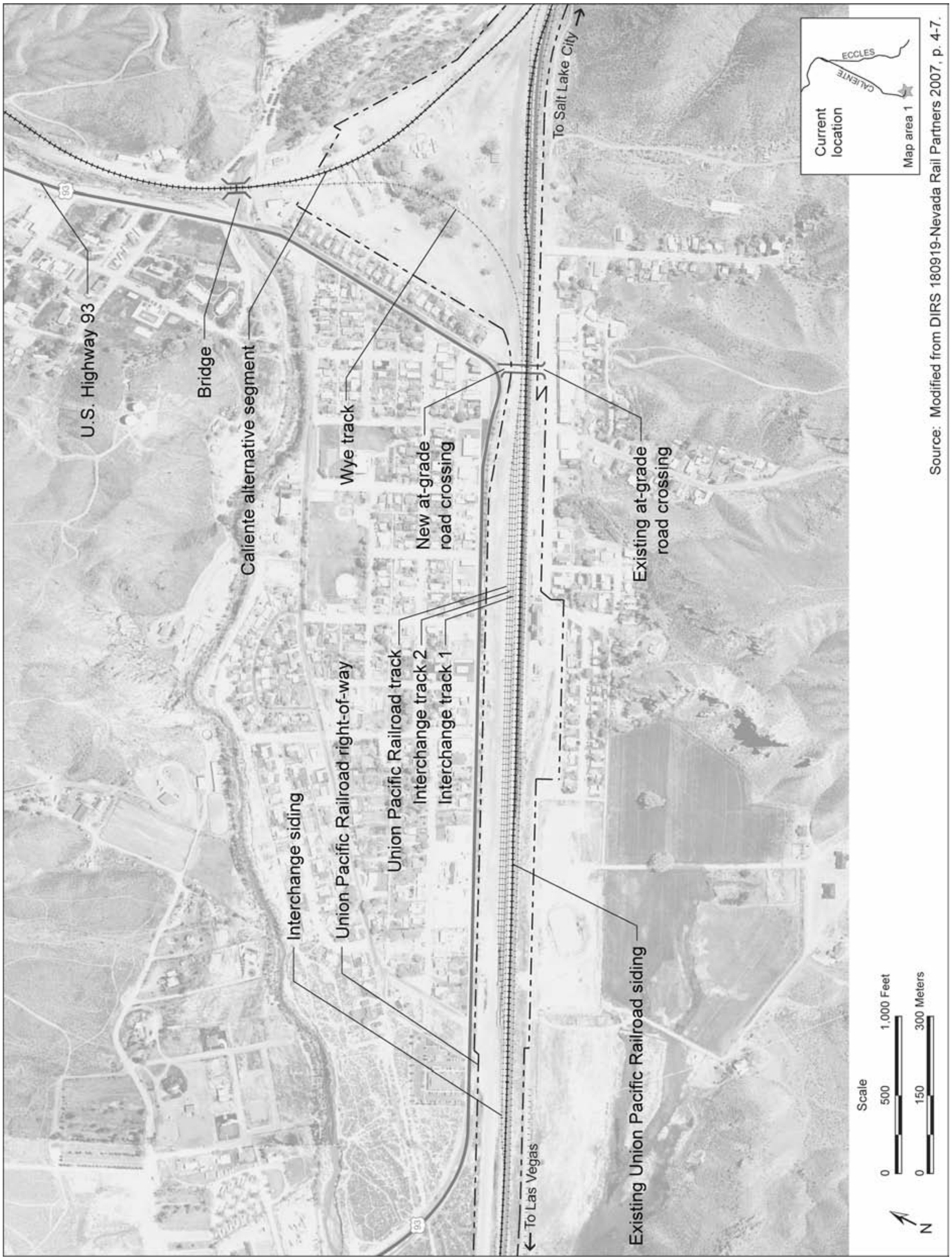


Figure 2-43. Interchange Yard – Eccles.



Source: Modified from DIRS 180919-Nevada Rail Partners 2007, p. 4-7.

Figure 2-44. Interchange Yard – Caliente.

> A **wye track** is a triangular arrangement of tracks coming off of the mainline that allows a train or locomotive to safely turn around.

The conceptual design for the Interchange Yard includes a ***wye track,*** which would allow trains to change directions. The design for the Interchange Yard in Caliente includes such a wye track; however, at the site for the Eccles Interchange Yard, grades would prohibit construction of a wye track. If DOE selected the Eccles alternative segment, the wye track would have to be at the Eccles-North location for the Staging Yard (see Section 2.2.4.1.1.2).

2.2.4.1.1.2 Staging Yard. The Staging Yard would be used to hold cask cars and hold and sort cars containing construction and other materials for movement to the Rail Equipment Maintenance Yard. The Staging Yard would include a ***locomotive sanding area*** and fueling area, a maintenance warehouse, a Satellite Maintenance-of-Way Facility (see Section 2.2.4.1.2.3), and a yard office, which could serve as the location of the Nevada Railroad Control Center and National Transportation Operations Center (see Section 2.2.3). The Staging Yard would be one of the first facilities constructed and would serve as the staging area for materials to be used during the construction phase. When construction was complete, DOE would use this yard to support the shipment of supplies to Yucca Mountain (DIRS 180919-Nevada Rail Partners 2007, p. 5-2).

DOE is considering three locations for the Staging Yard: two along the Caliente alternative segment (Indian Cove [Figure 2-45 and the Map Atlas [DIRS 182843-ICF 2007, Part A, Plates 3 and 4] and Upland [Figure 2-46 and the Map Atlas [DIRS 182843-ICF 2007, Part A, Plate 9]) and one along the Eccles alternative segment (Eccles-North [Figure 2-47 and the Map Atlas [DIRS 182843-ICF 2007, Part A, Plates 20 and 21]). DOE is considering these locations because of their proximity to the Union Pacific Railroad Mainline, proximity to a major road, and engineering feasibility. The Staging Yard would occupy approximately 0.20 square kilometer (50 acres).

The Staging Yard would have a normal power demand of 386 kilowatts (or 290 kilowatts without the Nevada Railroad Control Center and National Transportation Operations Center). DOE would build a substation connected to existing transmission lines to supply this power at the selected location for the Staging Yard, and would use diesel-powered backup generators. Approximately 21,000 liters (5,500 gallons) of water per day would be needed during the operations phase at the Staging Yard. These needs would be met by connecting to wells drilled during the construction phase. Approximately 21,000 liters (5,500 gallons) of wastewater per day would be generated at the Staging Yard. Wastewater disposal would be by local septic systems and leach fields (DIRS 180919-Nevada Rail Partners 2007, p. 5-4).

Operation of the Interchange Yard and the Staging Yard would require a workforce of approximately 50.

2.2.4.1.2 Maintenance-of-Way Facilities

Maintenance and inspection of track, bridges, culverts, grade crossings, signal equipment, communications equipment, and other wayside facilities and equipment would be performed from the Maintenance-of-Way Trackside Facility, the Maintenance-of-Way Headquarters Facility, and two Satellite Maintenance-of-Way Facilities (DIRS 180919-Nevada Rail Partners 2007, p. 7-1).

2.2.4.1.2.1 Maintenance-of-Way Trackside Facility. The Trackside Facility would occupy approximately 0.61 square kilometer (15 acres) and would consist of an administrative building; a warehouse for storage of spare parts and small tools; and an outside storage area for heavy materials (for example, spare concrete ties, rail, and ballast) and large on-track track maintenance machines. Figure 2-48 is a schematic of the Maintenance-of-Way Trackside Facility (DIRS 180919-Nevada Rail Partners 2007, p. 7-2); the proposed location of this facility is shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 303 to 305).

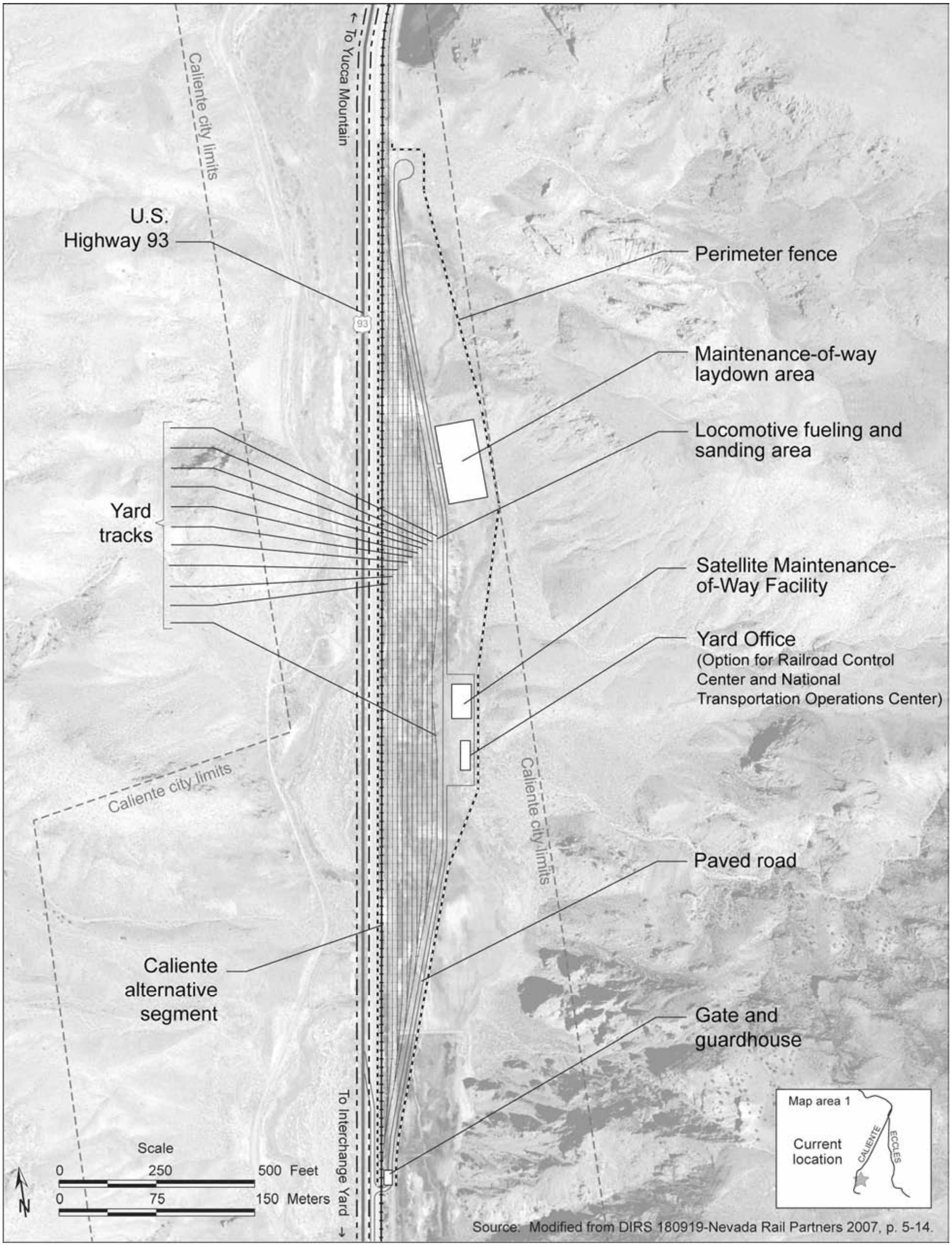


Figure 2-45. Staging Yard – Caliente-Indian Cove option.

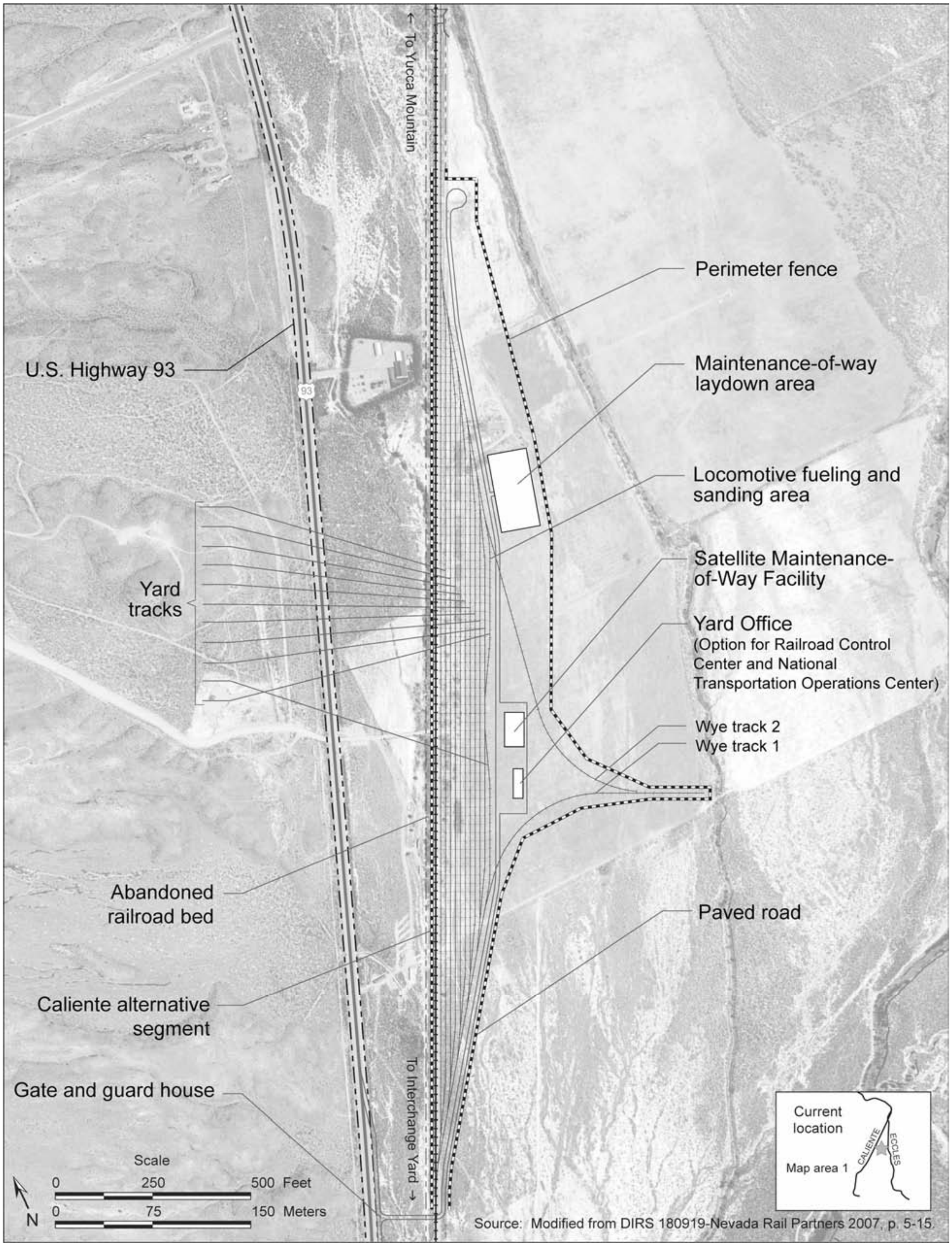


Figure 2-46. Staging Yard – Caliente-Upland option.

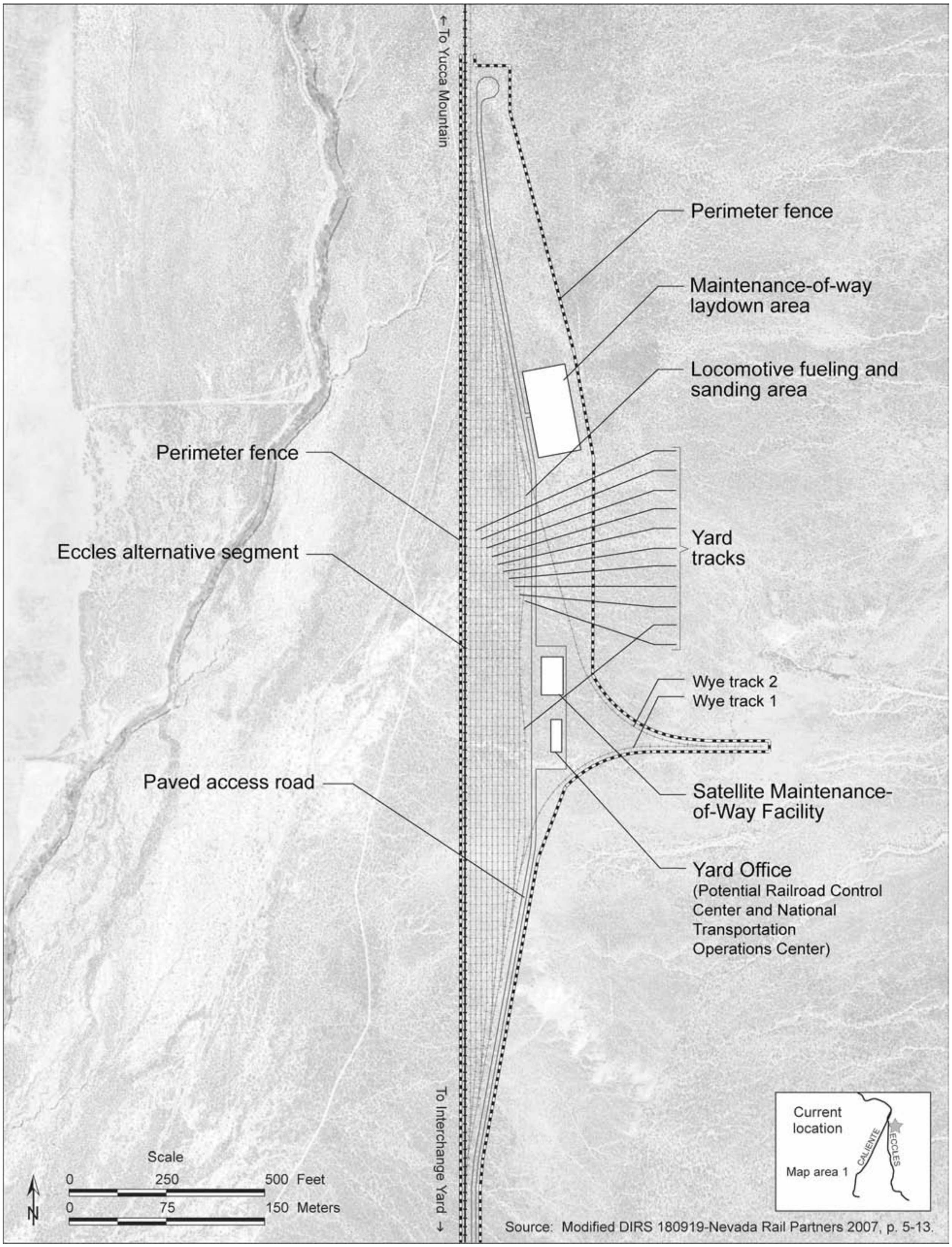


Figure 2-47. Staging Yard – Eccles-North option.

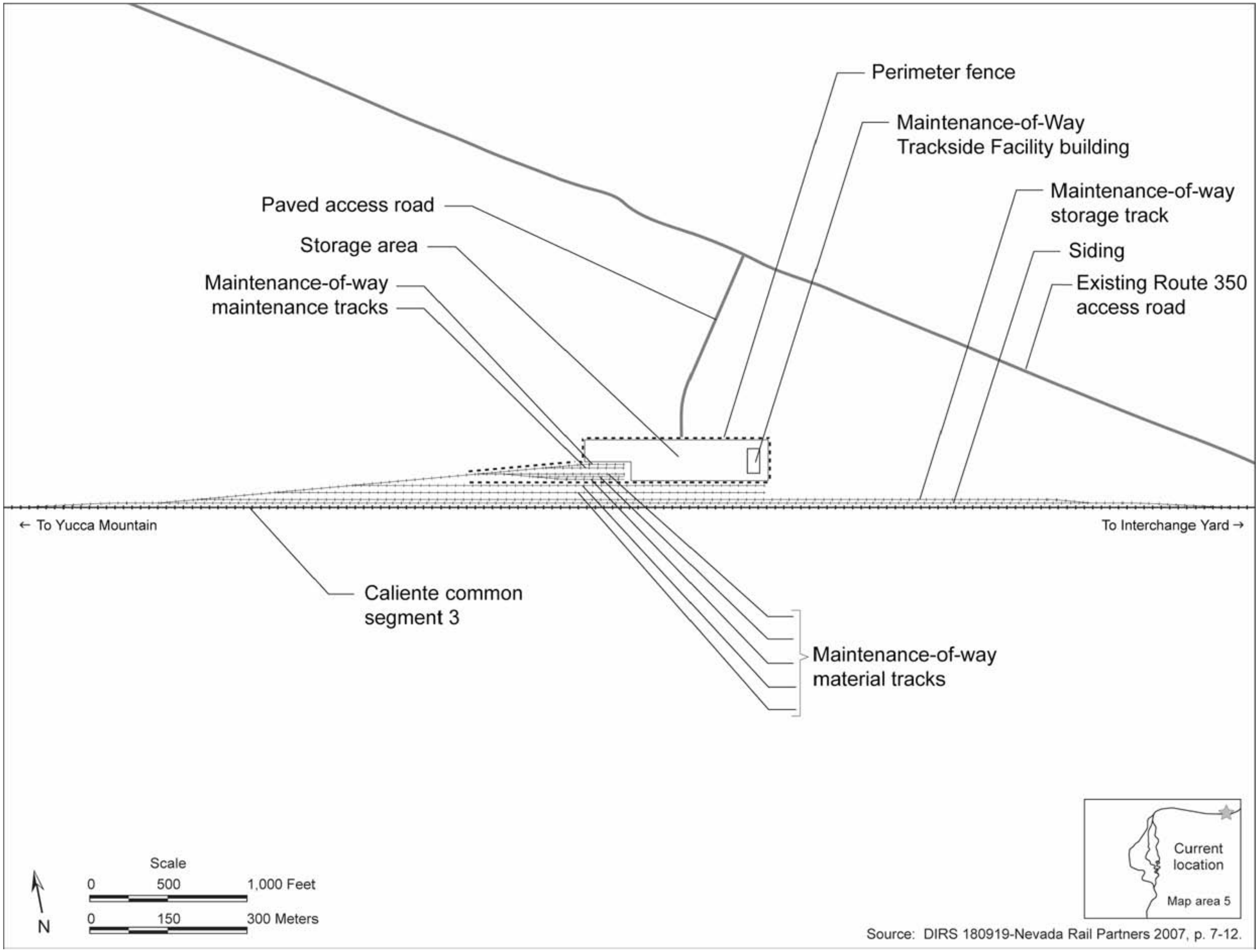


Figure 2-48. Maintenance-of-Way Trackside Facility schematic.

For purposes of analysis in this Rail Alignment EIS, the Trackside Facility is assumed to be along Caliente common segment 3 approximately 48 kilometers (30 miles) southeast of Tonopah; however, it could also be anywhere along Caliente common segment 3 between this analyzed location and the start of the Goldfield alternative segments.

Water needs at the Maintenance-of-Way Trackside Facility would be met by using wells drilled during the construction phase. Approximately 9,500 liters (2,500 gallons) per day of water would be required during the operations phase. The Maintenance-of-Way Trackside Facility would have a normal power demand of 78 kilowatts, which would be met by tying into nearby commercial electric-power distribution lines. In addition, electric power from the proposed railroad distribution line could be available for use, as would diesel-power standby generators. Approximately 11,000 liters (3,000 gallons) of wastewater per day would be generated at the Trackside Facility, which would be disposed of using new, local septic systems and leach fields.

Approximately 40 persons would be employed at the Maintenance-of-Way Trackside Facility.

2.2.4.1.2.2 Maintenance-of-Way Headquarters Facility. The Maintenance-of-Way Headquarters Facility would occupy less than 0.013 square kilometer (3.2 acres) of land. This building would house the maintenance organization supervisory and administrative staff, have parking for hi-rail trucks needed for maintenance activities, and also have space for storage of spare parts, tools, and small track-maintenance machines. Figure 2-49 is a schematic of the Maintenance-of-Way Headquarters Facility (DIRS 180919-Nevada Rail Partners 2007, p. 7-2).

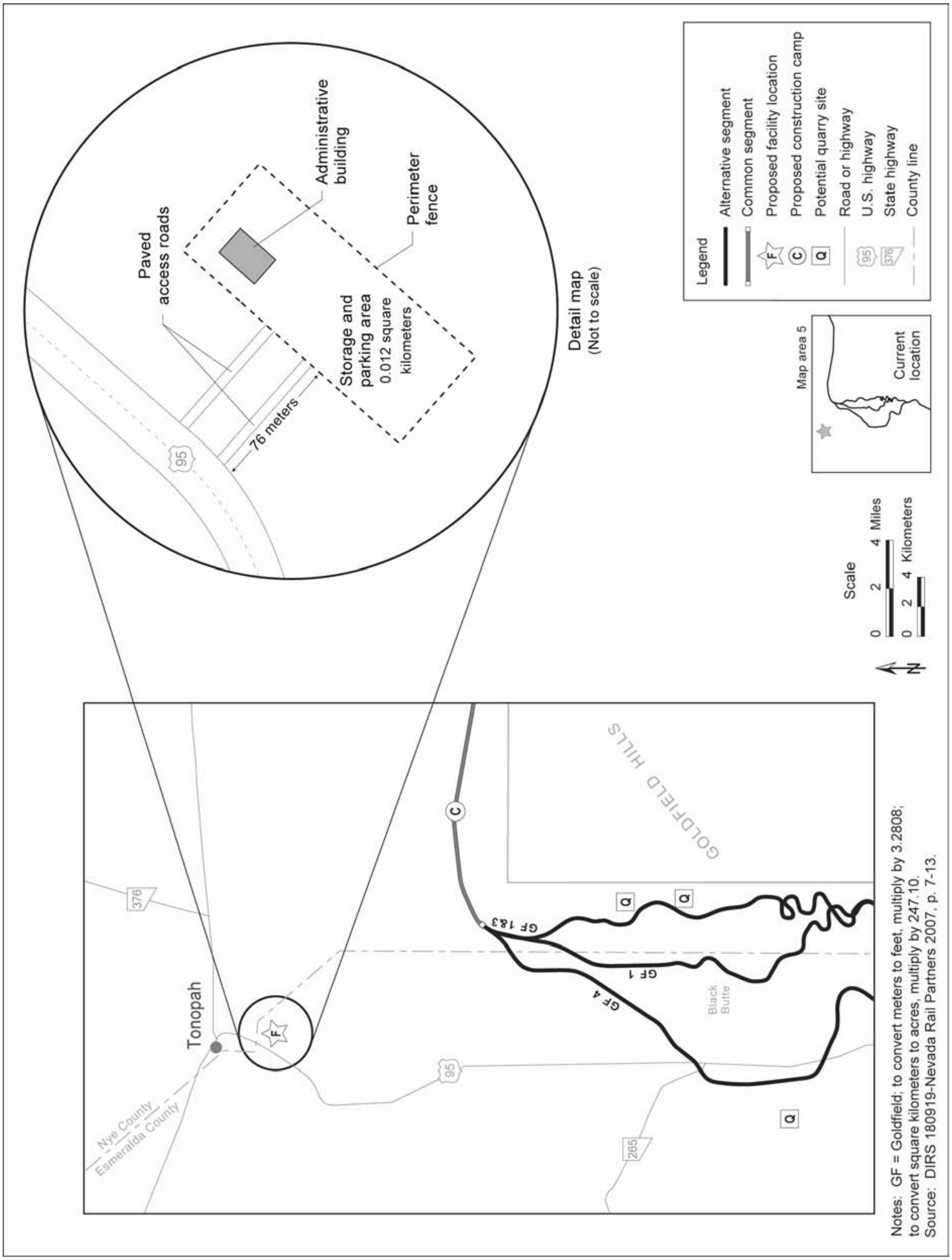
For purposes of analysis in this Rail Alignment EIS, the Headquarters Facility is assumed to be 8 kilometers (5 miles) south of Tonopah near the intersection of U.S. Highway 95 and U.S. Highway 6; however, it could also be anywhere along U.S. Highway 95 between this analyzed location and the intersection of U.S. Highway 95 and Goldfield alternative segment 4.

Water needs at the Maintenance-of-Way Headquarters Facility would be met by using water wells drilled during construction or supplied by a local municipality. Approximately 11,000 liters (3,000 gallons) of water per day would be required. The Maintenance-of-Way Headquarters Facility would have a normal power demand of 406 kilowatts, which would be met by tying into nearby commercial electric-power distribution lines. Approximately 11,000 liters (3,000 gallons) of wastewater per day would be generated at the Maintenance-of-Way Headquarters Facility, which would be disposed of using local septic systems and leach fields.

Approximately 10 persons would be employed at the Maintenance-of-Way Headquarters Facility.

2.2.4.1.2.3 Satellite Maintenance-of-Way Facilities. The Satellite Maintenance-of-Way Facilities would be at the Staging Yard and the Rail Equipment Maintenance Yard (see Sections 2.2.4.1.1 and 2.2.4.3.1). The Satellite Facility at the Staging Yard would handle the maintenance needs of the eastern third of the rail line. The Satellite Facility at the Rail Equipment Maintenance Yard would handle the maintenance needs of the Rail Equipment Maintenance Yard and the western third of the rail line approaching the Rail Equipment Maintenance Yard (DIRS 180919-Nevada Rail Partners 2007, p. 7-1).

Sections 2.2.4.1.1.2 and 2.2.4.3.1 describe power, water, and wastewater-handling needs for the Satellite Maintenance-of-Way Facilities because these facilities would be housed at the Staging Yard and the Rail Equipment Maintenance Yard. Employees for the Satellite Maintenance-of-Way Facilities would be based at the Maintenance-of-Way Headquarters Facility and Trackside Facility.



Notes: GF = Goldfield; to convert meters to feet, multiply by 3.2808; to convert square kilometers to acres, multiply by 247.10.
Source: DIRS 180919-Nevada Rail Partners 2007, p. 7-13.

Figure 2-49. Maintenance-of-Way Headquarters Facility schematic.

2.2.4.2 Mina Rail Alignment Facilities

2.2.4.2.1 Staging Yard

Along the Mina rail alignment, the Staging Yard would include the functions described for the Interchange Yard and the Staging Yard along the Caliente rail alignment (see Sections 2.2.4.1.1.1 and 2.2.4.1.1.2).

For the Mina rail alignment, the Staging Yard would be near Hawthorne along Mina common segment 1. The Staging Yard would be used to hold cask cars and hold and sort cars containing construction and other materials for movement to the Rail Equipment Maintenance Yard. The Staging Yard would include a locomotive fueling and sanding area, a maintenance warehouse, a Satellite Maintenance-of-Way Facility (see Section 2.2.4.2.2.2), the Interchange Yard, and a yard office, which could serve as the location of the Nevada Railroad Control Center and the National Transportation Operations Center (see Section 2.2.3). The Staging Yard would be one of the first facilities constructed and would serve as the staging area for materials to be used during the construction phase. When construction was complete, DOE would use this yard to support the shipment of supplies to Yucca Mountain (DIRS 180919-Nevada Rail Partners 2007, p. 5-2). Figure 2-50 is a schematic of the proposed Staging Yard at Hawthorne; the proposed location of this facility is shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 173 and 174).

The purpose of the Interchange Yard would be to allow the exchange of railcars containing construction and other materials between the Union Pacific Railroad Mainline and the proposed railroad. The conceptual design for the Interchange Yard includes a wye track, which would allow trains to change directions.

The Staging Yard would have a normal power demand of 386 kilowatts with the Nevada Railroad Train Control Center and National Transportation Operations Center (or 290 kilowatts without). DOE would build a substation connected to existing transmission lines to service this power need, and would use diesel-powered backup generators.

Approximately 21,000 liters (5,500 gallons) of water per day would be needed during the operations phase at the Staging Yard. These needs would be met by connecting to wells drilled during the construction phase or from the Hawthorne Army Depot potable and non-potable water systems. Approximately 21,000 liters (5,500 gallons) of wastewater per day would be generated at the Staging Yard. Wastewater disposal would be by local septic systems and leach fields (DIRS 180919-Nevada Rail Partners 2007, p. 5-4). Operation of the Staging Yard, including the Interchange Yard, would require a workforce of approximately 40 onsite.

2.2.4.2.2 Maintenance-of-Way Facilities

2.2.4.2.2.1 Maintenance-of-Way Facility. Maintenance of track, bridges, culverts, grade crossings, signal equipment, communications equipment, and other wayside facilities and equipment would be performed from the Maintenance-of-Way Facility and two Satellite Maintenance-of-Way Facilities (DIRS 180919-Nevada Rail Partners 2007, p. 7-1).

The Maintenance-of-Way Facility would occupy approximately 0.024 square kilometer (6 acres) and would be located either along Montezuma alternative segment 1 near Silver Peak (Figure 2-51) or along Montezuma alternative segments 2 and 3 near Klondike (Figure 2-52). The proposed locations of this facility are shown in the Map Atlas (DIRS 182844-ICF 2007, Part B, Plates 275 and 338). It would consist of an administrative building; a warehouse for storage of spare parts and small tools; a parking

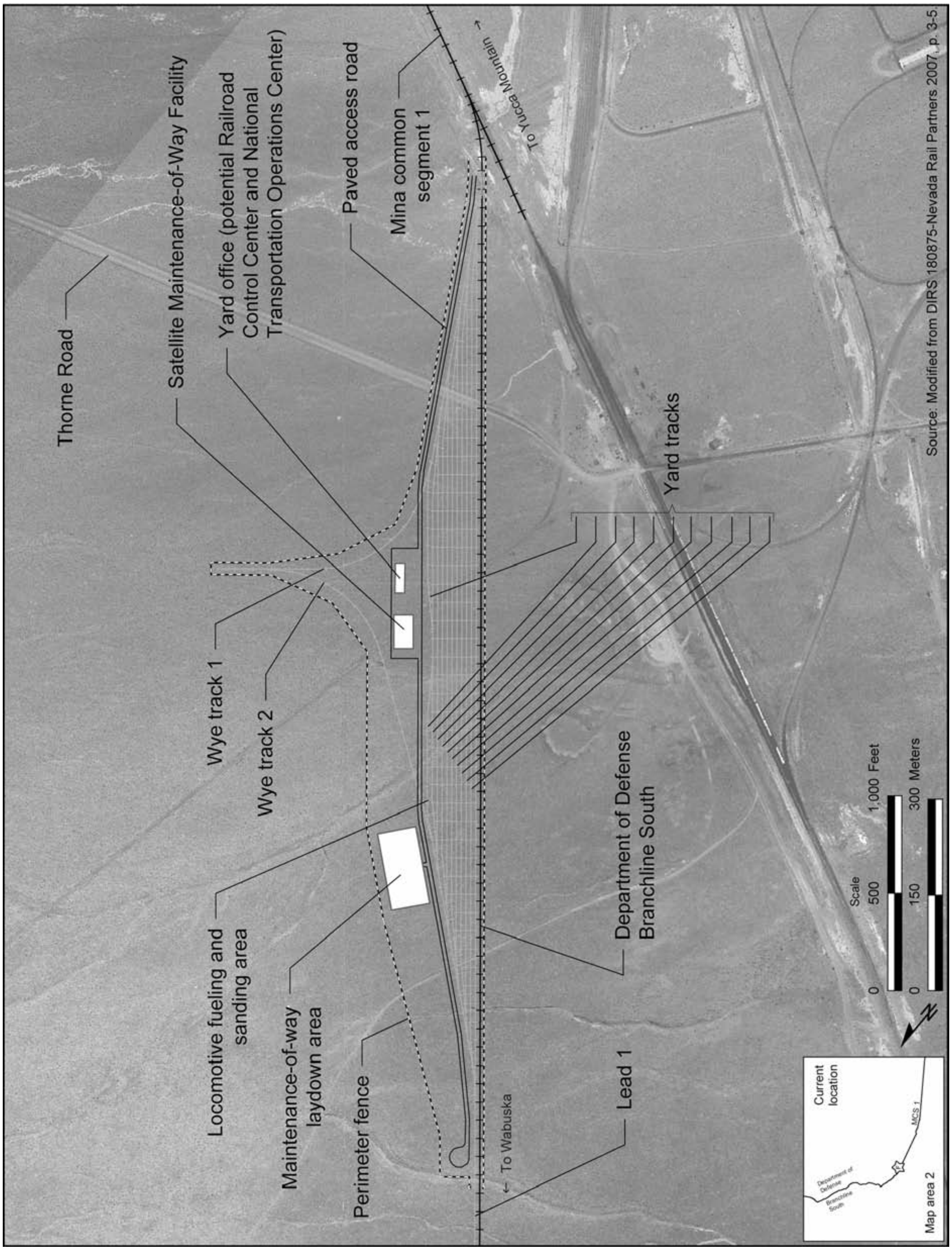


Figure 2-50. Staging Yard – Hawthorne.

area for hi-rail trucks needed for maintenance activities; and an outside storage area for heavy materials (for example, spare concrete ties, rail, and ballast) and large on-track track maintenance machines. The administrative building would house the maintenance organization supervisory and administrative staff.

Water needs at the Maintenance-of-Way Facility would be met by using wells drilled during the construction phase. Approximately 11,000 liters (3,000 gallons) per day of water would be required during the operations phase. Normal power demand would be approximately 484 kilowatts, which would be met by tying into nearby commercial electric power distribution lines. In addition, electric power from the proposed railroad distribution line could be available for use, as would diesel-power standby generators. Approximately 11,000 liters (3,000 gallons) of wastewater per day would be generated at the Maintenance-of-Way Facility, which would be handled using local treatment systems.

Approximately 40 persons would be employed at the Maintenance-of-Way Facility.

2.2.4.2.2.2 Satellite Maintenance-of-Way Facilities. The Satellite Maintenance-of-way Facilities would be at the Staging Yard and the Rail Equipment Maintenance Yard (see Sections 2.2.4.2.1 and 2.2.4.3.1). The Satellite Facility at the Staging Yard would handle the maintenance needs of the eastern third of the rail line. The Satellite Facility at the Rail Equipment Maintenance Yard would handle the maintenance needs of the Rail Equipment Maintenance Yard and the western third of the rail line approaching the Rail Equipment Maintenance Yard (DIRS 180919-Nevada Rail Partners 2007, p. 7-1).

Sections 2.2.4.2.1 and 2.2.4.3.1 describe power, water, and wastewater-handling needs for the Satellite Maintenance-of-Way Facilities because these facilities would be housed at the Staging Yard and the Rail Equipment Maintenance Yard. Employees for the Satellite Maintenance-of-Way Facilities would be based at the Maintenance-of-Way Facility.

2.2.4.3 Facilities Common to both the Caliente and Mina Rail Alignments

2.2.4.3.1 Rail Equipment Maintenance Yard and Interface with the Geologic Repository Operations Area

The Rail Equipment Maintenance Yard would be the termination point for the proposed railroad and would serve as the staging area for the delivery of loaded cask cars and other materials to the repository receiving and inspection area. The facility would be on a 0.41-square-kilometer (100-acre) site, less than 1.6 kilometers (1 mile) south of the southern boundary of the geologic repository operations area. This area would include a Satellite Maintenance-of-Way Facility (see Sections 2.2.4.1.2.3 and 2.2.4.2.2.2), a locomotive light repair facility, a car repair shop, and an escort-car service facility, and could serve as the location of the Cask Maintenance Facility (see Section 2.2.4.3.2) and the Nevada Railroad Control Center and the National Transportation Operations Center. Figure 2-53 is a schematic of the Rail Equipment Maintenance Yard incorporating the Cask Maintenance Facility (DIRS 180919-Nevada Rail Partners 2007, p. 6-1); the proposed location of the Rail Equipment Maintenance Yard is shown in the Map Atlas (DIRS 182843-ICF 2007, Part A, Plates 499 and 500, and DIRS 182844-ICF 2007, Part B, Plates 510 and 511).

The Rail Equipment Maintenance Yard would include a shop for washing, inspecting, and repairing locomotives and railcars; communications equipment; and housing for train crews and escort personnel (located in the same building as the Nevada Railroad Control Center and National Transportation Operations Center). This facility would also house a 190,000-liter (50,000-gallon) above-ground diesel fuel storage tank (for locomotive fueling); an 830,000-liter (220,000-gallon) fire-water storage tank; an access road; parking areas; areas for railcar storage; train makeup and locomotive sanding areas; and

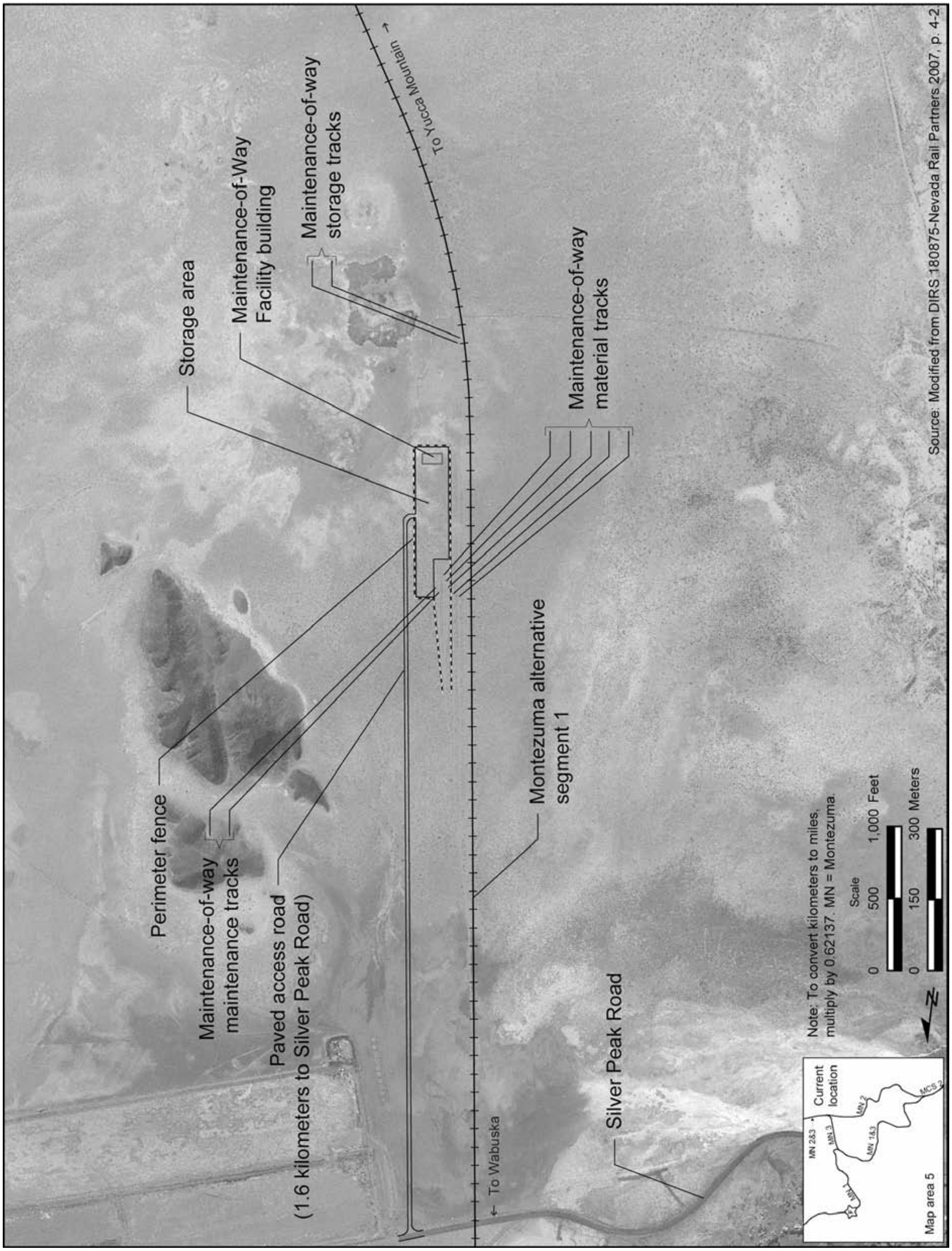


Figure 2-51. Maintenance-of-Way Facility – Silver Peak option.

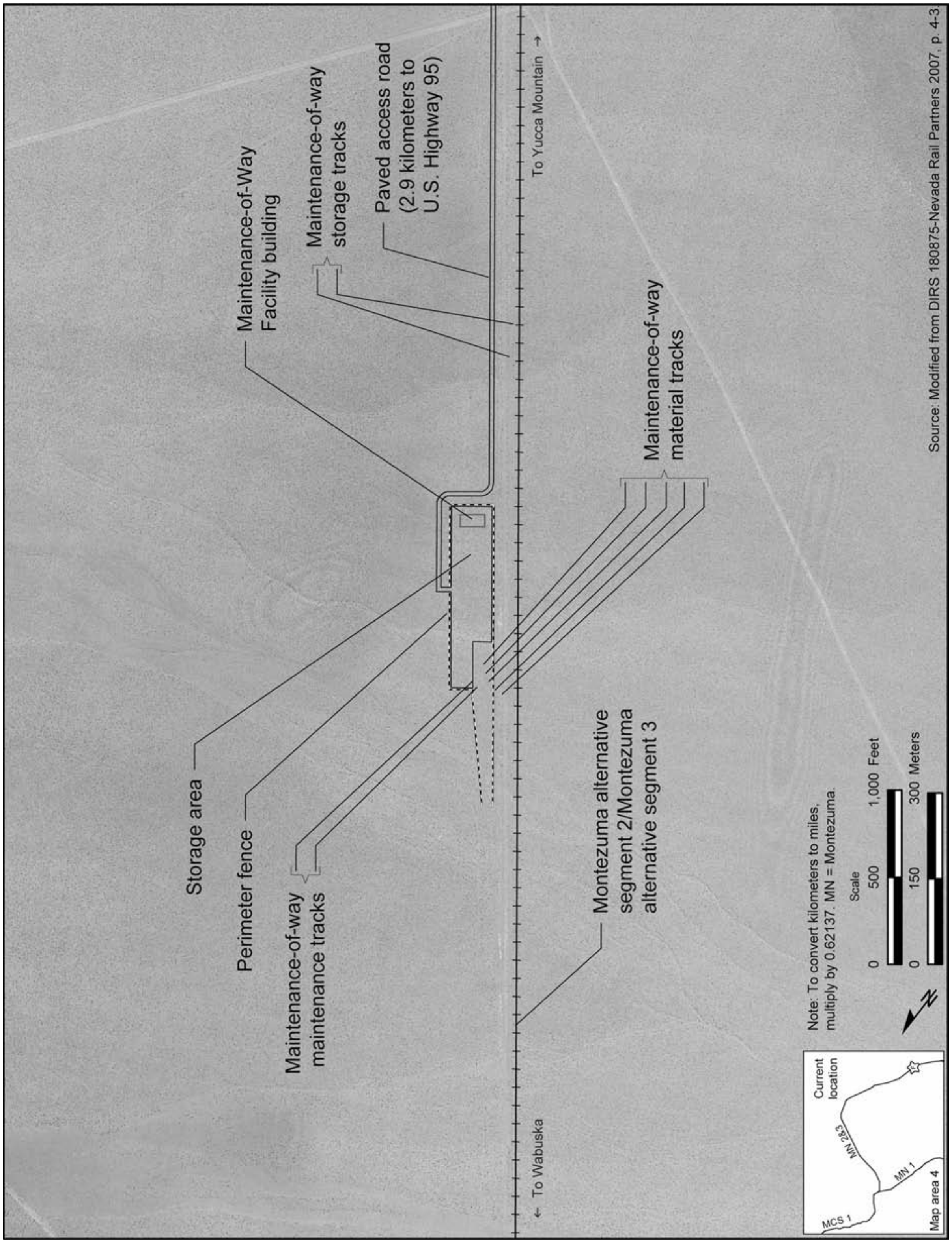


Figure 2-52. Maintenance-of-Way Facility – Klondike option.

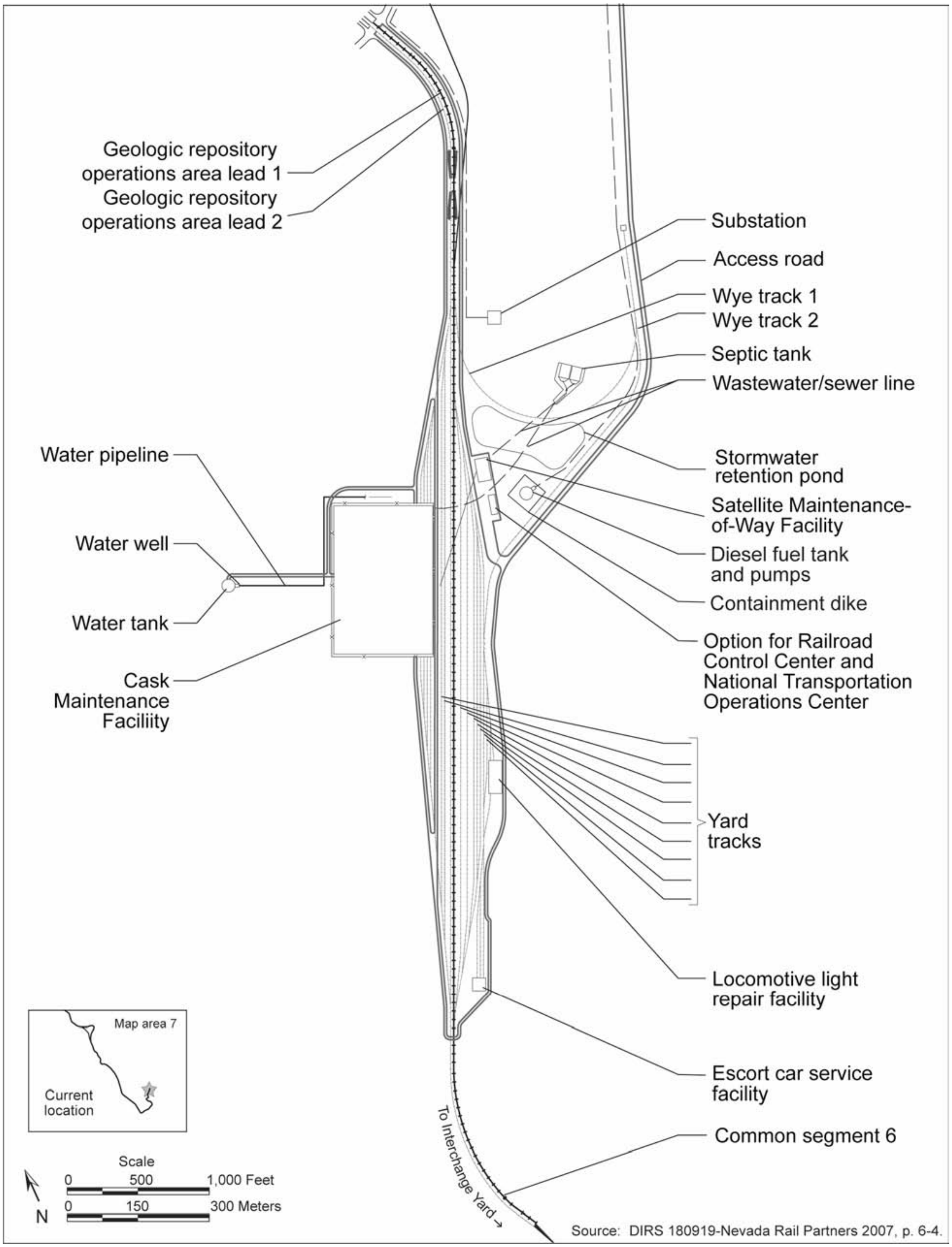


Figure 2-53. Potential Rail Equipment Maintenance Yard.

escort car maintenance and replenishing areas (DIRS 180919-Nevada Rail Partners 2007, pp. 6-3 and 6-4).

The interface with the geologic repository operations area would consist of a double track spur leading into the repository area for delivery of casks and supplies to the repository (DIRS 180919-Nevada Rail Partners 2007, p. 6-3).

Water needs at the Rail Equipment Maintenance Yard would be met by tapping into the geologic repository operations area water supply and constructing pipelines to the Rail Equipment Maintenance Yard. Approximately 23,000 liters (6,000 gallons) of water per day would be required during the operations phase (DIRS 180919-Nevada Rail Partners 2007, p. 6-6). Power requirements would be approximately 6 megawatts and would be met by tying into a new substation built for the facility or by tapping into an existing nearby power source (DIRS 181033-Hamilton-Ray 2007, all). Approximately 23,000 liters (6,000 gallons) of wastewater per day would be generated at the Rail Equipment Maintenance Yard, which would be handled using local treatment systems (DIRS 180919-Nevada Rail Partners 2007, p. 6-6).

The Rail Equipment Maintenance Yard would require an estimated 40 people to operate, including employees for the Nevada Railroad Control Center and National Transportation Operations Center.

2.2.4.3.2 Cask Maintenance Facility

The primary purpose of the Cask Maintenance Facility would be to process empty transportation casks used for shipping canistered fuel to ensure that all casks are road-ready. Transportation casks used for shipping bare spent nuclear fuel would be sent to an outsourced licensed facility elsewhere in the United States.

The basic functions of the Cask Maintenance Facility would be those necessary to ensure cask compliance with a Nuclear Regulatory Commission-issued Certificate of Compliance. The facility would consist of a 2,800-square-meter (30,000-square-foot) building with four tracks leading in and out. DOE anticipates that a staff of 30 would be required to operate the facility, which could be:

- Collocated with the Rail Equipment Maintenance Yard
- Along any portion of the Caliente rail alignment between Caliente and the Yucca Mountain Site boundary or any portion of the Mina rail alignment between Hawthorne and the Yucca Mountain Site boundary
- Outsourced to a licensed facility with the necessary services elsewhere in the United States

By being collocated with the Rail Equipment Maintenance Yard, the Cask Maintenance Facility would interface with repository operations. This location would allow the facility to service the casks prior to their return to the nuclear utility sites and would allow Cask Maintenance Facility personnel to take advantage of infrastructure and support services already available at the repository site. The power, water, and sewage needs of the Cask Maintenance Facility would be met by tapping into infrastructure developed at Yucca Mountain to support construction and operation of the repository. Power requirements would be approximately 2 megawatts and would be supplied from the newly constructed substation connected to the proposed 138-kilovolt transmission line system into the nearby geologic repository operations area (DIRS 181033-Hamilton-Ray 2007, all). Wastewater would be handled by the geologic repository operations area septic and wastewater treatment system.

This Rail Alignment EIS analyzes the impacts of collocating the Cask Maintenance Facility with the Rail Equipment Maintenance Yard inside the Yucca Mountain Site boundary. If DOE subsequently proposed to locate the Cask Maintenance Facility outside the Yucca Mountain Site boundary, the Department would perform additional NEPA analyses to determine the environmental impacts of placing the facility at a different location, as appropriate.

2.2.4.3.3 Nevada Railroad Control Center and National Transportation Operations Center

The National Transportation Operations Center would oversee the shipment of casks from sites throughout the United States to the proposed railroad. Once casks arrived at the railroad in Nevada, the Nevada Railroad Control Center would oversee their shipment to the repository at Yucca Mountain. The Nevada Railroad Control Center would oversee all train movements, rail operations, and emergency response operations along the proposed railroad (DIRS 180923-Nevada Rail Partners 2007, Section 6.1).

The Nevada Railroad Control Center and National Transportation Operations Center would be at either the Rail Equipment Maintenance Yard or the Staging Yard. Together, these facilities would require approximately 320 square meters (3,400 square feet) of office space and would require approximately 15 employees to operate. Personnel at the Nevada Railroad Control Center would primarily be responsible for directing all rail operations along the proposed railroad, including coordinating shipments to the proposed railroad with the National Transportation Operations Center; coordinating maintenance-of-way trains along the rail line; coordinating with security personnel; and maintaining communications with emergency response personnel during an accident (DIRS 180923-Nevada Rail Partners 2007, Section 6.1).

Sections 2.2.4.1.1.2, 2.2.4.2.1, and 2.2.4.3.1 describe power, water, and wastewater-handling needs for the Nevada Railroad Control Center and National Transportation Operations Center because these facilities would be housed at either the Rail Equipment Maintenance Yard or the Staging Yard.

2.2.5 RAILROAD ABANDONMENT

If built and operated, the proposed railroad could be abandoned after shipments to the repository were complete. DOE could decide to remove ballast, track, ties, signaling, and other related infrastructure. In addition, DOE could decide to decommission and dismantle facilities such as the Cask Maintenance Facility. DOE might not remove the rail roadbed, although the Department would reclaim the lands disturbed by the abandonment process. If DOE decided to abandon the railroad, it would relinquish its regulatory right-of-way and the BLM would continue to manage the land. Any abandonment of the railroad would be conducted in consultation with the BLM and other land-management entities, as appropriate, at the time of abandonment.

Analysis of railroad abandonment would be performed near the completion of the shipping campaign, when an accurate assessment could be made regarding the usefulness of maintaining portions of the rail line or individual facilities.

2.2.6 SHARED-USE OPTIONS

2.2.6.1 Overview

Under each Implementing Alternative, DOE has analyzed a Shared-Use Option, under which the Department would allow commercial shippers to use the rail line for general freight shipments. General freight would include stone and other nonmetallic minerals, petrochemicals, nonradioactive waste materials, or other commodities that private companies would ship or receive. Implementation of the

Shared-Use Option would require an STB license to construct and operate the railroad as a common-carrier rail line.

The Shared-Use Option would entail construction of commercial sidings to provide access for potential commercial shippers, and facilities for operation of commercial rail service. Funding for such construction and commercial rail service could be provided by either the private sector or other government sources. The Shared-Use Option would not require any changes to the design (for example, grade or curvature) of the proposed rail line from that described for the Proposed Action without shared use.

Commercial railcars would be hauled in trains that are separate from trains carrying spent nuclear fuel and high-level radioactive waste, but could be hauled with trains carrying other repository-related materials (for example, construction materials, water, and fuel). During the operations phase, trains carrying spent nuclear fuel and high-level radioactive waste would have priority over trains carrying commercial shipments.

Under a DOE-funded cooperative agreement, Nye County commissioned a study of the potential economic benefits to Nye, Esmeralda, and Lincoln Counties of the rail line along the Caliente rail alignment (DIRS 174090-Smith 2005, all). This report presented low-, mid-, and high-range estimates of commercial freight shipments on the rail line, based on interviews with potential shippers.

While preparing this Rail Alignment EIS, DOE conducted independent telephone interviews with each of the potential shippers identified in the Nye County study. Further consultation with representatives from Nye, Esmeralda, Mineral, and Churchill Counties, and with other ***stakeholders***, identified additional potential shippers along the Mina rail alignment. DOE interviewed these potential shippers in person and via telephone. Through these efforts, DOE estimated different levels of commercial freight demand for the Caliente and Mina rail alignments (DIRS 180694-Ang-Olson and Gallivan 2007, all).

DOE projected the total commercial freight demand on a rail line along the Caliente rail alignment would be approximately 223 carloads weekly (Table 2-28), which is similar to the mid-range demand scenario in the Nye County study (DIRS 174090-Smith 2005, all).

Table 2-28. Potential commercial freight shipments under the Shared-Use Option – Caliente rail alignment.[a]

Commodity	Weight (metric tons)[b]		Carloads	
	Per week	Per year	Per week	Per year
Stone	3,250	169,000	36	1,860
Other nonmetallic minerals	9,620	500,000	106	5,500
Petrochemicals	5,240	273,000	58	3,000
Nonradioactive waste materials	1,220	64,000	13	700
Other commodities	900	44,000	10	480
Totals	20,190	1,050,000	223	11,540

a. Source: DIRS 180694-Ang-Olson and Gallivan 2007, all.
b. To convert metric tons to tons, multiply by 1.1023.

DOE projected that total freight demand on a rail line along the Mina rail alignment would be approximately 514 carloads per week. Of this total, approximately 210 carloads would travel on dedicated unit trains that would not pass south of the Walker River Paiute Reservation (Table 2-29).

Most potential shippers expressed a willingness to truck their product to or from a siding, although the maximum acceptable trucking distance varied considerably among the shippers. Some shippers would need to construct storage or loading/unloading facilities at the sidings. Potential shippers did not express any interest in either a long spur or a short spur/siding location that would not be served by existing paved or gravel roads.

Table 2-29. Potential commercial freight shipments under the Shared-Use Option – Mina rail alignment.[a]

Commodity	Weight (metric tons)[b]		Carloads	
	Per week	Per year	Per week	Per year
Stone	16,890	878,000	186	9,660
Other nonmetallic minerals	4,830	251,000	50	2,760
Petrochemicals	240	13,000	3	140
Nonradioactive waste materials[c]	20,360[c]	1,059,000[c]	224[c]	11,650[c]
Other commodities	5,080	264,000	51	2,900
Totals	47,400	2,465,000	514	27,110

a. Source: DIRS 180694-Ang-Olson and Gallivan 2007, all.
b. To convert metric tons to tons, multiply by 1.1023.
c. Nineteen thousand one-hundred fifty metric tons (211 carloads) weekly would travel on dedicated unit trains that would not pass south of the Walker River Paiute Reservation.

2.2.6.2 Facilities and Sidings

2.2.6.2.1 Commercial-Use Sidings

Under the Shared-Use Option, DOE would construct the proposed rail line as described in Section 2.2.2, and others would construct commercial-use sidings. At these commercial-use sidings, which would be constructed within the operations right-of-way, commercial freight railcars would be set out and picked up. Commercial-use sidings would be constructed adjacent to passing sidings. As described in Section 2.2.2.8, DOE would construct passing sidings approximately every 40 kilometers (25 miles) so that trains running in opposite directions would be able to pass one another. Along the Caliente rail alignment, these passing sidings would be approximately 1,800 to 3,700 meters (6,000 to 12,000 feet) long to accommodate a maximum train length of 1,700 meters (5,500 feet). Along the Mina rail alignment, these passing sidings would be 2,100 to 5,800 meters (7,000 to 19,000 feet) long. For purposes of analysis, DOE assumed it would construct passing sidings in locations where commercial access would be needed. A commercial access siding (also known as a ***team track***) could then be constructed as a third track parallel to the mainline and the passing siding. Commercial-access sidings would generally be less than 300 meters (980 feet) long and would be double-ended (switches at both ends). Figure 2-54 is a schematic of a typical commercial access siding. To the extent practicable and appropriate, DOE also would accommodate the construction of additional access sidings, or short-spur lines, by private shippers. Commercial-access sidings could be constructed for use by any shipper or for use by a single shipper (called an ***industry track***). Possible locations for access sidings along the Caliente rail alignment include Caliente, the Panaca/Bennett Pass area, the Warm Springs Summit area, the Tonopah area, Goldfield, and the Beatty/Oasis Valley area. Possible locations for new access sidings along the Mina rail alignment include Luning, Mina, the Goldfield area, Silver Peak, and the Beatty/Oasis Valley area.

DOE assumes that the commercial-access sidings would be constructed at the same time as the proposed railroad, although construction could occur at a later date. The construction approach would be the same

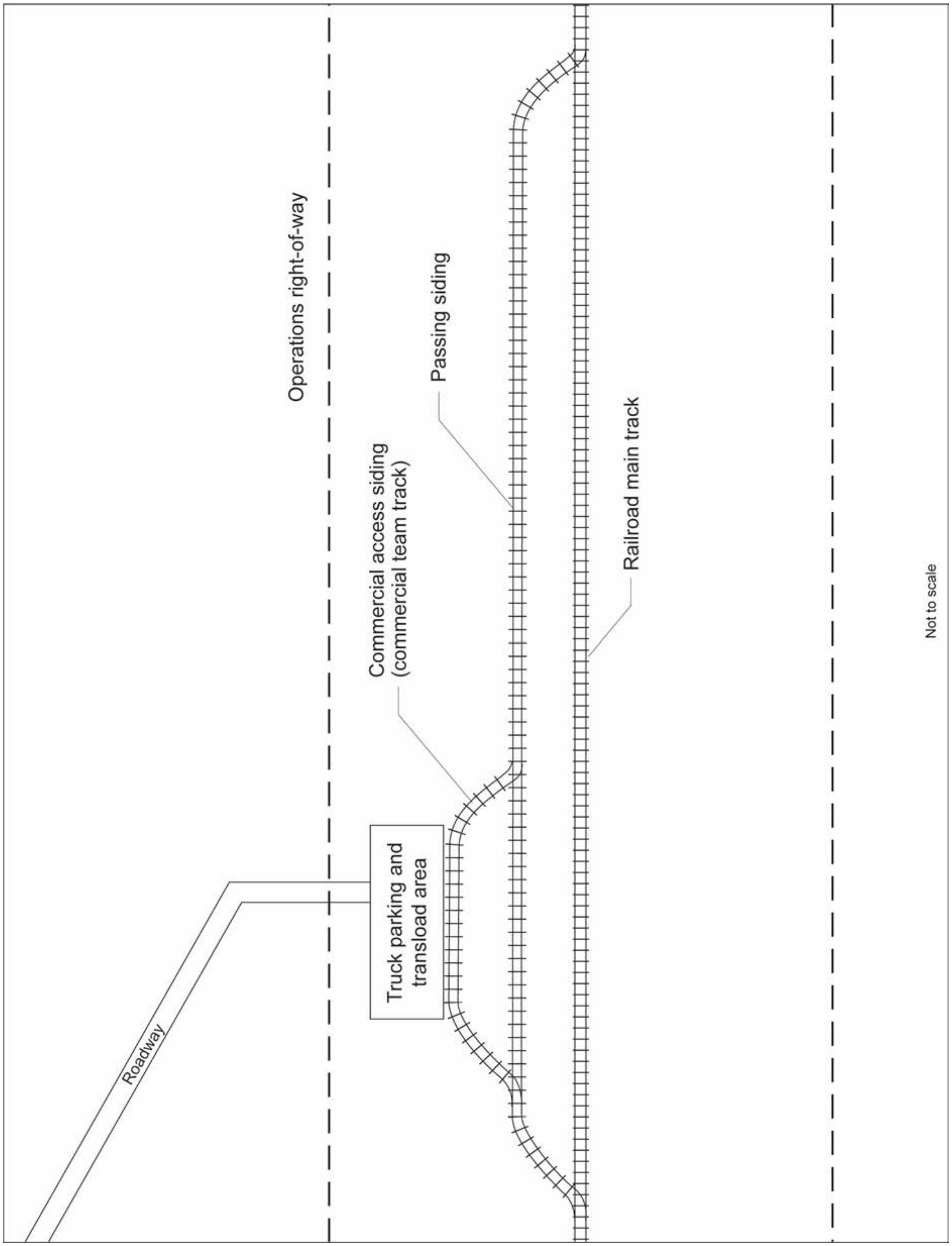


Figure 2-54. Commercial access siding schematic (conceptual).

as described in Section 2.2.2, with phased construction and implementation of appropriate best management practices. Because commercial sidings would be built at the locations of passing sidings, the incremental effort to construct commercial sidings would be minimized. Although some additional materials and labor would be needed, the increase beyond that described in Section 2.2.2 would be small and additional construction camps would not be required. Temporary access roads built for the construction of the proposed railroad would also be used for construction of commercial sidings; therefore, no new roads would be needed to support construction of commercial sidings.

The commercial sidings proposed to be constructed under the Shared-Use Option would represent an increase of less than 0.5 percent over the entire length of track laid under the Proposed Action without the Shared-Use Option for either the Caliente or Mina rail alignment. The land area disturbed under the Shared-Use Option as compared to the Proposed Action without the Shared-Use Option would be less than 0.1 percent.

Commercial sidings and the additional facilities for shared use described in Section 2.2.6.2.2 would be constructed within the operations right-of-way, as practicable. Any facilities constructed outside the operations right-of-way would need the appropriate approval from the BLM.

2.2.6.2.2 Additional Facilities for Shared Use

The supporting infrastructure at team tracks and industry tracks would vary with the types and amounts of commodities being shipped. Most, or all, commercial-access sidings would have facilities for transferring freight between railcars and trucks. They might require a paved or unpaved parking area where trucks could access the freight cars, along with a loading dock (for transferring machinery or pallets) and possibly other specialized loading equipment (such as tanks for storing petroleum products or conveyers for moving some nonmetallic minerals).

An existing paved or unpaved road would provide truck access to the loading facilities. Commercial sidings and truck-loading facilities would be on relatively flat terrain near existing roads whenever feasible. Some improvements to existing roads might be required.

The Shared-Use Option could require construction and operation of one or more facilities to allow commercial rail service, which would be funded by the private sector or other government sources. Commercial trains would not have access to the restricted areas at the Cask Maintenance Facility or the restricted area designated for the geologic repository operations area, including the Rail Equipment Maintenance Yard. A commercial-service end-of-line facility could be constructed at or near the last commercial stop, probably in the Beatty/Oasis Valley area, which would provide an area for locomotive and railcar parking. Commercial railcars would be serviced at one or more separate maintenance facilities, possibly in the Caliente area (Caliente rail alignment), the Tonopah/Goldfield area (Caliente or Mina rail alignment), the Hawthorne area (Mina rail alignment), or at the commercial service end-of-line facility. These facilities would consist of about 100 meters (330 feet) of track (in addition to the access sidings) for parking and maintenance of locomotives and other railcars.

2.2.6.3 Operation and Maintenance under the Shared-Use Option

The commercial rail service and facilities would be operated and maintained in accordance with the appropriate Federal Railroad Administration standards and requirements, and applicable regulations of the State of Nevada. All such work would also be conducted in accordance with other appropriate industry codes, standards, engineering principles, and practices, with particular attention to those that incorporate system safety, human factors, reliability, availability, maintainability, habitability standards, and environmental protection. Shared-use rail service would begin after the completion of proposed railroad construction. Maintenance of the commercial rail facilities would be an ongoing process that would be concurrent and coordinated with maintenance of the proposed railroad, as described in Section 2.2.3.2.

2.2.6.3.1 Operations

During the proposed railroad operations phase, approximately eight one-way commercial trains would run per week along the Caliente rail alignment. Along the Mina rail alignment, approximately 18 one-way commercial trains would run per week, eight of which would travel only on the northern portions of the rail alignment. Ten trains per week would pass south of Hawthorne. For comparison, an average total of 17 one-way trains would run between the Staging Yard and the Rail Equipment Maintenance Yard each week, carrying casks and other materials, as described in Section 2.2.3. The commercial trains (not including the locomotive) could consist of up to 60 cars and would be approximately 1,100 meters (3,600 feet) long. Depending on the weight of the train, three or four locomotives could be required. Commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials. Commercial railcars would also be hauled in trains carrying materials related to the construction (for example, reinforcing steel and cement) and operation (for example, waste packages, fuel oil) of the repository.

The operating characteristics of these commercial trains cannot be accurately defined; therefore, DOE cannot describe the travel times and operational movements of these trains. The Nevada Railroad Control Center described in Section 2.2.3 would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the railroad. During operation of commercial service, there would be an increase in truck traffic to and from the commercial sidings, but an overall decrease in truck traffic due to the shift to rail for transporting commercial freight. Under the Proposed Action without shared use, private companies near the rail line would continue to ship and receive freight using truck-only transport. Under the Shared-Use Option, some of those shipments would be diverted to rail, generally using trucks to access the commercial rail sidings.

2.2.6.3.2 Maintenance

Industry-track owners would likely perform maintenance of the industry track sidings, and commercial operators would likely perform maintenance of team track sidings. Because the commercial rail service would primarily use the same track as the cask trains, there would be only minimal need for maintenance beyond the anticipated levels of the Proposed Action without shared use. Maintenance techniques for commercial facilities would be similar to those described in Section 2.2.3.2.

2.2.6.4 Abandonment

Under the Shared-Use Option, the current assumption is that DOE would not abandon the proposed railroad upon completion of the DOE shipping campaign. Local communities or the private sector could maintain the rail line, and possibly some facilities not within the Yucca Mountain Site boundary, for other uses. DOE would decommission and dismantle facilities that would not be useful to local communities or the private sector.

2.3 No-Action Alternative

Council on Environmental Quality regulations (40 CFR 1502.14) require that the alternatives analysis in an EIS include the alternative of no action. Under the No-Action Alternative in this Rail Alignment EIS, DOE would not select a rail alignment within the Caliente or Mina rail corridor for the construction and operation of a railroad. As such, the No-Action Alternative provides a basis for comparison with the Proposed Action.

In the event that DOE were not to select a rail alignment in the Caliente or Mina rail corridor, the future course that it would pursue to meet its obligation under the NWPA is highly uncertain.

Under the No-Action Alternative, DOE would relinquish the ***public lands*** withdrawn from surface and mineral entry for purposes of evaluating the lands for the potential construction, operation, and maintenance of a railroad (70 *FR* 76854, December 28, 2005). These lands would then become available for surface and mineral entry.

2.4 DOE Preferred Alternative

The Council on Environmental Quality NEPA implementing regulations require an agency to identify its preferred alternative, if one or more exists, in the Draft EIS (40 CFR 1502.14[e]). For this Rail Alignment EIS, the DOE preferred alternative is to construct and operate a railroad along the Caliente rail alignment and to implement the Shared-Use Option. DOE identified preferred alternative segments within the Caliente rail alignment based on analysis of environmental impacts, engineering and cost factors, and regulatory compliance issues, including permit requirements and challenges, stakeholder preference, land-use conflicts, and uncertainties (See Table 2-30). All six of the common segments along the Caliente rail alignment are part of the DOE preferred alternative (Figure 2-55).

Table 2-30. Caliente rail alignment preferred alternative segments[a] (page 1 of 2).

DOE preferred alternative	Analysis factors
Caliente alternative segment	• The Eccles alternative segment would include an Interchange Yard that requires a large amount of fill in Clover Creek to enable construction of the Staging Yard. The Caliente alternative segment Interchange Yard location would avoid this impact to Clover Creek. • The Caliente alternative segment would have greater impacts to wetlands than the Eccles alternative segment. This would create greater regulatory complexity associated with obtaining a U.S. Army Corps of Engineers permit to fill jurisdictional waters. • The Caliente alternative segment would cross more private land than the Eccles alternative segment. • The Eccles alternative segment would be more complex to construct and would cost approximately twice as much as the Caliente alternative segment. • Based on scoping comments, more stakeholders prefer the Caliente alternative segment. • The Caliente alternative segment Indian Cove Staging Yard location would require filling 47 acres (0.19 square kilometer) of wetlands. The Upland Staging Yard location would avoid the impacts to wetlands associated with the Indian Cove location.[b]
Garden Valley alternative segment 1	• Engineering factors and regulatory complexity do not offer a means to discriminate among the Garden Valley alternative segments. • Garden Valley 1 would disturb less area than Garden Valley 2, 3, or 8.
South Reveille alternative segment 3	• No major environmental discriminator. • South Reveille 3 would avoid complex road and wash crossing that would be required for South Reveille 2.

Table 2-30. Caliente rail alignment preferred alternative segments[a] (page 2 of 2).

Preferred alternative segment	Analysis factors
Goldfield alternative segment 3	• Engineering uncertainty of crossing ***mining district*** associated with Goldfield 1. • Goldfield 4 would include two grade-separated crossings of U.S. Highway 95. • Goldfield 4 would have greater cultural resources impacts than Goldfield 1 or Goldfield 3. Goldfield 4 would enter the Goldfield Historic District. • Goldfield 3 would have fewer land-use conflicts than Goldfield 1 or Goldfield 4.
Bonnie Claire alternative segment 3	• No major environmental discriminator. • Bonnie Claire 2 would be close to the boundary of the Nevada Test and Training Range and would be more complex to construct than Bonnie Claire 3.
Oasis Valley alternative segment 1	• No major environmental discriminator. • Oasis Valley 1 would cross one parcel of private property. Oasis Valley 3 would not cross private property. • Oasis Valley 1 would require fewer earthworks for construction than Oasis Valley 3.

a. The DOE preferred rail alignment, Caliente, includes all six common segments.
b. DOE has not identified a preference for the Staging Yard location.

2.5 Comparison of Environmental Impacts

Council on Environmental Quality regulations that implement the procedural requirements of NEPA state that agencies should provide a comparison of the environmental impacts of the Proposed Action and its alternatives to sharply define the issues and provide a clear basis for choice. The comparison in this chapter is based on the information and analyses presented in subsequent chapters of this Rail Alignment EIS.

Tables 2-31 through 2-33 highlight the differences in potential impacts under the Proposed Action Caliente and Mina Implementing Alternatives and the No-Action Alternative. Table 2-31 lists the range of potential impacts under the Proposed Action for the Caliente Implementing Alternative and the Mina Implementing Alternative considering the largest and smallest potential impacts of the different alternative segments. Table 2-31 allows a comparison of the Proposed Action to the No-Action Alternative.

Potential impacts under the Shared-Use Option would be generally the same as impacts under the Proposed Action without shared use, unless noted otherwise in the tables. Potential commercial sidings and facilities that could be constructed under the Shared-Use Option would likely be constructed within the operations right-of-way to the extent practicable; therefore, the impacts of their construction are included within those impacts presented for the Proposed Action.

Tables 2-32 and 2-33 highlight potential impacts under the Proposed Action for the Caliente rail alignment and the Mina rail alignment, respectively. The tables include the alternative segments and common segments that could form each rail alignment. To make the tables more useful to the reader in discriminating between alternative segments, they focus on the major differences in impacts. Therefore, the tables do not include entries for all resource areas. Chapter 4 includes full summaries of potential impacts for each resource area.

These tables illustrate that the Mina Implementing Alternative would be environmentally preferable when compared to the Caliente Implementing Alternative. In general, the Mina Implementing Alternative would have fewer private-land conflicts, less surface disturbance, smaller wetlands impacts, and smaller air quality impacts than the Caliente Implementing Alternative. However, the Mina Implementing Alternative remains the nonpreferred alternative due to the objection of the Walker River Paiute Tribe to the transportation of spent nuclear fuel and high-level radioactive waste through its Reservation.

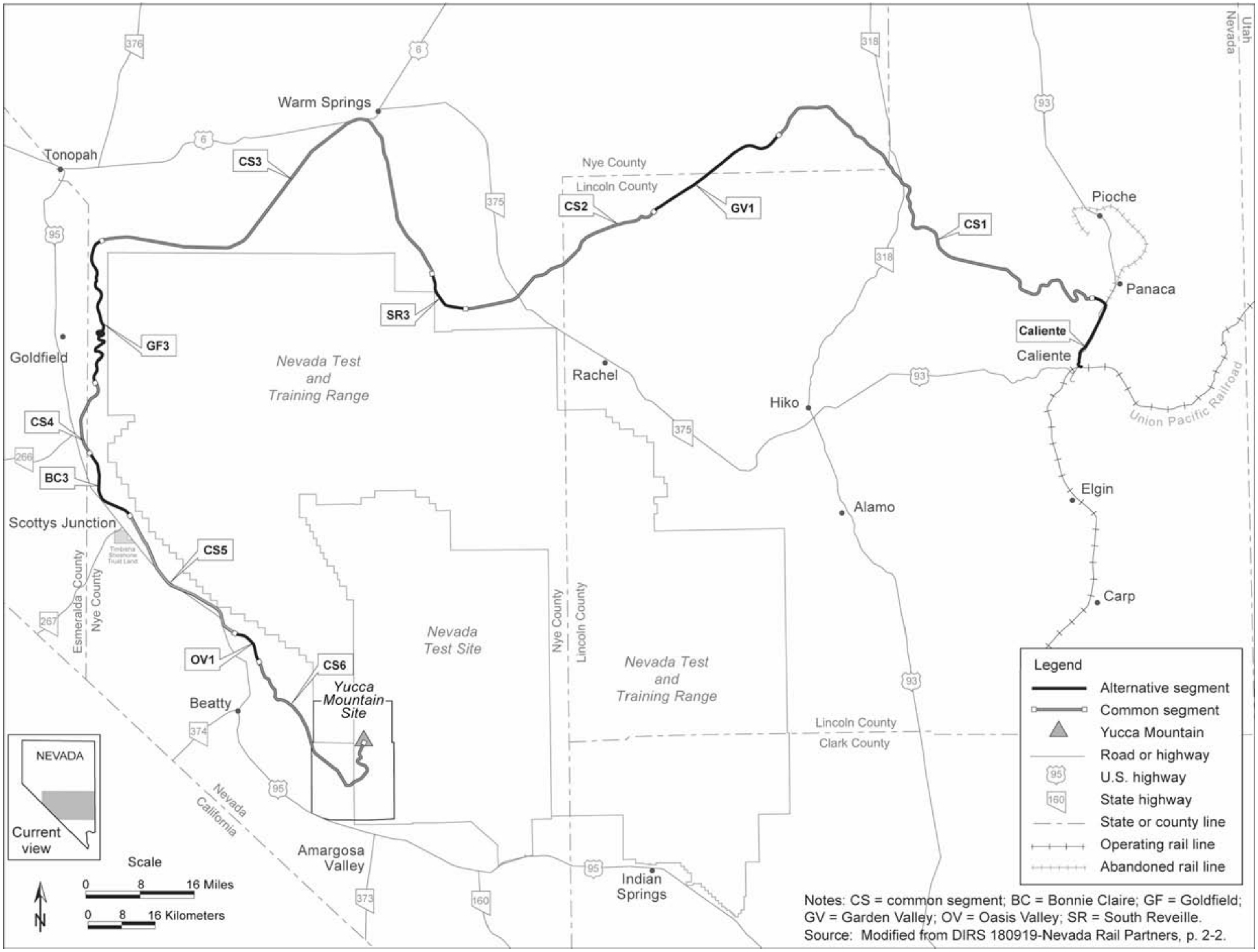


Figure 2-55. Preferred Caliente rail alignment, combination of common segments and alternative segments.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 1 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Physical setting	Total surface disturbance: 55 to 61 square kilometers (14,000 to 15,000 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 1.3 to 1.8 square kilometers (320 to 440 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.	Total surface disturbance: 40 to 48 square kilometers (9,900 to 12,000 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.011 to 0.014 square kilometer (2.7 to 3.5 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	No surface disturbance or prime farmland soils impacts because the rail line and associated facilities would not be constructed.
Land use and ownership	Land-use change on public lands for operations right-of-way. Private parcels the rail line would cross: 14 to 71. Area of private land affected: 0.33 to 0.72 square kilometer (82 to 178 acres). Private land needed for facilities: 1.15 square kilometers (284 acres) Active grazing allotments the rail line would cross: 24 to 27. Animal unit months lost: 1,019 to 1,050. (An animal unit month represents enough dry forage for one mature cow for one month.) Sections with unpatented mining claims that would be crossed: 32 to 37.	Land-use change on public lands and the Walker River Paiute Reservation for operations right-of-way. Private parcels the rail line would cross: 1 to 40. Area of private land affected: 0.21 to 0.59 square kilometer (52 to 146 acres). Active grazing allotments the rail line would cross: 5 to 8. Animal unit months lost: 159 to 246. Sections with unpatented mining claims that would be crossed: 23 to 30.	DOE would relinquish public lands along the Caliente rail alignment that were withdrawn for study under Public Land Order 7653. DOE would also relinquish the public lands segregated from surface and mineral entry for 2 years along the Caliente and Mina rail alignments.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 2 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Aesthetic resources	Small to moderate impact across Caliente rail alignment from operations. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads.	Same as the Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed. Public land would remain subject to BLM administration under applicable resource management plans. BLM would continue to manage public land for multiple use.
	Small impact from train operations. No contrast to strong contrast in the short term from passing trains.	Same as the Caliente Implementing Alternative.	
	Moderate impact from Staging Yard at Indian Cove. Moderate contrast from the operation of the facility in the Class III non-BLM lands, weak contrast from the track on BLM Class II lands at the north end; in each area, consistent with applicable BLM management objectives.	Small to moderate impact from Schurz alternative segments. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives. (Moderate to strong contrast in the short term from construction of the rail-over-road grade-separated crossing of U.S. Highway 95 for Schurz 6, which would not meet BLM Class III management objectives.)	
	Potential quarry CA-8B - Moderate impact. Moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93. No long-term impact under the Proposed Action; conveyor would be removed at end of construction phase. Moderate impact under the Shared-Use Option from the use of a conveyor across U.S. Highway 93 for 6 to 8 years.	Small to moderate impact from Montezuma alternative segment 1. Weak contrast from new linear feature adjacent to State Route 265 and weak to moderate contrast in Clayton Valley; would meet BLM Class III and IV management objectives.	
		Potential Garfield Hills quarry - Moderate impact. Moderate contrast in the short term from quarrying, ballast production facilities, and conveyor close to viewers that would be compatible with BLM Class III management objectives. Small impact in long term; production facilities and conveyor would be removed and quarried areas restored after closure of quarry at end of construction phase.	

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 3 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Aesthetic resources (continued)		Potential Gabbs Range quarry - Small to moderate impact. Weak to moderate contrast in the short term from ballast production facilities close to viewers that would be compatible with BLM Class III management objectives. Small impact in long term; production facilities would be removed after closure of quarry at end of construction phase. Potential North Clayton quarry - Weak to moderate impact. Moderate contrast in the short term from production facilities close to viewers that would be compatible with BLM Class IV management objectives. Small impact in long term; production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.	
Air quality and climate – Lincoln County	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from the construction or operation of the railroad, the Caliente Interchange Yard, or potential quarry CA-8B. The closest approach to a NAAQS standard would be for 24-hour PM_{10} (38 percent of standard for rail line and potential quarry CA-8B) during the construction phase.	Not applicable. No portion of a rail line along the Mina rail corridor would be constructed in Lincoln County.	No impacts because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 4 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Air quality and climate – Esmeralda County	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from railroad construction and operations. The closest approaches to a NAAQS standard would be for 24-hour PM_{10} (87 percent of standard) and 24-hour $PM_{2.5}$ (74 percent of standard), for rail line construction near Goldfield.	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from the railroad construction and operations or the potential Malpais Mesa quarry, with most values expected to be well below the NAAQS. The closest approach to a NAAQS standard would for 24-hour PM_{10} (63 percent of standard) and 24-hour $PM_{2.5}$ (54 percent of standard) for the rail line construction near Silver Peak.	No impacts because the rail line and associated facilities would not be constructed.
Air quality and climate – Nye County	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected from the railroad construction operations, with the possible exception of 24-hour PM_{10}. Modeling at the potential quarry NN-9B site in the South Reveille Valley indicates a potential exceedance (160 percent of standard, temporary and localized) of the 24-hour PM_{10} NAAQS. However, operating restrictions in the required Surface Disturbance Permit would likely reduce PM_{10} emissions, making such an exceedance unlikely.	No exceedances of the NAAQS would be expected from the railroad construction and operations, with most values expected to be far below the NAAQS.	No impacts because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 5 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Air quality and climate – Churchill County	Not applicable. No portion of the rail line along the Caliente rail alignment would be constructed in Churchill County.	No exceedances of the NAAQS would be expected from the railroad operations, with most values expected to be far below the NAAQS. There is no new rail line construction planned within Churchill County; the only construction activity would the operation of trains carrying construction material on the existing rail line.	No impacts because the rail line and associated facilities would not be constructed.
Air quality and climate – Lyon County	Not applicable. No portion of the rail line along the Caliente rail alignment would be constructed in Lyon County.	No exceedances of the NAAQS would be expected from the railroad construction and operations, with most values expected to be far below the NAAQS.	No impacts because the rail line and associated facilities would not be constructed.
Air quality and climate – Mineral County	Not applicable. No portion of the rail line along the Caliente rail alignment would be constructed in Mineral County.	Conservative modeling indicated potential exceedances of the NAAQS for PM_{10} and $PM_{2.5}$ in the following scenarios: • Rail line construction near Mina; 111 percent of the 24-hour PM_{10} NAAQS. • Rail line construction near Schurz, 186 percent of the 24-hour PM_{10} NAAQS. • Rail line construction near Schurz, 124 percent of the 24-hour $PM_{2.5}$ NAAQS. • Rail line construction near Schurz, 103 percent of the annual PM_{10} NAAQS. • Staging Yard construction near Hawthorne, 165 percent of the 24-hour PM_{10} NAAQS. • Staging Yard construction near Hawthorne, 118 percent of the 24-hour $PM_{2.5}$ NAAQS. • Staging Yard construction near Hawthorne, 102 percent of the annual PM_{10} NAAQS. • Operation of the potential Garfield Hills quarry near Hawthorne, 200 percent of the 24-hour PM_{10} NAAQS. However, operating restrictions in the required Surface Disturbance Permit would likely reduce PM_{10} and $PM_{2.5}$ emissions, making such exceedances unlikely. No exeedances for other criteria pollutants would be expected, with most values expected to be well below the NAAQS.	No impacts because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 6 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Air quality and climate – Mineral County (continued)		Modeling of emissions from construction of the Staging Yard at Hawthorne found that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be exceeded in the immediate vicinity of the Staging Yard under some conditions. Modeling of emissions from the operation of the potential quarry at Garfield Hills indicates that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be potentially exceeded. However, the required Surface Disturbance Permit is anticipated to greatly reduce PM_{10} and $PM_{2.5}$ emissions, making an exceedance of the NAAQS unlikely.	
Surface-water resources	Caliente alternative segment: Approximately 0.05 square kilometer (12 acres) of wetlands would be filled. Long-term reduced and potentially eliminated access to Caliente Hot Springs. Eccles alternative segment: Negligible amount of wetlands would be filled. Caliente alternative segment: Indian Cove Staging Yard, approximately 0.19 square kilometer (47 acres) of wetlands would be filled; Upland Staging Yard, no wetlands would be filled. Potential quarry CA-8B: Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding. Eccles alternative segment, Interchange Yard: Approximately 0.033 square kilometer (8.2 acres) of Clover Creek would be filled. Goldfield alternative segment 3: Long-term reduced and potentially eliminated access to Willow Springs.	Schurz alternative segments: Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 to 28 square meters (220 to 300 square feet) would be permanently filled to construct the bridge over the Walker River.	No impacts because the rail line and associated facilities would not be constructed. Erosion and sedimentation would continue under natural processes.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 7 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Groundwater resources	Physical impacts to existing groundwater resource features such as existing wells or springs resulting from railroad construction and operation would be small.	Physical impacts to existing groundwater resource features such as existing wells or springs resulting from railroad construction and operations would be small.	No impacts because the rail line and associated facilities would not be constructed.
	Groundwater withdrawals during construction from hydrographic areas in Panaca Valley, Sarcobatus Flat, and Oasis Valley could impact existing groundwater resources and users through localized and temporary drawdown of the water table. However, mitigation measures such as reducing the pumping rate or relocating proposed wells Pan V25/26, Pan V4, Pan V5, Pan V7/8, Pan V2, Pan V24, SaF1, OV3, OV4, and OV5/13 would minimize these impacts.	Groundwater withdrawals during construction from hydrographic areas in Clayton Valley, Sarcobatus Flat, Oasis Valley, and Columbus Salt Marsh could impact existing groundwater resources and users. However, mitigation measures such as reducing the pumping rate or relocating proposed wells CL-1a, SaF1, OV3, OV4, OV5/13, and CSM-2a would minimize these impacts.	
	The potential for groundwater withdrawals during the construction and operations phases to cause subsidence of the ground surface would be small.	Same as the Caliente Implementing Alternative.	
	The impact of proposed groundwater withdrawals on groundwater quality would be small, and the impact of withdrawals on downgradient hydrographic areas would be very small. The proposed withdrawals would not conflict with water quality standards protecting groundwater resources.	Same as the Caliente Implementing Alternative.	

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 8 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Biological resources	Short-term impact to 0.12 to 0.24 square kilometer (30 to 59 acres) wetland/riparian habitat. Long-term impact to 0.11 to 0.23 square kilometer (27 to 57 acres) wetland/riparian habitat. Short-term moderate impact on riparian and wetland vegetation along Oasis Valley alternative segment 3. Small to moderate impact on raptor nesting sites from the construction of potential quarry NN-9A. Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	Short-term impact to 0.01 to 0.05 square kilometer (2.5 to 12 acres) wetland/riparian habitat. Long-term impact to 0 to 0.01 square kilometer (0 to 2.5 acres) wetland/riparian habitat. Same as the Caliente Implementing Alternative. Small to moderate long-term impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat along Schurz alternative segment 6. Moderate long-term impact to Inter-Mountains Mixed Salt Desert Scrub along Mina common segment 1. Short-term and long-term moderate impacts to western snowy plover along Mina common segment 1. Moderate impact to winterfat communities – Montezuma alternative segments and potential Gabbs Range quarry site. Long-term moderate impacts to Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush at potential North Clayton and Malpais Mesa quarry sites. Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	No impacts because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 9 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Noise and vibration	Noise from construction activities in Caliente would exceed Federal Transit Administration guidelines. Daytime limits would be exceeded by 11 dBA from construction equipment noise and by 7 dBA from pile driving; 30-day DNL limit would be exceeded by 2 dBA from construction equipment noise and by 12 dBA from pile driving. Noise from construction equipment along the Eccles alternative segment would exceed limits by 5 dBA. No adverse noise or vibration impacts from construction trains or from operational train activity.	DOE estimates that 34 receptors would be included within the construction-train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would be considered temporary adverse impacts. Noise from operations would create adverse noise impacts at eight receptors in Silver Springs and one receptor in Wabuska. No vibration impacts from construction trains or from operational train activity.	No change to existing noise and vibration. No impacts because the rail line and associated facilities would not be constructed.
Socioeconomics – Throughout the region of influence	*Construction* Up to 1,083 animal unit months lost, valued at $57,000 (An animal unit month represents enough dry forage for one mature cow for one month.) *Operations* Continued lack of access to up to 1,083 animal unit months, valued at $57,000	*Construction* Up to 326 animal unit months lost, valued at $17,400 *Operations* Continued lack of access to up to 326 animal unit months, valued at $17,400	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics – Lincoln County	*Construction* Population: 1.7 percent increase Employment: 5.6 percent increase Real disposable income: 4.1 percent increase Gross regional product: 28 percent increase State and local government spending: 1.9 percent increase Traffic impacts to local highways: level of service on U.S. Highway 93 at Caliente would degrade from A to B	Not applicable	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 10 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Socioeconomics – Lincoln County (continued)	*Operations* Population: 2.9 percent increase Employment: 3.9 percent increase Real disposable income: 4.7 percent increase Gross regional product: 5.2 percent increase State and local government spending: 3.2 percent increase		
Socioeconomics – Esmeralda County	*Construction* Population: 1.1 percent increase Employment: 2.7 percent increase Real disposable income: 7.6 percent increase Gross regional product: 9.5 percent increase State and local government spending: 2.2 percent increase *Operations* Population: 2.0 percent increase Employment: 3.0 percent increase Real disposable income: 2.9 percent increase Gross regional product: 3.8 percent increase State and local government spending: 3.1 percent increase	*Construction* Population: 3.1 percent increase Employment: 14 percent increase Real disposable income: 27 percent increase Gross regional product: 57 percent increase State and local government spending: 4.6 percent increase *Operations* Population: 7.0 percent increase Employment: 14 percent increase Real disposable income: 10 percent increase Gross regional product: 24 percent increase State and local government spending: 9.9 percent increase	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 11 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Socioeconomics – Nye County	*Construction*	*Construction*	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
	Population: 0.2 percent increase	Population: 0.16 percent increase	
	Employment: 1.2 percent increase	Employment: 0.6 percent increase	
	Real disposable income: 0.9 percent increase	Real disposable income: 0.4 percent increase	
	Gross regional product: 3.5 percent increase	Gross regional product: 1 percent increase	
	State and local government spending: 0.4 percent increase	State and local government spending: 0.2 percent increase	
	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	
	Operations	*Operations*	
	Population: 0.3 percent increase	Population: 0.3 percent increase	
	Employment: 0.3 percent increase	Employment: 0.1 percent increase	
	Real disposable income: 0.3 percent increase	Real disposable income: 0.1 percent increase	
	Gross regional product: 0.5 percent increase	Gross regional product: 0.2 percent increase	
	State and local government spending: 0.3 percent increase	State and local government spending: 0.1 percent increase	
	Housing: county-wide population increase could place a strain on housing units in Pahrump	Housing: county-wide population increase could place a strain on housing units in Pahrump	
	Health-care services: moderate impacts due to population increases in medically underserved area	Health-care services: moderate impacts due to population increases in medically underserved area	
	Fire-protection services: moderate impacts in Pahrump due to population increases in underserved area	Fire-protection services: moderate impacts in Pahrump due to population increases in underserved area	
	Educational services: addition of 30 school-aged children to overcrowded schools	Educational services: addition of 23 school-aged children to overcrowded schools	
	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	Traffic impacts to local highways: level of service on U.S. Highway 95 near access to Yucca Mountain Site would degrade from B to C	

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 12 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Socioeconomics - Churchill County	Not applicable	*Construction and Operations* Delay impacts on road traffic at grade crossings; less than 1 percent of vehicles traveling on U.S. Highway 50A in Hazen would incur a delay of less than 1 minute Rail impacts on existing rail traffic: moderate	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics - Lyon County	Not applicable	*Construction* Population: 0.01 percent increase Employment: 0.02 percent increase Real disposable income: 0.03 percent increase Gross regional product: 0.04 percent increase State and local government spending: 0.01 percent increase Rail impacts on existing rail traffic: moderate *Operations* Population: less than 0.01 percent increase Employment: 0.01 percent increase Real disposable income: 0.01 percent increase Gross regional product: 0.01 percent increase State and local government spending: 0.01 percent increase Rail impacts on existing rail traffic: moderate	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 13 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Socioeconomics – Walker River Paiute Reservation	Not applicable	*Construction* Assuming one of the construction camps is placed on the Walker River Paiute Reservation: Employment: up to 20 additional jobs Real disposable income: up to $386,000 Gross regional product: up to $1.4 million *Operations* Included in the Mineral County estimates because the forecasting model cannot discriminate impacts to the Reservation.	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics – Mineral County	Not applicable	*Construction* Population: 1.4 percent increase Employment: 6.1 percent increase Real disposable income: 4.5 percent increase Gross regional product: 14 percent increase State and local government spending: 1.8 percent increase Rail impacts on existing rail traffic: moderate *Operations* Population: 1.6 percent increase Employment: 2.6 percent increase Real disposable income: 2.8 percent increase Gross regional product: 1.9 percent increase State and local government spending: 1.5 percent increase Rail impacts on existing rail traffic: moderate	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 14 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Socioeconomics - Clark County	*Construction* Population: less than 0.1 percent increase Employment: 0.1 percent increase Real disposable income: 0.2 percent increase Gross regional product: 0.2 percent increase State and local government spending: small increase *Operations* Population: less than 0.1 percent increase Employment: less than 0.1 percent increase Real disposable income: less than 0.1 percent increase Gross regional product: less than 0.1 percent increase State and local government spending: less than 0.1 percent increase	*Construction* Population: 0.04 percent increase Employment: 0.1 percent increase Real disposable income: 0.1 percent increase Gross regional product: 0.1 percent increase State and local government spending: 0.04 percent increase *Operations* Population: less than 0.01 percent increase Employment: less than 0.1 percent increase Real disposable income: less than 0.1 percent increase Gross regional product: less than 0.1 percent increase State and local government spending: less than 0.1 percent increase	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.
Socioeconomics - Washoe County/Carson City	Not applicable	*Construction* Population: less than 1 percent increase Employment: less than 0.3 percent increase Real disposable income: less than 0.3 percent increase Gross regional product: less than 0.3 percent increase State and local government spending: less than 0.1 percent increase *Operations* Population: less than 0.1 percent increase Employment: less than 0.1 percent increase Real disposable income: less than 0.1 percent increase Gross regional product: less than 0.1 percent increase State and local government spending: less than 0.1 percent increase	No impacts to existing socioeconomic conditions because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 15 of 17).

Resource Area	Proposed Action		
	Caliente Implementing Alternative	Mina Implementing Alternative	No-Action Alternative
Occupational and public health and safety	Occupational radiological impacts: less than one latent cancer fatality Public radiological impacts: less than one latent cancer fatality Nonradiological industrial hazards during proposed railroad construction and operations: 2.22 worker fatalities Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 8 fatalities Rail-related fatalities during construction and operations: 1.3 fatalities *Shared-Use Option* Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 8 fatalities Rail-related fatalities during construction and operations: 4.6 fatalities	Occupational radiological impacts: less than one latent cancer fatality Public radiological impacts: less than one latent cancer fatality Nonradiological industrial hazards during proposed railroad construction and operations: 2 worker fatalities Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 7 fatalities Rail-related accidents during construction and operations: 1.1 fatalities *Shared-Use Option* Vehicular-related accidents during construction: 6 fatalities Vehicular-related accidents during operations: 7 fatalities Rail-related fatalities during construction and operations: 7.4 fatalities	No impacts because the rail line and associated facilities would not be constructed or operated.
Utilities, energy and materials	Utility interfaces: Potential for short-term interruption of service during construction. No permanent or long-term loss of service or prevention of future service area expansions. Public water systems: Most water would be supplied by new wells; small effect on public water systems from population increase attributable to construction and operations employees.	Utility interfaces: Potential for short-term interruption of service during construction. No permanent or long-term loss of service or prevention of future service area expansions. Public water systems: Most water would be supplied by new wells; small effect on public water systems from population increase attributable to construction and operations employees.	No impacts because the rail line and associated facilities would not be constructed.

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 16 of 17).

Resource Area	Proposed Action: Caliente Implementing Alternative	Proposed Action: Mina Implementing Alternative	No-Action Alternative
Utilities, energy, and materials (continued)	Wastewater treatment systems: Dedicated treatment systems would be provided at construction camps and operations facilities; small impact on public systems from population increase attributable to construction and operations employees.	Wastewater treatment systems: Same as Caliente Implementing Alternative.	
	Fossil fuels: Demand would be approximately 6.5 percent of statewide use during construction and less than 0.25 percent of statewide use during operations. Demand could be met by existing regional supply systems and suppliers.	Fossil fuels: Demand would be approximately 6 percent of statewide use during construction and less than 0.25 percent of statewide use during operations. Demand could be met by existing regional supply systems and suppliers.	
	Materials: Requirements generally would be very small in relation to supply capacity.	Materials: Same as Caliente Implementing Alternative.	
	Shared-Use Option Fossil fuels: Demand would be less than 0.3 percent of statewide use during operations. Demand could be met by existing regional supply systems and suppliers.	*Shared-Use Option* Fossil fuels: Same as Caliente Implementing Alternative.	
Hazardous materials and waste	Small (Apex Landfill) to moderate (smaller landfills) impacts during the construction phase and no impact to small impact during the operations phase from nonhazardous waste (solid and industrial and special waste) disposal.	Same as Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed.
	Small impacts from use of hazardous materials during the construction and operations phases.	Same as Caliente Implementing Alternative.	
	Small impacts from hazardous-waste disposal during the construction and operations phases.	Same as Caliente Implementing Alternative.	
	Small impacts during the operations phase from low-level radioactive waste disposal for wastes that would be generated at the Cask Maintenance Facility.	Same as Caliente Implementing Alternative.	

Table 2-31. Comparison of potential impacts under the Proposed Action (Caliente Implementing Alternative and Mina Implementing Alternative) and the No-Action Alternative[a] (page 17 of 17).

Resource Area	Proposed Action		No-Action Alternative
	Caliente Implementing Alternative	Mina Implementing Alternative	
Cultural resources	Numerous archaeological sites have been identified along segments of alignments subjected to sample inventory. Potential direct and indirect impacts to National Register-eligible sites and to other sites that might be identified during the complete survey. Construction could result in impacts to the early Mormon colonization cultural landscape, Pioche-Hiko silver mining community route, 1849 Emigrant Trail campsites, and American Indian trail systems. Indirect effects to a National Register-eligible rock-art site are likely from two quarry sites. More than 50 National Register-eligible sites have been identified along segments of alignments subjected to sample inventory.	Numerous archaeological sites have been identified along segments of alignments subjected to sample inventory. Potential direct and indirect impacts to National Register-eligible sites and to other sites that might be identified during the complete survey. More than 60 National Register-eligible sites have been identified along segments of alignments subjected to sample inventory.	No impacts because the rail line and associated facilities would not be constructed.
Paleontological resources	No direct impacts to known paleontological resources.	Same as Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed.
Environmental justice	Constructing and operating the proposed rail line along the Caliente rail alignment would not result in disproportionately high and adverse impacts to minority or low-income populations.	Same as Caliente Implementing Alternative.	No impacts because the rail line and associated facilities would not be constructed.

a. BLM = Bureau of Land Management; CO = carbon monoxide; dBA = A-weighted decibels; DNL = day-night average noise level; DOE = U.S. Department of Energy; NAAQS = National Ambient Air Quality Standards; NO_x = oxides of nitrogen; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

Table 2-32. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 1 of 7).

Resource Area	Alternative segments and common segments	
	Interface with the Union Pacific Railroad – Caliente	Interface with the Union Pacific Railroad – Eccles
Physical setting	Total surface disturbance: 3.1 square kilometers (770 acres). Loss of prime farmland soils: 0.16 square kilometer (40 acres). Less than 0.1 percent of prime farmland soils in Lincoln County.	Total surface disturbance: 2.1 square kilometers (520 acres). Loss of prime farmland soils: 0.10 square kilometer (24 acres). Less than 0.1 percent of prime farmland soils in Lincoln County.
Land use and ownership	Private parcels crossed: 32. Area of private land affected: 0.31 square kilometer (77 acres). Active grazing allotments crossed: 2. Animal unit months lost: 6 (0.6 percent). Indian Cove Staging Yard area of private land affected: 0.73 square kilometer (180 acres) Upland Staging Yard, area of private land affected: 0.45 square kilometer (110 acres)	Private parcels crossed: 11. Area of private land affected: 0.32 square kilometer (80 acres). Active grazing allotments crossed: 4. Animal unit months lost: 18 (1.5 percent).
Aesthetic resources	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Moderate impact from Staging Yard at Indian Cove. Moderate contrast from the operation of the facility in the Class III non-BLM lands, weak contrast from the track on BLM Class II lands at the north end; in each area, consistent with applicable BLM objectives. Potential quarry CA-8B - Moderate impact. Moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93, consistent with surrounding non-BLM lands treated as Class III. No long-term impact under the Proposed Action; conveyor would be removed at end of construction phase.	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Quarry CA-8B would not be developed for the Eccles alternative segment.
Surface-water resources	Caliente alternative segment: Approximately 0.05 square kilometer (12 acres) of wetlands would be filled. Long-term reduced and potentially eliminated access to Caliente Hot Springs. Indian Cove Staging Yard: Approximately 0.19 square kilometer (47 acres) of wetlands would be filled. Potential quarry CA-8B: Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.	Eccles alternative segment: Negligible amount of wetlands would be filled. Eccles Interchange Yard: Approximately 0.033 square kilometer (8.2 acres) of Clover Creek would be filled.

Table 2-32. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 2 of 7).

Resource Area	Alternative segments and common segments	
	Interface with the Union Pacific Railroad – Caliente	Interface with the Union Pacific Railroad – Eccles
Groundwater resources	Groundwater withdrawals from the hydrographic area in Panaca Valley could impact existing groundwater users. However, mitigation measures such as reducing the pumping rate at or relocating proposed wells Pan V25/26, Pan V4, Pan V5, and Pan V3/6 would minimize these impacts.	Groundwater withdrawals from the hydrographic area in Panaca Valley could impact existing groundwater users. However, mitigation measures such as reducing the pumping rate at or relocating proposed wells Pan V3/6 and Pan V25/26 would minimize these impacts.
Biological resources	Caliente alternative segment and Interchange Yard: Short-term impact to 0.09 square kilometer (22 acres) wetland/riparian habitat. Long-term impact to 0.11 square kilometer (27 acres) wetland/riparian habitat. Upland Staging Yard: Short-term impact to 0.01 square kilometer (2.5 acres) wetland/riparian habitat. Long-term impact to less than 0.01 square kilometer (2 acres) wetland/riparian habitat. Indian Cove Staging Yard: Short-term impact to 0.09 square kilometer (22 acres) wetland/riparian habitat. Long-term impact to 0.04 square kilometer (9.9 acres) wetland/riparian habitat. Long-term moderate impact on riparian and wetland vegetation from the construction of a siding for potential quarry CA-8B.	Eccles alternative segment and Interchange Yard: Short-term impact to 0.10 square kilometer (24 acres) wetland/riparian habitat. Long-term impact to 0.10 square kilometer (24 acres) wetland/riparian habitat. Eccles-North Staging Yard: Short-term impact to 0.01 square kilometer (2.6 acres) wetland/riparian habitat. Long-term impact to 0.01 square kilometer (2.6 acres) wetland/riparian habitat.
Noise and vibration	Noise from construction activities would exceed Federal Transportation Administration guidelines. Daytime limits would be exceeded by 11 dBA from construction equipment noise and by 7 dBA from pile driving; 30-day DNL limit would be exceeded by 2 dBA from construction equipment noise and by 12 dBA from pile driving. There would be no adverse impacts from the operation of construction trains. There would be no receptors within the 65 DNL contour. There would be no adverse impacts from noise for the operation of trains along the rail alignment. No receptors would fall within the 3 dBA increase contour or the 65 DNL contour. There would be no adverse impacts from vibrations, which would fall below Federal Transportation Administration criteria.	Noise from construction activities would exceed Federal Transportation Administration guidelines. Construction equipment noise would cause daytime limits to be exceeded by 5 dBA. There would be no adverse impacts from the operation of construction trains. No receptors would fall within the 65 DNL contour. There would be no adverse impacts from noise for the operation of trains along the rail alignment. No receptors would be within the 65 DNL contour. There would be no adverse impacts from vibrations, which would fall below Federal Transportation Administration criteria.
Cultural resources	Potential direct and indirect impacts at three known National Register-eligible sites and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at two known potentially eligible sites and at other sites that might be identified during the complete survey.

Table 2-32. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments [a] (page 3 of 7).

Resource Area	Alternative segments and common segments			
	Caliente common segment 1			
Physical setting	Total surface disturbance: 12 square kilometers (3,000 acres). Loss of prime farmland soils: 1.2 square kilometers (300 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.			
Land use and ownership	Private parcels crossed: 1. Area of private land affected: 0.0007 square kilometer (0.2 acre). Active grazing allotments crossed: 10. Animal unit months lost: 453 (0.7 percent).			
Cultural resources	Construction activities could result in impacts to the early Mormon colonization cultural landscape, the Pioche-Hiko silver mining community route, 1849 emigrant campsites, a National Register-eligible prehistoric site in the vicinity of Black Rock Springs, and to other sites that might be identified during the complete survey.			
	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Physical setting	Total surface disturbance: 3.4 square kilometers (840 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.29 square kilometer (72 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.	Total surface disturbance: 3.6 square kilometers (890 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.4 square kilometer (99 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.	Total surface disturbance: 3.7 square kilometers (910 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0 square kilometer (0 acre).	Total surface disturbance: 3.7 square kilometers (910 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.36 square kilometer (89 acres). Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties.
Land use and ownership	Active grazing allotments crossed: 5. Animal unit months lost: 120 (1.34 percent).	Active grazing allotments crossed: 4. Animal unit months lost: 131 (1.1 percent).	Active grazing allotments crossed: 5. Animal unit months lost: 126 (1.4 percent).	Active grazing allotments crossed: 4. Animal unit months lost: 131 (1.1 percent).

Table 2-32. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 4 of 7).

Resource Area	Alternative segments and common segments			
	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Aesthetic resources	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.	Small impact. Track on some parts of the alternative segment would create a new linear feature that would not meet BLM Class II management objectives. Vegetated earthwork berms would reduce the contrast to levels consistent with Class II.
Cultural Resources	Construction could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.	Construction could result in direct and indirect impacts to American Indian trail systems, two National Register-eligible sites, and to other sites that might be identified during the complete survey.	Construction could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.	Construction could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.
	Caliente common segment 2			
Physical setting	Total surface disturbance: 4.1 square kilometers (1,000 acres). Would result in topsoil loss and increased potential for erosion.			
Land use and ownership	Active grazing allotments crossed: 3. Animal unit months lost: 128 (0.4 percent).			
Cultural resources	Potential indirect impacts include visual impacts to the Black Top archaeological locality; potential direct and indirect impacts to American Indian trail systems and a potential historic ranching cultural landscape, and to other sites that might be identified during the complete survey.			
	South Reveille 2		South Reveille 3	
Physical setting	Total surface disturbance: 4.8 square kilometers (1,200 acres). Would result in topsoil loss and increased potential for erosion.		Total surface disturbance: 5 square kilometers (1,240 acres). Would result in topsoil loss and increased potential for erosion.	
Land use and ownership	Active grazing allotments crossed: 1. Animal unit months lost: 54 (0.2 percent). Sections with unpatented mining claims the alignment would cross: 2 sections with 72 claims.		Active grazing allotments crossed: 1. Animal unit months lost: 58 (0.2 percent). Sections with unpatented mining claims the alignment would cross: 2 sections with 72 claims.	

Table 2-32. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 5 of 7).

Resource Area	Alternative segments and common segments	
	South Reveille 2	South Reveille 3
Biological resources	Small to moderate impact on raptor nesting sites from the construction of potential quarry NN-9A.	Small to moderate impact on raptor nesting sites from the construction of potential quarry NN-9A.
Cultural resources	Rail line construction could represent a long-term indirect impact on a National Register-eligible rock-art site, and potential direct and indirect impacts at other sites that might be identified during the complete survey.	Rail line construction could represent a long-term indirect impact on a National Register-eligible rock-art site, and potential direct and indirect impacts at other sites that might be identified during the complete survey.

Resource Area	Caliente common segment 3
Physical setting	Total surface disturbance: 10 square kilometers (2,500 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Active grazing allotments crossed: 3. Animal unit months lost: 250 (0.6 percent). Sections with unpatented mining claims the alignment would cross: 10 sections with 166 claims.
Cultural resources	Potential direct and indirect impacts at one known National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.

Resource Area	Goldfield 1	Goldfield 3	Goldfield 4
Physical setting	Total surface disturbance: 9.8 square kilometers (2,400 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 10.2 square kilometers (2,500 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 6.5 square kilometers (1,600 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 6. Area of private land affected: 0.37 square kilometer (91 acres). Unpatented mining claims the alignment would cross: 14 sections with 474 claims.	Private parcels crossed: 2. Area of private land affected: 0.01 square kilometer (2 acres). Unpatented mining claims the alignment would cross: 14 sections with 359 claims.	Private parcels crossed: 37. Area of private land affected: 0.23 square kilometer (56 acres). Unpatented mining claims the alignment would cross: 19 sections with 538 claims.
Cultural resources	Potential direct and indirect impacts at possible Western Shoshone camps, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at one possible Western Shoshone camp, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at multiple National Register-eligible sites and in and around the town of Goldfield, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
Surface-water resources	No impact to Willow Springs.	Long-term reduced and potentially eliminated access to Willow Springs.	No impact to Willow Springs.

Table 2-32. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 6 of 7).

Resource Area	Alternative segments and common segments	
	Caliente common segment 4	
Physical setting	Total surface disturbance: 1.1 square kilometers (270 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	
	Bonnie Claire 2	Bonnie Claire 3
Physical setting	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.
Cultural resources	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.
	Common segment 5	
Physical setting	Total surface disturbance: 3.1 square kilometers (770 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at two National Register-eligible archaeological sites, 20 additional resources that have been recorded within the region of influence, and at other sites that might be identified during the complete survey.	
	Oasis Valley 1	Oasis Valley 3
Physical setting	Total surface disturbance: 1 square kilometer (250 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.3 square kilometers (320 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 1. Area of private land affected: 0.04 square kilometer (9.9 acres). Active grazing allotments crossed: 1. Animal unit months lost: 8 (0.8 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.	Private parcels crossed: 0. Area of private land affected: 0. Active grazing allotments crossed: 1. Animal unit months lost: 13 (1.4 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.
Groundwater resources	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed wells OV3, OV4, and OV5 or drawing water from alternative wells nearby would minimize these impacts.	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed well OV13 or drawing water from alternative wells nearby would minimize these impacts.

Table 2-32. Comparison of potential impacts under the Proposed Action – Caliente rail alignment alternative segments and common segments[a] (page 7 of 7).

Resource Area	Alternative segments and common segments	
	Oasis Valley 1	Oasis Valley 3
Biological resources	No impact on riparian and wetland vegetation.	Short-term moderate impact on riparian and wetland vegetation.
Cultural resources	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Common segment 6	
Physical setting	Total surface disturbance: 5.5 square kilometers (1,400 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at archaeological sites recorded in region of influence, including three National Register-eligible resources, and at other sites that might be identified during the complete survey.	
Land use and ownership	Sections with unpatented mining claims the alignment would cross: 4 sections with 34 claims.	
Biological resources	Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	

a. BLM = Bureau of Land Management; dBA = A-weighted decibels; DOE = U.S. Department of Energy.

Table 2-33. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 1 of 7).

Resource area	Existing rail line/alternative segments/common segments
	Union Pacific Railroad Hazen Branchline
Noise and vibration	DOE estimates that 34 receptors would be included within the construction train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would be considered temporary adverse impacts. Noise from operations would create adverse noise impacts at eight receptors in Silver Springs and one receptor in Wabuska. There would be no adverse impact from vibrations, which would fall below Federal Transportation Administration criteria.
	Department of Defense Branchline North
Physical setting	Total surface disturbance: 0.16 square kilometer (40 acres). Would result in topsoil loss and increased potential for erosion.

Table 2-33. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 2 of 7).

	Existing rail lines/alternative segments/common segments			
Resource area	Schurz alternative segment 1	Schurz alternative segment 4	Schurz alternative segment 5	Schurz alternative segment 6
Physical setting	Total surface disturbance: 4.6 square kilometers (1,100 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.011 square kilometer (2.7 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	Total surface disturbance: 6.1 square kilometers (1,500 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.012 square kilometer (3 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	Total surface disturbance: 6.9 square kilometers (1,700 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.014 square kilometer (3.5 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.	Total surface disturbance: 6.5 square kilometers (1,600 acres). Would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.014 square kilometer (3.5 acres). Less than 3 percent of the prime farmland soils of the Walker River Paiute Reservation.
Aesthetic resources	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives. Moderate to strong contrast in the short term from construction of the rail-over-road crossing of U.S. Highway 95 for Schurz 6, which would not meet BLM Class III management objectives.

Table 2-33. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 3 of 7).

Resource area	Existing rail line/alternative segments/common segments			
	Schurz alternative segment 1	Schurz alternative segment 4	Schurz alternative segment 5	Schurz alternative segment 6
Biological resources	No impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.03 square kilometer (6.4 acres) wetland/riparian habitat. Long-term impact to 0.01 square kilometer (3.1 acres) wetland/riparian habitat.	No impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.03 square kilometer (6.4 acres) wetland/riparian habitat. Long-term impact to 0.01 square kilometer (3.1 acres) wetland/riparian habitat.	No impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.02 square kilometer (4.9 acres) wetland/riparian habitat. No long-term impact to wetland/riparian habitat.	Small to moderate long-term impacts to Inter-Mountains Mixed Salt Desert Scrub and Inter-Mountain Basins Greasewood Flat. Short-term impact to 0.01 square kilometer (3.1 acres) wetland/riparian habitat. No long-term impact to wetland/riparian habitat.
Surface-water resources	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 square meters (220 square feet) would be permanently filled to construct the bridge over the Walker River.	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 square meters (220 square feet) would be permanently filled to construct the bridge over the Walker River.	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 28 square meters (300 square feet) would be permanently filled to construct the bridge over the Walker River.	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 28 square meters (300 square feet) would be permanently filled to construct the bridge over the Walker River.
Cultural resources	Potential direct and indirect impacts at two potential National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at three potential National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at two potential National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Department of Defense Branchline South			
Physical setting	Total surface disturbance: 0.26 square kilometer (64 acres). Would result in topsoil loss and increased potential for erosion.			
	Mina common segment 1			
Physical setting	Total surface disturbance: 12 square kilometers (3,000 acres). Would result in topsoil loss and increased potential for erosion.			

Table 2-33. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 4 of 7).

Resource area	Existing rail line/alternative segments/common segments		
	Mina common segment 1		
Land use and ownership	Private parcels the rail line would cross: 1. Area of private land affected: 0.21 square kilometer (53 acres). Active grazing allotments the rail line would cross: 3. Animal unit months lost: 104 (0.6 percent).		
Aesthetic resources	Potential Garfield Hills quarry - Moderate impact. Moderate contrast in the short term from quarrying, ballast production facilities, and conveyor close to viewers that would be compatible with BLM Class III management objectives. Small impact to no impact in long term; production facilities and conveyor would be removed and quarried areas restored after closure of quarry at end of construction phase. Potential Gabbs Range quarry - Small to moderate impact. Weak to moderate contrast in the short term from ballast production facilities close to viewers that would be compatible with BLM Class III management objectives. Small impact to no impact in long term; production facilities would be removed after closure of quarry at end of construction phase.		
Biological resources	Moderate long-term impact to Inter-Mountains Mixed Salt Desert Scrub. Moderate impact to winterfat communities – Potential Gabbs Range quarry.		
Cultural resources	Potential direct and indirect impacts at multiple National Register-eligible sites, at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.		
	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Physical setting	Total surface disturbance: 16 square kilometers (4,000 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 11 square kilometers (2,700 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 17 square kilometers (4,200 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 0. Area of private land affected: 0 square kilometer (0 acre). Active grazing allotments crossed: 4. Animal unit months lost: 117 (1.2 percent). Unpatented mining claims the alignment would cross: 17 sections containing 202 claims.	Private parcels crossed: 38. Area of private land affected: 0.34 square kilometer (84 acres). Active grazing allotments crossed: 1. Animal unit months lost: 47 (0.5 percent). Unpatented mining claims the alignment would cross: 24 sections containing 655 claims.	Private parcels crossed: 1. Area of private land affected: 0.1 square kilometer (24 acres). Active grazing allotments crossed: 2. Animal unit months lost: 129 (0.8 percent). Unpatented mining claims the alignment would cross: 19 sections containing 249 claims.

Table 2-33. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 5 of 7).

Resource area	Existing rail line/alternative segments/common segments		
	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Aesthetic resources	Small to moderate impact. No to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, access roads. Weak contrast from new linear feature adjacent to State Route 265 and weak to moderate contrast in Clayton Valley; would meet BLM Class III and IV management objectives. Potential North Clayton quarry - Small to moderate impact. Moderate contrast in the short term from production facilities close to viewers that would be compatible with BLM Class IV management objectives. Small impact to no impact in long term; production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, access roads.	Small to moderate impact. No contrast to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, access roads. Potential North Clayton quarry - Weak to moderate impact. Moderate contrast in the short term from production facilities close to viewers that would be compatible with BLM Class IV management objectives. Small impact to no impact in long term; production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.
Groundwater resources	Groundwater withdrawals from hydrographic area 143 (Clayton Valley) would impact existing users of groundwater in the vicinity of Silver Peak. However, mitigation measures such as reducing the pumping rate at proposed well CL-1a would minimize these impacts.	Groundwater withdrawals would not result in impacts on existing groundwater users or groundwater resources.	Groundwater withdrawals would not result in impacts on existing groundwater users or groundwater resources.

Table 2-33. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 6 of 7).

Resource area	Existing rail line/alternative segments/common segments		
	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Biological resources	Moderate impact to winterfat communities.	Moderate impact to winterfat communities.	Moderate impact to winterfat communities.
	Long-term moderate impacts to Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush at potential North Clayton and Malpais Mesa quarry sites.		Long-term moderate impacts to Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush at potential Malpais Mesa quarry site.
Cultural resources	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Mina common segment 2		
Physical setting	Total surface disturbance: 0.28 square kilometer (69 acres). Would result in topsoil loss and increased potential for erosion.		
Cultural resources	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that may be identified during the complete survey.		
	Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3	
Physical setting	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.9 square kilometers (470 acres). Would result in topsoil loss and increased potential for erosion.	
Cultural resources	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at one National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	
	Common segment 5		
Physical setting	Total surface disturbance: 3.1 square kilometers (770 acres). Would result in topsoil loss and increased potential for erosion.		
Cultural resources	Potential direct and indirect impacts at two National Register-eligible archaeological sites, 20 additional resources that have been recorded within the region of influence, and at other sites that might be identified during the complete survey.		

Table 2-33. Comparison of potential impacts under the Proposed Action – Mina rail alignment existing rail line, alternative segments, and common segments[a] (page 7 of 7).

Resource area	Existing rail line/alternative segments/common segments	
	Oasis Valley alternative segment 1	Oasis Valley alternative segment 3
Physical setting	Total surface disturbance: 1 square kilometer (250 acres). Would result in topsoil loss and increased potential for erosion.	Total surface disturbance: 1.3 square kilometers (320 acres). Would result in topsoil loss and increased potential for erosion.
Land use and ownership	Private parcels crossed: 1 Area of private land affected: 0.04 square kilometer (9.9 acres). Active grazing allotments crossed: 1 Animal unit months lost: 8 (0.8 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.	Private parcels crossed: 0 Area of private land affected: 0 Active grazing allotments crossed: 1 Animal unit months lost: 13 (1.4 percent). Unpatented mining claims the alignment would cross: 2 sections with 14 claims.
Groundwater resources	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed wells OV3, OV4, and OV5 or drawing water from nearby alternative wells would minimize these impacts.	Groundwater withdrawals from hydrographic area 228 (Oasis Valley) would impact existing groundwater users or groundwater resources. However, mitigation measures such as reducing the pumping rate at proposed well OV13 or drawing water from nearby alternative wells would minimize these impacts.
Biological resources	No impact on riparian and wetland vegetation.	Short-term moderate impact on riparian and wetland vegetation.
Cultural resources	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	Potential direct and indirect impacts at a historic cattle ranch, campsite, archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.
	Common segment 6	
Physical setting	Total surface disturbance: 5.5 square kilometers (1,400 acres). Would result in topsoil loss and increased potential for erosion.	
Biological resources	Short-term moderate impacts to desert bighorn sheep southwest of common segment 6.	
Land use and ownership	Sections with unpatented mining claims the alignment would cross: 4 sections with 34 claims.	
Cultural resources	Potential direct and indirect impacts at archaeological sites recorded in region of influence, including three National Register-eligible resources, and at other sites that might be identified during the complete survey.	

a. BLM = Bureau of Land Management; dBA = A-weighted decibels; DNL = day-night average noise level; DOE = U.S. Department of Energy.

Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor

DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada

DOE/EIS-0369D

Volume II

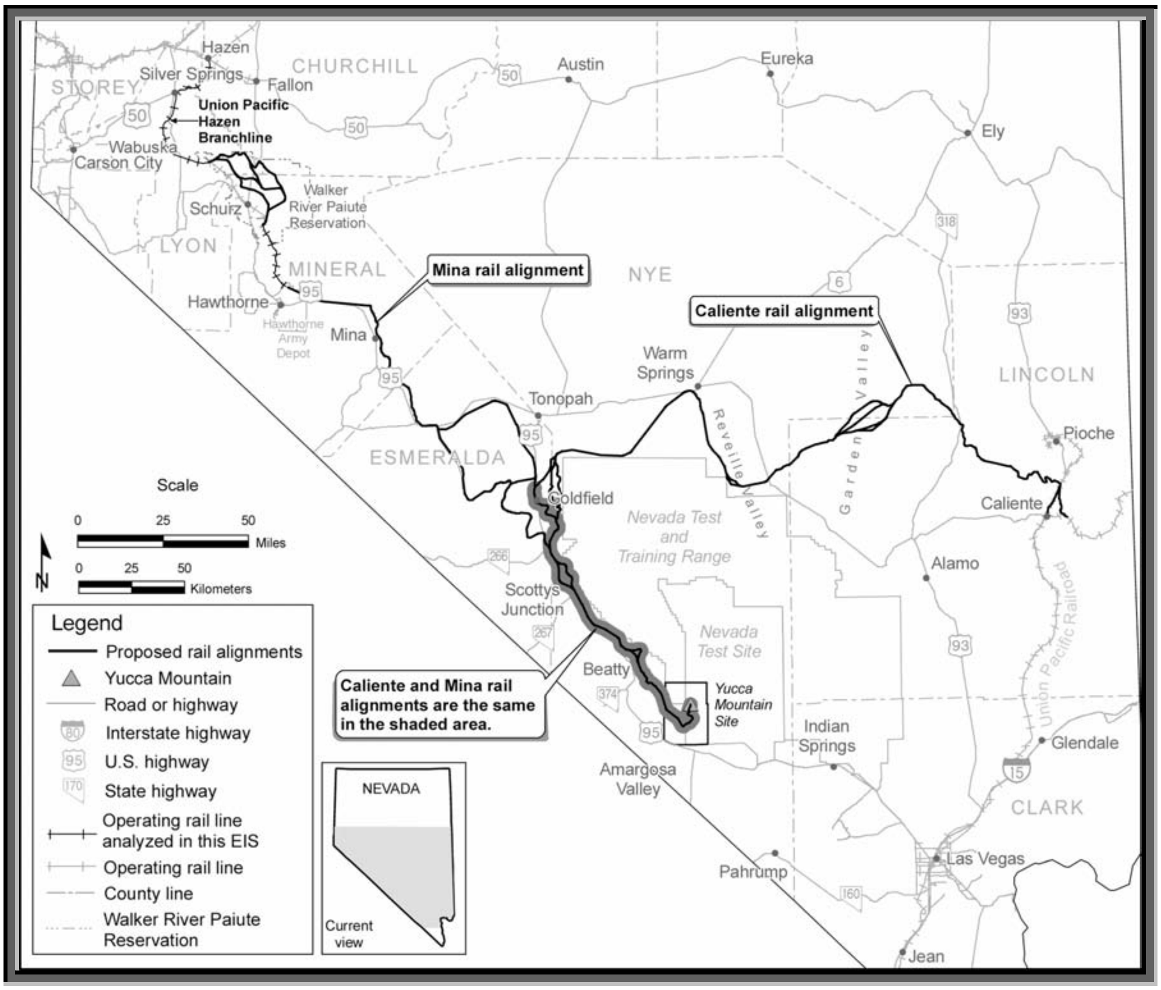
U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

3. AFFECTED ENVIRONMENT

This chapter describes the environmental setting and existing conditions in the areas encompassing Caliente rail alignment and Mina rail alignment alternative segments and common segments; it provides a baseline for use in evaluating the potential project-related environmental impacts of constructing and operating the proposed railroad. Section 3.2 describes the affected environment along the Caliente rail alignment; Section 3.3 describes the affected environment along the Mina rail alignment; and Section 3.4 describes American Indian interests in the affected environment.

Glossary terms shown in ***bold italics***.



3.1 Introduction

The U.S. Department of Energy (DOE or the Department) has compiled extensive information about the environmental resources that could be affected if the Department constructed and operated the proposed ***railroad*** along a ***rail alignment*** within either the Caliente ***rail corridor*** or the Mina rail corridor. DOE used this information to establish the baseline against which it assessed potential ***impacts*** under the ***Proposed Action*** and ***Shared-Use Option*** (see Chapter 4, Environmental Impacts).

DOE obtained baseline environmental information from many sources, including DOE-sponsored reports and studies, other federal agencies (for example, the Bureau of Land Management), the State of Nevada, and local governments.

Descriptions of the ***affected environments*** along the Caliente rail alignment and the Mina rail alignment focus on environmental resources within and adjacent to the ***alternative segments*** and ***common segments***, and the proposed locations of railroad ***construction and operations support facilities*** outside the ***nominal*** width of the rail line ***construction right-of-way***.

This chapter describes the environmental setting and existing conditions for the following resource areas:

- Physical setting (physiography, geology, and soils)
- Land use (grazing, mineral and energy resources, recreation and land access, utility and transportation corridors) and ownership (private and ***public lands***)
- Aesthetic (visual) resources
- ***Air quality*** and climate
- Surface-water resources (streams and ***washes***, ***waters of the United States***, ***wetlands***, ***floodplains***)
- Groundwater resources (***hydrographic areas***, wells, springs)
- Biological resources (vegetation, wildlife, special status species, Nevada game species, wild horses and burros)
- Noise and vibration
- Socioeconomics (employment and income, population and housing, public services, and transportation)
- Occupational and public health and safety (nonradiological and radiological)
- Utilities, energy, and materials (public suppliers of water, ***wastewater treatment***, and electricity; fossil fuels; construction materials)
- Hazardous materials and waste (use of materials and generation of wastes)
- Cultural resources (archaeological, historical, cultural)
- Paleontological resources (***fossils***)
- ***Environmental justice***

Proposed Action: To determine a rail alignment within a rail corridor in which to construct and operate a railroad to transport spent nuclear fuel, high-level radioactive waste, and other materials from an existing railroad in Nevada to a repository at Yucca Mountain, Nye County, Nevada. The Proposed Action includes the construction of railroad construction and operations support facilities.

This Rail Alignment EIS analyzes two alternatives that would implement the Proposed Action: the Caliente rail alignment and the Mina rail alignment.

This Rail Alignment EIS also analyzes a Shared-Use Option for each implementing alternative, under which DOE would allow commercial shippers to use the rail line for transportation of general freight.

Rail corridor: A strip of land 400 meters (0.25 mile) wide through which DOE would identify an alignment for the construction of a ***rail line*** in Nevada to a geologic repository at Yucca Mountain

Rail alignment: An engineered refinement of a rail corridor in which DOE would identify the location of a rail line. A rail alignment is comprised of common segments and alternative segments.

Construction right-of-way: Nominally, 150 meters (500 feet) on either side of the centerline of the rail alignment (a nominal width of 300 meters [1,000 feet]). In some locations along the rail alignment, the nominal width of the construction right-of-way would be greater (for example, to accommodate certain deep cuts and fills and construction of drainage structures) or less (for example, to avoid sensitive environmental resources). The rail line construction right-of-way is generally linear, but also includes specific locations of construction and operations support facilities (such as quarries, some water wells, and access roads) outside the linear construction right-of-way.

3.2 Caliente Rail Alignment

> The **region of influence** is the physical area that bounds the environmental, sociologic, economic, or cultural features of interest for analysis purposes.

This section describes the affected environment along the Caliente rail alignment. The scope of the affected environment reflects the ***region of influence*** for each resource area. DOE expects that most potential impacts would occur within a certain distance from the centerline of the rail alignment and within the ***footprints*** of construction and operations support facilities. However, resource area regions of influence vary, depending on the nature and type of the resource. Each environmental resource section fully describes the region of influence for the resource. Table 3-1 summarizes the regions of influence for the Caliente rail alignment analyzed in this Rail Alignment Environmental Impact Statement (EIS).

Table 3-1. Regions of influence for environmental resource areas – Caliente rail alignment (page 1 of 4).

Resource area	Region(s) of influence
Physical setting	All areas that would be directly or indirectly affected by construction and operation of the proposed railroad. These areas include the nominal width of the rail line construction right-of-way, and the footprints of construction and operations support facilities outside the nominal width of the construction right-of-way. See Section 3.2.1.1.
Land use and ownership	The nominal width of the construction right-of-way, including all private land (including patented mining claims), American Indian lands, and public land fully or partially within this area. Also includes the locations of construction and operations support facilities outside the nominal width of the construction right-of-way. See Section 3.2.2.1.
Aesthetic resources	The ***viewshed*** around all alternative segments, common segments, and proposed locations of construction and operations support facilities. DOE used a conservative region of influence extending 40 kilometers (25 miles) on either side of the centerline of the rail alignment. See Section 3.2.3.1.
Air quality and climate	The air basins bounded by Lincoln, Nye, and Esmeralda Counties. See Section 3.2.4.1.
Surface-water resources	The nominal width of the construction right-of-way for most of the analysis. In cases where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage patterns could carry eroded soil, sedimentation, or spills downstream, the region of influence extends to 1.6 kilometers (1.0 mile) on either side of the centerline of the rail alignment. See Section 3.2.5.1.
Groundwater resources	***Aquifers*** that would underlie areas of proposed railroad construction and operations, portions of groundwater aquifers DOE would use to obtain water for construction and operations support and that would be affected by these groundwater withdrawals, and nearby springs that might be affected by such groundwater withdrawals. The horizontal extent of the region of influence varies depending on the particular aspects of the specific project activity. See Section 3.2.6.1.

Table 3-1. Regions of influence for environmental resource areas – Caliente rail alignment (page 2 of 4).

Resource area	Region(s) of influence
Biological resources	DOE used two areas of assessment to describe the affected environment for biological resources: a region of influence and a study area. *Region of influence*: Generally, the nominal width of the construction right-of-way. For facilities that would be outside the nominal width of the construction right-of-way (such as quarries), the footprint of the proposed facility. *Study area*: A 16-kilometer (10-mile)-wide area, extending 8 kilometers (5 miles) on either side of the centerline of the rail alignment, for use in database and literature searches to ensure the identification of sensitive ***habitat*** areas near the Caliente rail alignment and transient or migratory wildlife, particularly special status species, that could pass through the region of influence. See Section 3.2.7.1.
Noise and vibration	The nominal width of the construction right-of-way out to variable distances, depending on several analytical factors (***ambient*** sound level, train speed, number of trains per day, and number of railcars). For construction and operations support facilities, the region of influence varies depending on the magnitude of noise those facilities would generate and ***ambient noise*** levels, which would affect how far away the noise might be heard. Therefore, the region of influence varies along the rail alignment. Also includes the locations of receptors that might be affected by noise, vibration, or both. See Section 3.2.8.1.
Socioeconomics	*Employment and income, population and housing, and public services:* Lincoln, Nye, Esmeralda, and Clark Counties in Nevada. *Transportation resources:* Public roadways near the Caliente rail alignment and the alignment itself.. See Section 3.2.9.1.
Occupational and public health and safety	*Nonradiological region of influence* The region of influence for public nonradiological impacts includes: • The nominal width of the construction right-of-way • Public roads in Lincoln, Nye, and Esmeralda Counties that the workforce would use during railroad construction and operations • Railroad construction and operations support facilities including access roads, water wells, and quarries where workers would perform construction, operations, or maintenance activities *Radiological region of influence* The region of influence for radiological impacts for incident-free transportation includes the area 0.8 kilometer (0.5 mile) on either side of the centerline of the rail alignment. The region of influence for occupational radiological impacts for incident-free operation also includes the physical boundaries of railroad operations support facilities, where workers would perform operations involving ***casks*** and ***cask cars***. Railroad operations support facilities within the radiological region of influence include only the ***Interchange Yard***, the ***Staging Yard***, the ***Rail Equipment Maintenance Facility***, and the ***Cask Maintenance Facility*** because DOE anticipates that ***radioactive*** materials would be managed only at those facilities. See Section 3.2.10.1.

Table 3-1. Regions of influence for environmental resource areas – Caliente rail alignment (page 3 of 4).

Resource area	Region(s) of influence
Occupational and public health and safety (continued)	For purposes of this Rail Alignment EIS, the affected environment for public radiological impacts includes: • Residents within the region of influence of the Caliente rail alignment, including persons who live within 0.8 kilometer (0.5 mile) of either side of the centerline of the rail alignment. For the public radiological impact analysis, DOE evaluated four specific alignments: the alignment that would have the highest exposed population; the shortest alignment; the longest alignment, and the alignment that would have the lowest population. • Individuals at locations such as residences or businesses near the rail alignment. • Individuals within the region of influence for radiological impacts for potential public exposure related to accidents and sabotage. This includes the area 80 kilometers (50 miles) on either side of the centerline of the rail line. See Section 3.2.10.1.
Utilities, energy, and materials	*Regions of influence for utilities and energy* • Public water systems: Systems in Lincoln, Nye, and Esmeralda Counties and communities within those counties. • Wastewater treatment: For wastewater transported offsite for treatment and disposal, the existing permitted treatment facilities in Lincoln, Nye, and Esmeralda Counties and communities within those counties. (Note: For wastewater treated using other methods [for example, on-site portable wastewater-treatment facilities], DOE would recycle treated wastewater, and there is no associated region of influence.) • Telecommunications: For telephone and fiber-optic telecommunications, the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Lincoln County Telephone System, Inc. • Electricity: Areas serviced by the southern Nevada electrical grid operated by Caliente Public Utilities, Lincoln County Power District No. 1, Nevada Power Company, Sierra Pacific Power Company, and Valley Electric Association, Inc. • Fossil fuels: Regional suppliers within the State of Nevada that could most economically supply the project. *Regions of influence for materials* • The region of influence for cast-in-place concrete and ***subballast*** is limited to the State of Nevada. Subballast, sand, and gravel would be generated from ***overburden*** at quarries and ***borrow sites*** near the rail alignment. There is a high likelihood DOE would also find subballast, sand, and gravel along ***cuts*** for the proposed rail line on ***alluvial fans***. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate. See Section 3.2.11.1.

Table 3-1. Regions of influence for environmental resource areas – Caliente rail alignment (page 4 of 4).

Resource area	Region(s) of influence
Utilities, energy, and materials (continued)	*Regions of influence for materials* (continued) • DOE would obtain ballast rock from potential quarry sites close to the construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase. • Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete could be procured and shipped from various national suppliers. Therefore, the region of influence for these materials is national. See Section 3.2.11.1.
Hazardous materials and waste	*Use of hazardous materials and the generation of hazardous and nonhazardous wastes*: The nominal width of the construction right-of-way, and the locations of construction and operations support facilities outside that area. *Disposal of low-level radioactive waste:* DOE low-level waste disposal sites, sites in ***Agreement States***, and U.S. Nuclear Regulatory Commission-licensed sites. *Disposal of hazardous wastes*: The entire continental United States. *Disposal of nonhazardous waste*: Disposal facilities in Lincoln, Nye, Esmeralda, and Clark Counties in Nevada. See Section 3.2.12.1.
Cultural resources	Two levels of coverage, based on distance from the rail alignment: • Level I. The first level of coverage is within the nominal width of the rail line construction right-of-way, the area where ground disturbance could directly or indirectly impact cultural resources. • Level II. The second level of coverage is a 3.2-kilometer (2-mile)-wide area centered on the rail alignment. This area includes potential disturbances that could indirectly impact cultural resources. See Section 3.2.13.1.
Paleontological resources	The nominal width of the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities. Section 3.2.14.1
Environmental justice	An area encompassing the regions of influence for all other resource areas. Includes populations that could be affected by the project that have cultural or religious ties to the area. See Section 3.2.15.1.

3.2.1 PHYSICAL SETTING

This section describes physiography, geology, and soils along the Caliente rail alignment. Characterization of the physical setting also identifies relationships to other resource areas described in this Rail Alignment EIS, such as aesthetics, land use, biological (vegetation) resources, and surface-water resources.

Section 3.2.1.1 describes the region of influence for physical setting along the Caliente rail alignment; Section 3.2.1.2 describes the general physical setting and characteristics in the region of influence; and Section 3.2.1.3 describes the physical setting in more detail for the Caliente rail alignment alternative segments and common segments.

3.2.1.1 Region of Influence

The region of influence for physical setting along the Caliente rail alignment includes all areas that would be directly or indirectly affected by construction and operation of the proposed railroad. These areas include the nominal width of the ***rail line*** construction right-of-way, and the footprints of facilities outside the nominal width of the construction right-of-way.

3.2.1.2 General Setting and Characteristics

3.2.1.2.1 Physiography

The Caliente rail alignment would cross the Basin and Range Physiographic Province, which is characterized in this area by north-trending, linear mountain ranges separated by broad sediment-filled valleys. Most of the Caliente rail alignment would cross the southern Great Basin, a subdivision of the Basin and Range Province. The mountain ranges are mostly tilted, ***fault***-bounded crustal blocks as much as 80 kilometers (50 miles) long and 24 kilometers (15 miles) wide. Mountain ranges typically rise from 300 to 1,500 meters (980 to 4,900 feet) above the adjacent valley floors and occupy 40 to 50 percent of the total land area. As shown in Figure 3-1, from northeast to southwest, a rail line along the Caliente rail alignment would use gaps, passes, and valleys to cross or travel near the following mountain ranges: Cedar Range, Highland Range, Chief Range, North Pahroc Range, Seaman Range, Golden Gate Range, Quinn Canyon Range, Reveille Range, Kawich Range, Hot Creek Range, and Goldfield Hills.

From east to west, the rail line would cross lowlands in Meadow Valley Wash, Dry Lake Valley, White River Valley, Coal Valley, Garden Valley, Sand Spring Valley, Railroad Valley, Reveille Valley, Stone Cabin Valley, Cactus Flat, Ralston Valley, Mud Lake, Stonewall Flat, Lida Valley, Sarcobatus Flat, Oasis Valley, Crater Flat, and Jackass Flats (Figure 3-1). All lowlands, with the exception of Meadow Valley Wash, Oasis Valley, Crater Flat, and Jackass Flats, have interior drainage to ***playas*** or dry washes and are therefore closed basins. Section 3.2.5 describes surface-water resources in the Caliente rail alignment region of influence. Sediment in the valleys are composed of coarse to fine alluvial debris (boulders, cobbles, sand, silt and clay) eroded from the adjacent mountains. Large alluvial fans, a common landform in the region, begin from the base of the mountains, and sometimes extend far into the valleys.

Alluvial fan: A low, outspread, relatively flat-to-gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream where it issues from a narrow mountain valley on a plain or break valley.

Playas: A nearly level area at the bottom of a desert basin that does not drain to a river and is temporarily covered with water from heavy rains or snowmelts. Normally a dry lakebed that may contain water in response to seasonally high runoff.

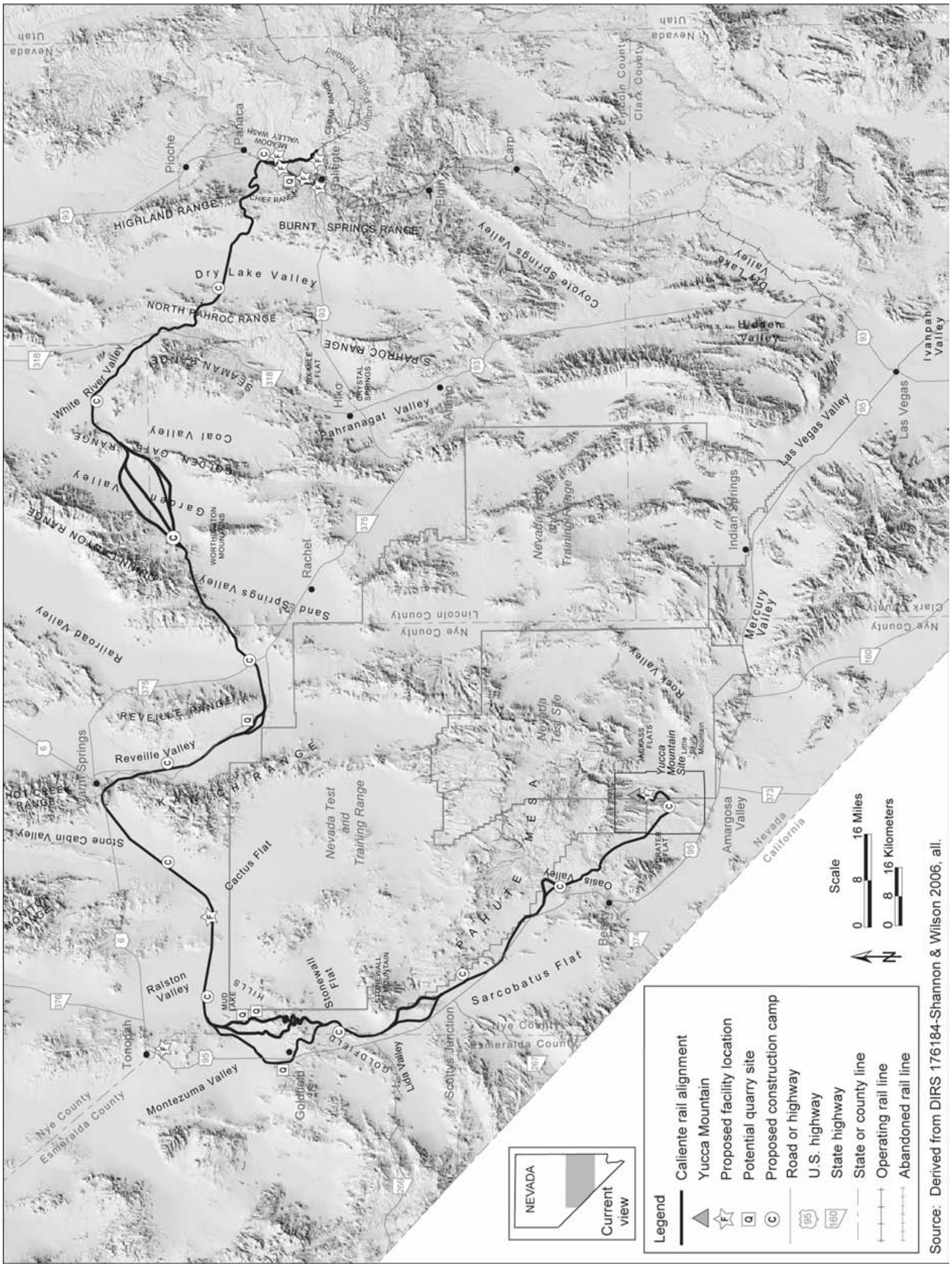


Figure 3-1. Physiographic setting along the Caliente rail alignment.

Playas occur in the lowest parts of some valleys. After heavy rains or snowmelt, the lowlands can fill with water. Evaporation of this water over days or weeks leaves a variety of salts near the surface that limit the growth of vegetation. These valleys are sometimes referred to as closed basins, because no surface water flows out of them.

Elevations along the Caliente rail alignment range from about 980 meters (3,200 feet) above mean sea level at the base of Busted Butte on the west side of Jackass Flats to about 1,900 meters (6,200 feet) above mean sea level at Warm Springs Summit in the Kawich Range (DIRS 176184-Shannon & Wilson 2006, Figure 3, Plates 70 and 71).

3.2.1.2.2 Geology

This section summarizes regional geology along the Caliente rail alignment. The geotechnical report to support the preliminary design effort (DIRS 176184-Shannon & Wilson 2006, all) provides a more detailed discussion of regional geology.

The Caliente rail alignment would cross a region of complex stratigraphic and structural elements that includes major north-south trending basins and ranges and broad volcanic uplands. Table 3-2 provides a generalized stratigraphic description and lists rock sequences according to the geologic age during which they were deposited, and their locations from east to west along the Caliente rail alignment. Table 3-2 also defines the geologic periods discussed in the geology sections of this Rail Alignment EIS.

In general, the age and ***lithology*** of rocks exposed to the east and west of the South Reveille Range are quite different. To the east, Tertiary ***volcanic rocks*** and Paleozoic ***sedimentary rocks***, largely of marine origin, are the principal rocks exposed; to the west, Tertiary volcanic rocks are the principal rocks exposed. The Tertiary volcanic rocks in the western area overlie Paleozoic sedimentary rocks, but these sedimentary rocks are compositionally different from the Paleozoic rocks in the eastern area. The Tertiary volcanic rocks, in turn, are covered in many areas by a variety of late Tertiary and Quaternary alluvial deposits.

Soils in the valleys were primarily formed from late Tertiary and Quaternary and some Paleozoic debris eroded from neighboring mountains, wind-blown sand and silt, fine-grained lake deposits, evaporite deposits, marsh and playa sediments, and spring-carbonate deposits. In some areas, alluvial fans are thin and overlie bedrock surfaces. Elsewhere, basin-fill sediments are more than 1,200 meters (4,000 feet) thick (DIRS 176184-Shannon & Wilson 2006, p. 12).

Volcanic rocks are rocks that have been ejected at or near the earth's surface. ***Tuffs***, lava flows, volcanic ***breccias***, basalt, andesite, and rhyolite are types of volcanic rocks that are found in the Great Basin. They are differentiated by chemistry and texture.

Sedimentary rocks are rocks formed by the accumulation of sediment in water or land. Sandstone, chert, limestone, dolomite, shale, siltstone, and mudstone are types of sedimentary rocks that are found in the Great Basin. They are differentiated by chemistry, deposition, and grain size.

Metamorphic rocks are rocks in which the original mineralogy, texture, or composition has changed due to the effects of pressure, temperature, or the gain or loss of chemical components.

The oldest ***outcrops*** in the region are Precambrian Era ***metamorphic rocks***, which are exposed in hills west of Goldfield alternative segment 4 and west of Caliente common segment 6. Other than these two exposures, Precambrian rocks are covered by younger rocks.

Table 3-2. General stratigraphy – Caliente rail alignment.[a]

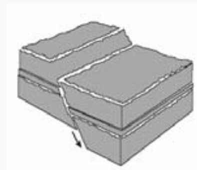
Geologic period[b]	Eastern portion of the Caliente rail alignment[c]	Central portion of the Caliente rail alignment[d]	Western portion of the Caliente rail alignment[e]	Southern portion of the Caliente rail alignment (southwest Nevada volcanic field)[f]
Cenozoic Era[g] (less than 65 Ma)-Quaternary Period (less than 1.6 Ma)	Stream channel, floodplain, and valley floor alluvium; wind-blown, playa, and landslide deposits; fan alluvium; terrace, marsh, spring, and lake beach deposits.	Stream channel and floodplain alluvium; wind-blown, playa, and landslide deposits; fan alluvium; basin-fill deposits.	Stream channel and floodplain alluvium; wind-blown, playa, and landslide deposits; fan alluvium; basin-fill deposits.	Stream channel and floodplain alluvium; wind-blown, playa, and landslide deposits; fan alluvium; basin-fill deposits. Basalt flows.
Cenozoic Era[g] (less than 65 Ma)-Tertiary Period (65 to 1.6 Ma)	Late Tertiary rocks include conglomerate and sandstone. Mid-Tertiary rocks include tuffs and rhyolitic to basaltic lava flows. Early Tertiary rocks include lake-derived limestone and conglomerate, marine limestone, shale, mudstone, sandstone, and siltstone.	Late Tertiary rocks include basalt flows and andesite flows. Mid-Tertiary rocks include tuffs, dacite lava flows, and andesite lava flows. Early Tertiary rocks include sandstone, conglomerate, and calcareous siltstone and mudstone.	Late Tertiary rocks include conglomerate and sandstone. Mid-Tertiary rocks include tuffs, basalt, and andesite. Early Tertiary rocks are not exposed in the region.	Silicic ash-flow tuffs; minor basalts. Predominantly volcanic rocks of the southwestern Nevada volcanic field.
Mesozoic Era (240 to 65 Ma)	No rocks of this age are exposed along this portion of the alignment.	No rocks of this age are exposed along this portion of the alignment.	Quartz monzonite and granodiorite.	Granitic rocks of late Mesozoic (Cretaceous) age occur. No other rocks of this age are exposed along this portion of the alignment.
Paleozoic Era (570 to 240 Ma)	Alternating marine and terrestrial sediments comprised mostly of shale, quartzite, limestone, and dolomite.	Alternating marine and terrestrial sediments comprised mostly of shale, quartzite, limestone, and dolomite.	Rocks of Late and Middle Paleozoic age are not exposed along this portion of the alignment. Rocks of early Paleozoic (Ordovician and Cambrian) are largely limestone and dolomite.	Alternating marine and terrestrial sediments comprised mostly of shale, quartzite, limestone, and dolomite.
Precambrian Era (greater than 570 Ma)	Rocks of this age are not exposed along this portion of the alignment.	Rocks of this age are not exposed along this portion of the alignment.	Conglomerate, quartzite, sandstone, shale, dolomite, limestone, chert, and diabase overlie old ***igneous*** and metamorphic rocks that form the crystalline "basement."	Conglomerate, quartzite, sandstone, shale, dolomite, limestone, chert, and diabase overlie old igneous and metamorphic rocks that form the crystalline "basement."

a. Source: DIRS 176184-Shannon & Wilson 2006, Tables 2 and 3.
b. Ma = approximate years ago in millions.
c. Includes Meadow Valley Wash; Dry Lake and White River Valleys; and Chief, North Pahroc, and Seaman Ranges.
d. Includes Railroad, Reveille, Stone, and Cabin Valleys; Cactus Flat; Golden Gate, Quinn Canyon, and Kawich Ranges.
e. Includes Goldfield Hills, Stonewall Flat, Lida Valley, and Stonewall Mountain.
f. Includes Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, Rock Valley, and Yucca Flat.
g. The Cenozoic Era consists of both the Quarternary and the Tertiary periods.

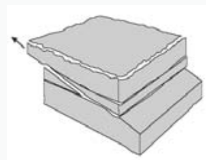
During the late Paleozoic Era, the area was periodically covered by shallow seas to the east that generally deepened westward. Thick layers of limestone, shale, and sandstone, now exposed widely in the mountains along Caliente common segment 1, are the remains of these Paleozoic seas. By early Mesozoic time, the seas had retreated westward across the region for the last time (DIRS 176184-Shannon & Wilson 2006, pp. 9 to 11).

Faulting is movement of the earth's crust that produces relative displacement of adjacent rock masses along a fracture. Generally, the fracture is referred to as a fault.

Splay faults are minor faults that branch off of a primary fault, or interconnect to form a fault zone.



A **normal fault** is a fault where the block above an inclined fault has moved down relative to the other block.



A **thrust fault** is a fault that occurs when squeezing forces push the block above an inclined fault up in relation to the other block.

Source: DIRS 155970-DOE 2002, Figure 3-9.

Major east-west compression occurred periodically in the Great Basin between about 350 million and 65 million years ago (DIRS 169734-BSC 2004, p. 2-16). This compression moved large sheets of old rock great distances upward and eastward over young rocks along ***thrust faults*** to produce mountains. Most of the thrust fault traces have eroded away; however, a remnant of the Pahranagat Fault has been identified south of the Garden Valley alternative segments (DIRS 176184-Shannon & Wilson 2006, Plate 4). Range-bounding ***normal faults***, which have developed in response to ***crustal extension*** over the past 20 million years, are conspicuous features in this part of Nevada and are especially visible in parts of Nye County. These faults have surface traces that form distinctive segments 5 to 30 kilometers (3.1 to 19 miles) long (DIRS 174214-Kleinhampl and Ziony 1985, p. 144). Although generally coincident with the range fronts, in places these normal faults, and shorter ***splay faults*** radiating outward from these normal faults, extend into adjacent valleys where they are buried by recent alluvial deposits. Both the exposed and buried parts of active faults could be capable of rupturing the surface.

Crustal extension in the region, which began about 20 million years ago, is still occurring (DIRS 176184-Shannon & Wilson 2006, p. 12). Present-day mountains and valleys were well developed by about 11.5 million years ago. Evidence of recent, continuing crustal extension is based on Holocene-age (about the last 10,000 years) faults, recurring ***earthquakes***, and geothermal features (some of which are used for commercial purposes such as spas and pools). The Holocene-age faults are visible in many valleys in Nye County that the Caliente rail alignment would cross (Figure 3-2).

Evidence of crustal extension is seen in the Walker-Lane Structural Belt, a 96-kilometer (60-mile)-wide deformation zone that parallels the Nevada-California border from Las Vegas to northern California. The belt includes generally northwest-trending faults that were active within the last 20 million years (DIRS 176184-Shannon & Wilson 2006, p. 14). Ruptures along these faults or along buried faults are possible and could cause earthquakes. Section 3.2.1.2.2.1 provides more information on ***seismic*** activity along the Caliente alignment.

The southwestern Nevada volcanic field is a volcanic plateau that developed between 16 and 7 million years ago, with the greatest eruptions occurring between 14 and 11 million years ago (DIRS 176184-Shannon & Wilson 2006, p. 11). The volcanic field encompasses common segment 5, the Oasis Valley alternative segments, and common segment 6 (Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, and Rock Valley).

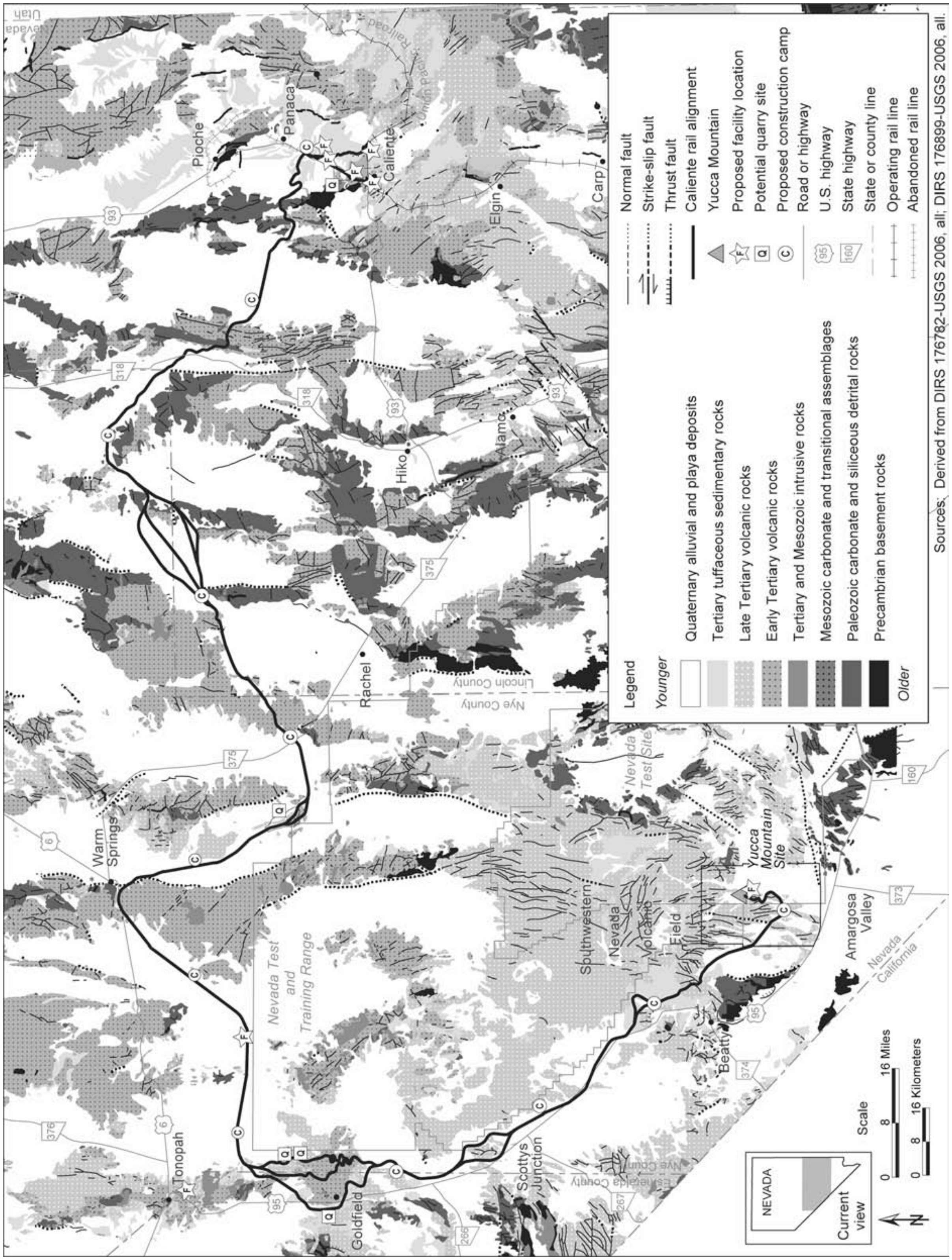


Figure 3-2. Geologic setting along the Caliente rail alignment.

The volcanic field has a complex history of volcanism and deformation (DIRS 169734-BSC 20040, pp. 2-4 through 2-15). Eruption of 17 ash-flow ***tuff*** sequences and lava flows occurred from at least seven large, overlapping ***caldera*** complexes to form the southwestern Nevada volcanic field. The youngest caldera-forming events associated with this feature occurred between 7.5 and 7.6 million years ago with eruptions east of Caliente common segment 4 (DIRS 176184-Shannon & Wilson 2006, p. 11). The mid-Tertiary eruptions deposited ash and created volcanic-ash flows with minor lava flows and reworked materials. Only Tertiary and younger rocks are exposed in the southwestern Nevada volcanic field area.

3.2.1.2.2.1 Faulting and Seismic Activity. Historically, there have been numerous earthquakes in the Great Basin region as a result of ongoing crustal extension (see Figure 3-3). Consistent with geologic evidence, the historical record of Holocene-age ***seismicity*** (occurring within the last 10,000 years) suggests that seismic activity was concentrated in the western part of the Great Basin, and to a lesser extent, in the eastern part (DIRS 176184-Shannon & Wilson 2006, p. 15 and Plate 4). Modern earthquakes in the southern Great Basin predominantly occur at depths of 2 to 12 kilometers (1.2 to 7 miles) below Earth’s surface (DIRS 169734-BSC 20040, p. 4-35).

The southern Great Basin contains many Quaternary fault traces; however, there are few instances of surface rupture within the last 10,000 years (DIRS 176184-Shannon & Wilson 2006, p. 15). These faults are characterized by discontinuous scarps (vertical displacement along a fault), from surface displacement. Studies of Holocene faults in the Great Basin have calculated slip rates of 0.001 to 0.01 millimeter (0.000039 to 0.00039 inch) per year, with a surface-rupturing recurrence interval of about 100 years (DIRS 176905-Workman et al. 2002, p. 18). Studies of fractures other than ***block-bounding faults*** around Yucca Mountain determined that fault displacements of about 0.10 centimeter (0.039) would have an exceedance ***probability*** of once every 100,000 years (DIRS 169734-BSC 2004, p. 4-64).

Figure 3-3 shows the number and locations of earthquakes of magnitude 3.0 and greater on the Richter scale based on available historical and recorded data from 1852 to 2004. Most of the earthquakes around the Caliente rail alignment fall within a magnitude range of 3.0 to 3.9, the range that most people begin to feel ground shaking (DIRS 180969-USGS 2006, all). As magnitude increases, the potential for damage from ground shaking also increases.

Five seismic events with a magnitude 5.0 or greater occurred within 30 kilometers (19 miles) of the Caliente rail alignment, several occurring on the Nevada Test Site north of Yucca Mountain. Most seismic events on the Nevada Test Site are associated with historical underground testing, not natural ***faulting***. Seismic activity from manmade tests has not activated local faults (DIRS 169734-BSC 2004, pp. 4-33 and 4-35). A magnitude 6.0 earthquake was also recorded within the Chief Range southeast of the City of Caliente. A 1992 earthquake near Little Skull Mountain is the largest recorded earthquake in the vicinity of Yucca Mountain. The 5.6 magnitude event was apparently triggered by a 7.3 magnitude earthquake at Landers, California, which occurred 300 kilometers (190 miles) southwest of Yucca Mountain, and 20 hours earlier (DIRS 169734-BSC 2004, pp. 4-38 and 4-39). Since 1978, DOE has monitored seismic activity in the area around Yucca Mountain to pinpoint seismic events (DIRS 155970-DOE 2002, p. 3-32). In the area around the Caliente rail alignment, earthquakes with a magnitude of 6.1 to 6.4 are predicted to have a return period of 2,500 years (DIRS 174296-Shannon & Wilson 2005, p. 14).

Through the National Earthquake Hazard Reduction Program, national and regional shaking-hazard maps are used to determine the probability of seismic-related damage based on regional earthquake occurrence rates and how far the shaking travels horizontally (DIRS 174194-USGS 2005, all). These maps are used to meet modern seismic design provisions for the construction of buildings, bridges, highways, and utilities. Shaking-hazard maps, also known as peak acceleration maps, show the levels of horizontal shaking that have a certain probability of being exceeded in a 50-year period (see Figure 3-4). When an

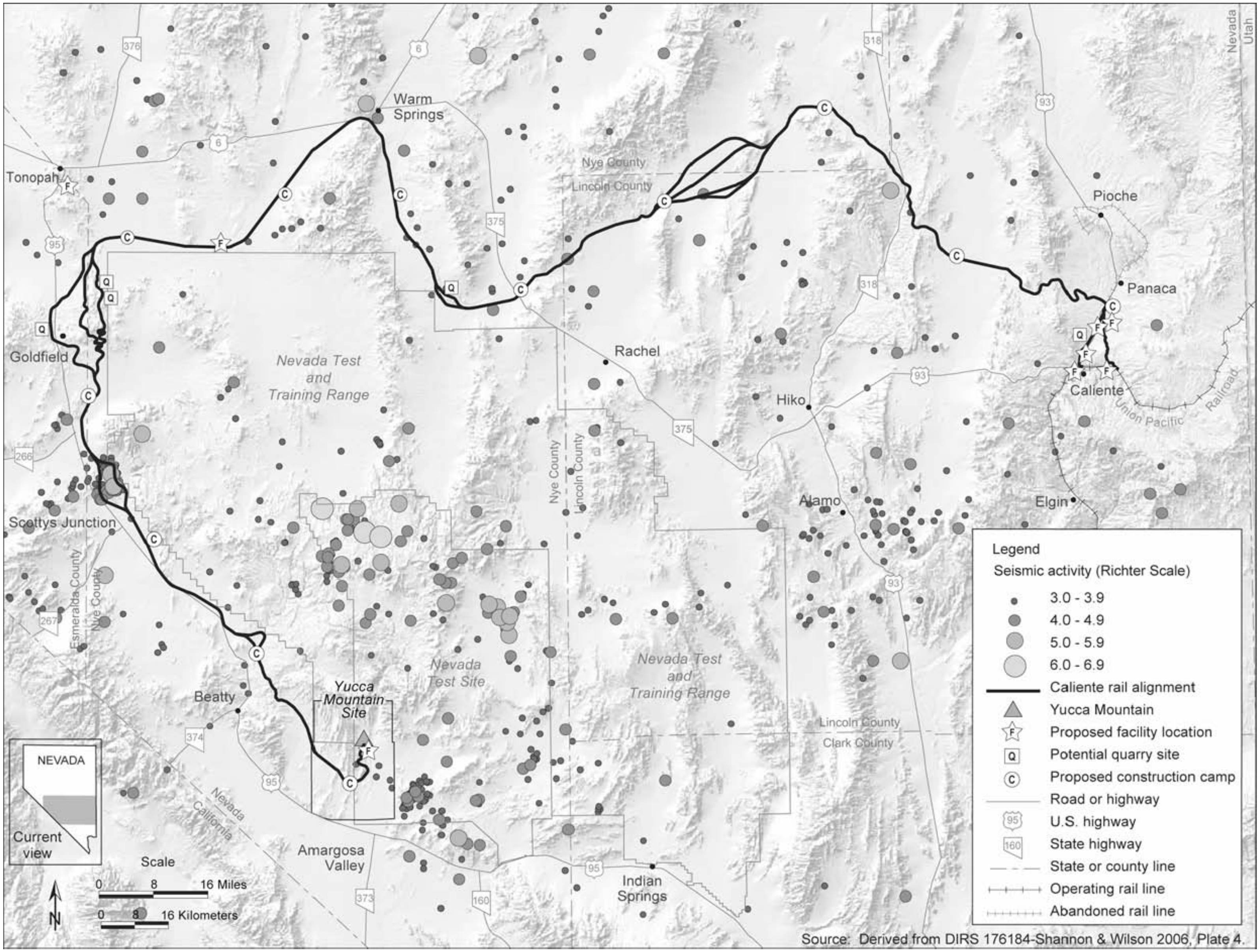


Figure 3-3. Seismic activity in Nevada along the Caliente rail alignment from 1852 to 2004.

earthquake occurs, the forces caused by the shaking can be measured as a percentage of the constant known as *g*, which is the acceleration of a falling object due to gravity. The resulting map uses contour lines to show the amount of shaking a location would experience during any area earthquake, regardless of its distance to the epicenter.

The predicted peak horizontal accelerations tend to decrease from west to east across the Caliente rail alignment. Most of the Caliente rail alignment would have a 2-percent probability of exceeding a peak horizontal acceleration of 30-percent *g* within a 50-year period (see Figure 3-4) and a 10-percent probability of exceeding a peak horizontal acceleration of 10 percent *g* within a 50-year period (DIRS 174296-Shannon & Wilson 2005, Figure 3). The southern section of Goldfield alternative segment 4, Caliente common segment 4, the Bonnie Claire alternative segments, and the northern section of common segment 5 would have a 2-percent probability of exceeding a peak ground acceleration range 40-percent *g* in 50 years. In other words, the alignment would experience shaking of 40-percent or less from a seismic event with a return period of about 2,500 (DIRS 174296-Shannon & Wilson 2005, p. 14). A peak horizontal acceleration of 10 percent *g* could cause minor structural damage to normal buildings, while 40-percent *g* could cause damage to most structures.

3.2.1.2.2.2 Mineral and Energy Resources. For more than 100 years, parts of the southern Great Basin have produced substantial amounts of base and precious metals, particularly gold and silver (DIRS 173841-Shannon & Wilson 2005, p. 16). Parts of the Caliente rail alignment, especially in the vicinity of the Goldfield and Clifford Mining Districts, have been intensely mined and have extensive surface and underground mine workings. Energy resources reported along and near the rail alignment include low-temperature geothermal water and indications of small areas with petroleum resources. Section 3.2.2, Land Use and Ownership, describes ***mining districts*** and associated land claims along the Caliente rail alignment in more detail.

3.2.1.2.2.3 Potential Sources of Construction Materials. As described in Chapter 2, there would be local sources for some rail line construction materials. The estimated quantity of ***ballast*** required for construction of a rail line along the Caliente rail alignment would range from 3.12 to 3.19 million metric tons (3.44 to 3.52 million tons) (DIRS 176172-Nevada Rail Partners 2006, p. 3-1). DOE has identified six potential ballast quarry sites along the Caliente rail alignment with topographic and geologic characteristics suitable to accommodate excavation and preparation facilities. Figures 2-25 through 2-28 show the potential quarry locations along the Caliente rail alignment (South Reveille alternative segment 2, South Reveille alternative segment 3, Goldfield alternative segment 3, and Goldfield alternative segment 4). The topography and geology of potential quarry sites are described in more detail in the discussion of the alternative segment with which they are associated (Sections 3.2.1.3.1.2, 3.2.1.3.5.2, and 3.2.1.3.7.2). There is also a high likelihood the Department would find suitable sands and gravels on the alluvial fans within the rail line construction right-of-way for use as ***subballast***. A final determination of subballast suitability would be made if DOE decided to implement the Proposed Action along the Caliente rail alignment. Section 3.2.11, Utilities, Energy, and Materials, describes the regional supply chains for other construction materials.

3.2.1.2.3 Soils

DOE used soil survey databases from the U.S. Department of Agriculture, Natural Resources Conservation Service (DIRS 176781-MO0603GSCSSGEO.000), to identify soil types and characteristics along the Caliente rail alignment. Approximately 95 percent of the project area has been surveyed. However, soil surveys around the Nevada Test and Training Range have not been completed. For areas with no available soils data, the Department does not consider the unavailable data critical to the design and construction of a railroad along the Caliente rail alignment, because soils are expected to be similar to

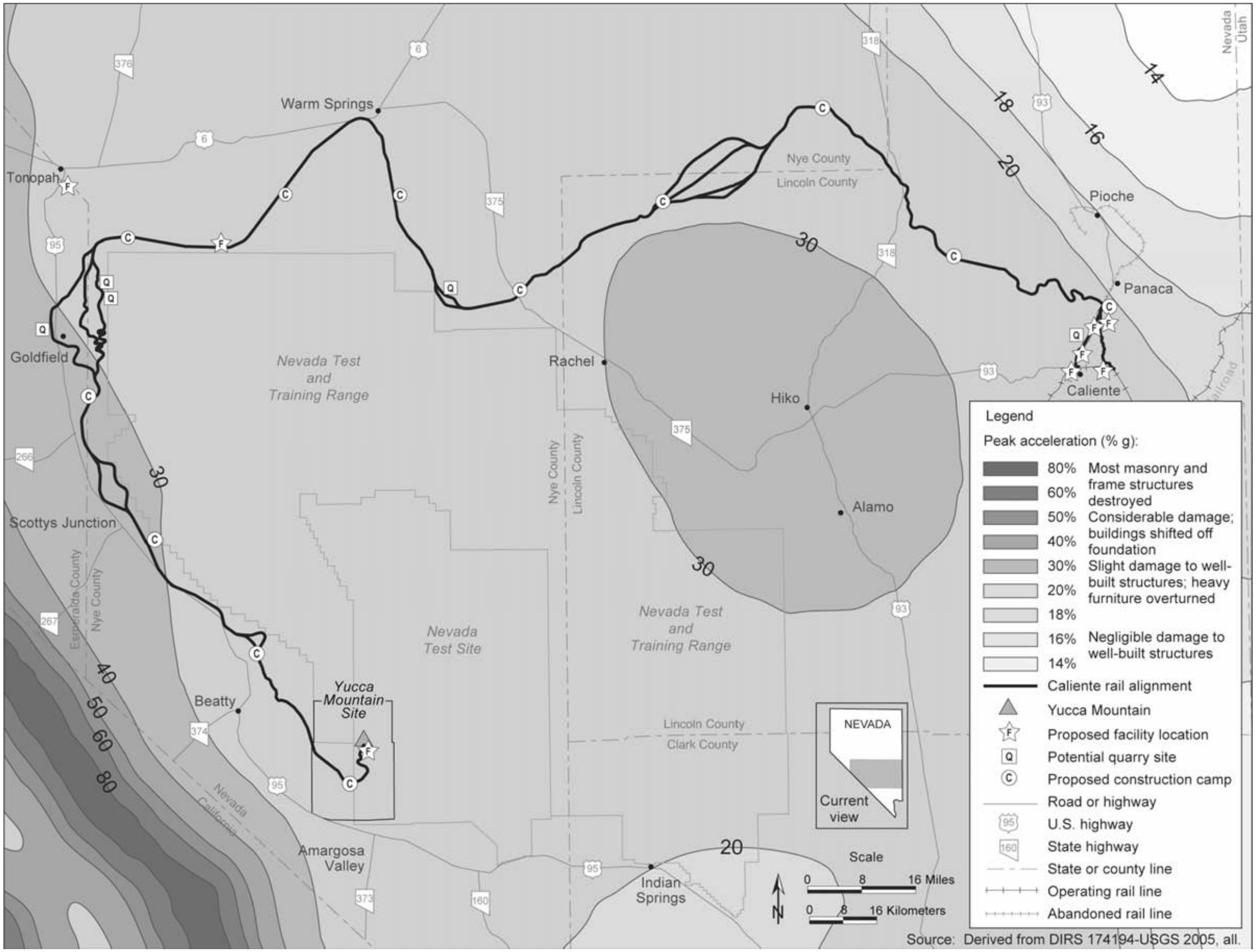


Figure 3-4. Seismic hazards along the Caliente rail alignment: peak acceleration (percent *g*) with 2-percent probability of exceedance in 50 years.

those already surveyed. In addition, as part of the final design, DOE would place geotechnical borings along the entire rail alignment to obtain site-specific soils data.

This Rail Alignment EIS identifies the specific soil characteristics relevant to railroad construction and operations. From a potential impact perspective, soil designated as supporting ***prime farmland*** is considered one of the relevant characteristics. The Natural Resources Conservation Service (DIRS 181427-NRCS 2007, Part 622.04(a)) defines prime farmland as:

> Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or ***alkalinity***, an acceptable content of salt or sodium, and few or no rocks. Its soils are ***permeable*** to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding.

The prime farmland soil label is applied to the soil types and associations that the National Resources Conservation Service identifies as satisfying this definition. Three percent, or about 1.8 square kilometer (440 acres), of the rail line construction right-of-way would contain soils classified as prime farmland (see Figure 3-5). Lincoln County has about 1,600 square kilometers (400,000 acres) and Nye County has 610 square kilometers (150,000 acres) of prime farmland soils (DIRS 176781-MO0603GSCSSGEO.000). Esmeralda County does not have any soils classified as prime farmland. The amount of prime farmland soils within the Caliente rail alignment construction right-of-way would be less than 0.1 percent of the total prime farmland soils in Lincoln and Nye Counties. DOE has also contacted the Nevada Natural Resources Conservation Service office to collaborate on the identification of prime, unique statewide, or locally important farmland along the alignment. This correspondence is described further in Section 4.2.1.2.1.3, and in the individual segment discussions in Section 4.2.1.2.2.

Table 3-3 lists the prime farmland and quantity of soils with other characteristics along the Caliente rail alignment. The table lists the percentage of the area within the nominal width of the construction right-of-way that contains soils with a particular characteristic. In some locations along the rail alignment, DOE would occupy and disturb less of the construction right-of-way to avoid sensitive environmental resources and private property. Because different combinations of alternative segments and common segments would be different lengths and have different disturbed areas, DOE judged the impacts from soil erosion based on the acreage of specific soil types that would be affected by construction-related disturbance. Section 4.2.1.2.1.3 provides a more detailed discussion of how railroad construction and operations could affect topsoil.

Other soil characteristics that are particularly relevant to railroad construction and operations are classified on Table 3-3 as ***erodes easily*** and ***blowing soil***. Soil with either of these characteristics can be quite susceptible to erosion. As seen in Table 3-3, these soil types are found in similar amounts within each group of alternative segments.

The erodes easily characteristic is a measure of the susceptibility of bare soil to be detached and moved by water. These soils, which tend to contain relatively high amounts of silts and ***loams***, tend to erode easily when disturbed. About 15 percent of the entire Caliente rail alignment has soils with this characteristic (DIRS 176781-MO0603GSCSSGEO.000).

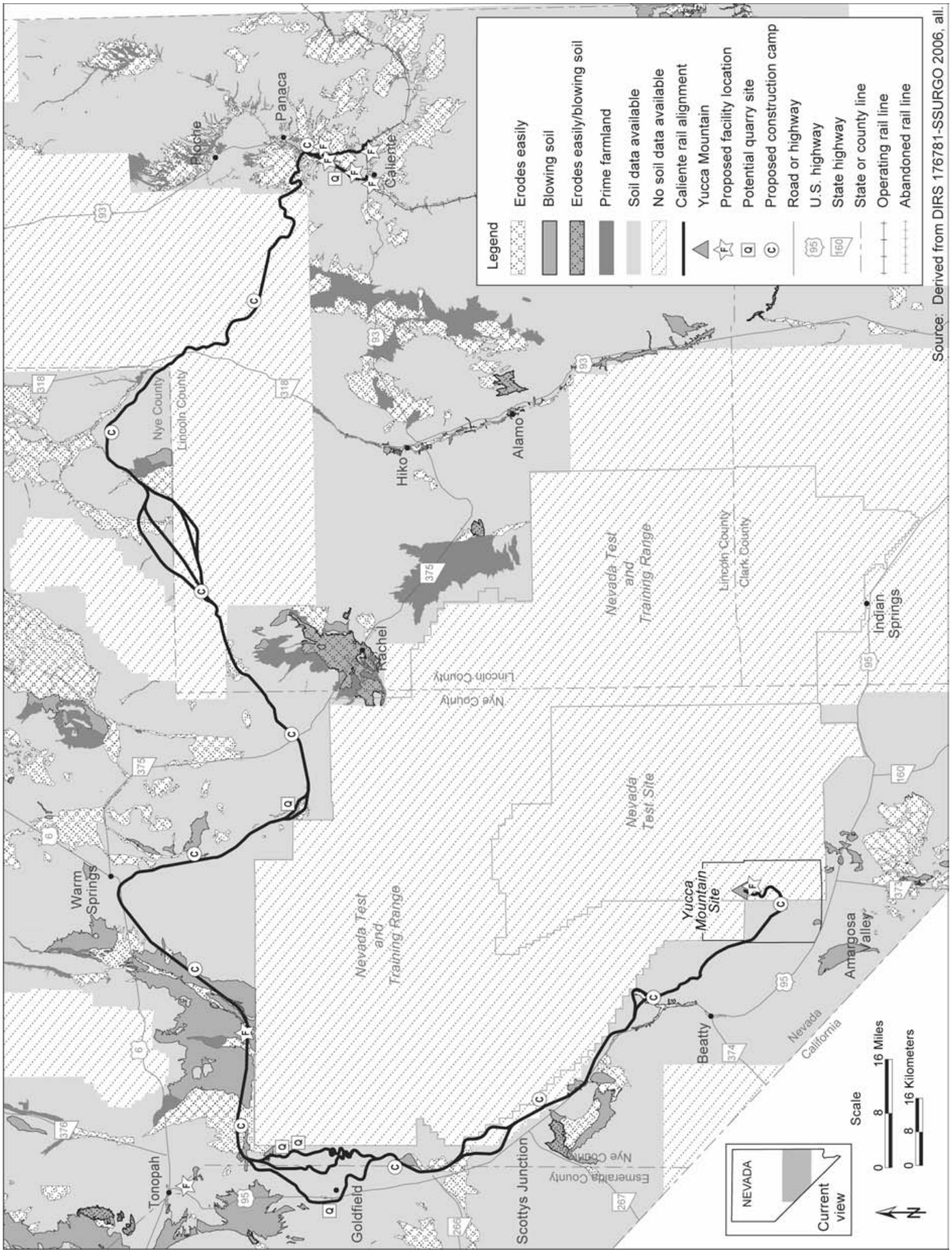


Figure 3-5. Soils with prime farmland, erodes easily, and blowing soil characteristics along the Caliente rail alignment.

Table 3-3. Percent of soil characteristics within the Caliente rail alignment construction right-of-way.[a]

Rail line segment	Percent prime farmland	Percent blowing soil	Percent erodes easily	Percent soil survey coverage[b]
Caliente alternative segment	5.2	c	74	100
Eccles alternative segment	4.8	c	71	100
Caliente common segment 1	10	c	18	100
Garden Valley alternative segment 1	8.4	5.7	13	100
Garden Valley alternative segment 2	11	6.1	22	100
Garden Valley alternative segment 3	c	2.1	12	100
Garden Valley alternative segment 8	9.8	6	14	100
Caliente common segment 2	c	10	16	100
South Reveille alternative segment 2	c	6.3	19	100
South Reveille alternative segment 3	c	c	15	100
Caliente common segment 3	c	32	17	100
Goldfield alternative segment 1	c	8.8	c	100
Goldfield alternative segment 3	c	9.5	c	100
Goldfield alternative segment 4	c	7.7	c	100
Caliente common segment 4	c	1.4	41	100
Bonnie Claire alternative segment 2	c	c	27	27
Bonnie Claire alternative segment 3	c	c	25	77
Common segment 5	c	2.6	c	73
Oasis Valley alternative segment 1	c	13	c	100
Oasis Valley alternative segment 3	c	4.8	c	100
Common segment 6	c	c	c	74

a. Source: DIRS 176781-MO0603GSCSSGEO.000.
b. There are data gaps around the Nevada Test and Training Range because those soil surveys have not been completed.
c. Characteristic not present. Soil percentages do not add up to 100 percent.

The blowing soil characteristic is based on the soil survey classification of susceptibility of a given soil to wind erosion. This classification method uses eight groupings. Soils assigned to Group 1 are the most susceptible to wind erosion and those assigned to Group 8 are the least susceptible. Soils listed in Table 3-3 with the blowing soil characteristic are those assigned to erodibility Group 1 or 2 (DIRS 181427-NRCS 2007, Exhibit 618-16). The blowing soil characteristic identifies areas where fine-textured, sandy materials predominate and where uncontrolled soil disturbance could result in increased wind erosion. Depending on combination of alternative segments and common segments, between 7.6 and 8.2 percent of the entire Caliente rail alignment would have soils with the blowing soil characteristic (DIRS 176781-MO0603GSCSSGEO.000). Figure 3-5 identifies the locations of prime farmland, erodes easily, and blowing soils.

3.2.1.3 Setting and Characteristics along Alternative Segments and Common Segments

3.2.1.3.1 Alternative Segments at the Interface with Union Pacific Railroad Mainline

3.2.1.3.1.1 Physiography. The physiography of the area where the Caliente rail alignment would interface with the Union Pacific Railroad Mainline is dominated by Meadow Valley Wash, the Cedar Range to the east, and the Chief Range to the west (see Figures 2-5 and Figure 3-6). There are terraces and alluvial fans on both sides of Meadow Valley Wash (DIRS 156091-Borup and Bagley 1976, pp. 5 and 6). The Caliente and Eccles alternative segments would start at different locations near Clover Creek, which is dry most of the year, and extend north, crossing Meadow Valley Wash. Elevations range from about 1,340 meters (4,400 feet) above mean sea level in the areas of Clover Creek and Meadow Valley Wash to just over 1,520 meters (5,000 feet) above mean sea level in the more rugged area north of Clover Creek.

3.2.1.3.1.2 Geology. The area where the Caliente rail alignment would interface with the Union Pacific Railroad Mainline is largely composed of recent sedimentary deposits and some volcanic rocks. The Caliente and Eccles alternative segments would not cross known Quaternary fault traces. Nonmetallic minerals (perlite, a glassy volcanic rock with high water content that can be used for insulation and acoustic tiles, and quartzite, a hard rock made up almost entirely of the mineral quartz) found within these rocks have been commercially mined in the vicinity of the Caliente alternative segment. Section 3.2.2, Land Use and Ownership, provides additional information about the mining districts around the Caliente rail alignment.

Neither the Caliente nor the Eccles alternative segment would cross Quaternary faults. There was a magnitude 6.0 earthquake in the Chief Range area southeast of the City of Caliente. Otherwise, there have been few earthquakes in the area within the past 150 years.

The site of potential quarry CA-8B is in hilly terrain north of the City of Caliente, west of the Caliente alternative segment. ***Basalt*** would be excavated from the Cobalt Canyon formation (DIRS 176172-Nevada Rail Partners 2006, Figure 3-C).

Geothermal resources close to the proposed Caliente rail alignment in the Caliente area are being used commercially in a hotel spa and for space heating (DIRS 173841-Shannon & Wilson 2005, pp. 115 and 116). Hot springs in the Caliente area are indicative of high heat flow within the Earth, and are related to the crustal extension of the southern Great Basin. There are no other energy resources along the Caliente or Eccles alternative segments.

3.2.1.3.1.3 Soils. Soils in the area of the Interface with the Union Pacific Railroad Mainline occur mainly on floodplains, low terraces, and alluvial fans (DIRS 156091-Borup and Bagley 1976, all). Most of these soils are on nearly level to moderate slopes, are very thick, and are well drained to moderately well drained. Other soils are very thin to moderately thick, are well drained, and gently slope to steep soils and rock outcrops.

About 5.2 and 4.8 percent of the soils in the Caliente and Eccles alternative segments, respectively, are classified as prime farmland (see Table 3-3). Along the Caliente alternative segment, soil associations classified as prime farmland are within the Caliente city limits, and are primarily on private residential land. Along the Eccles alternative segment, the southern prime farmland soils are on alluvial fan deposits in the Little Mountain ***Grazing Allotment***. The northern prime farmland soils are on alluvial fans in the Peck Grazing Allotment. Section 3.2.2, Land Use and Ownership, provides additional information about grazing allotments. About 74 and 71 percent of the soil along the Caliente and Eccles alternative segments, respectively, are classified as erodes easily. There are no soils anywhere along the Caliente or Eccles alternative segments with the blowing soil characteristic.

3.2.1.3.2 *Caliente Common Segment 1 (Dry Lake Valley Area)*

3.2.1.3.2.1 Physiography. From east to west, Caliente common segment 1 would cross between, through, or around the Chief, Highland, and Black Canyon Ranges, Dry Lake Valley, the North Pahroc Range, White River Valley, the Seaman Range, Coal Valley, and the Golden Gate Range (see Figures 3-6

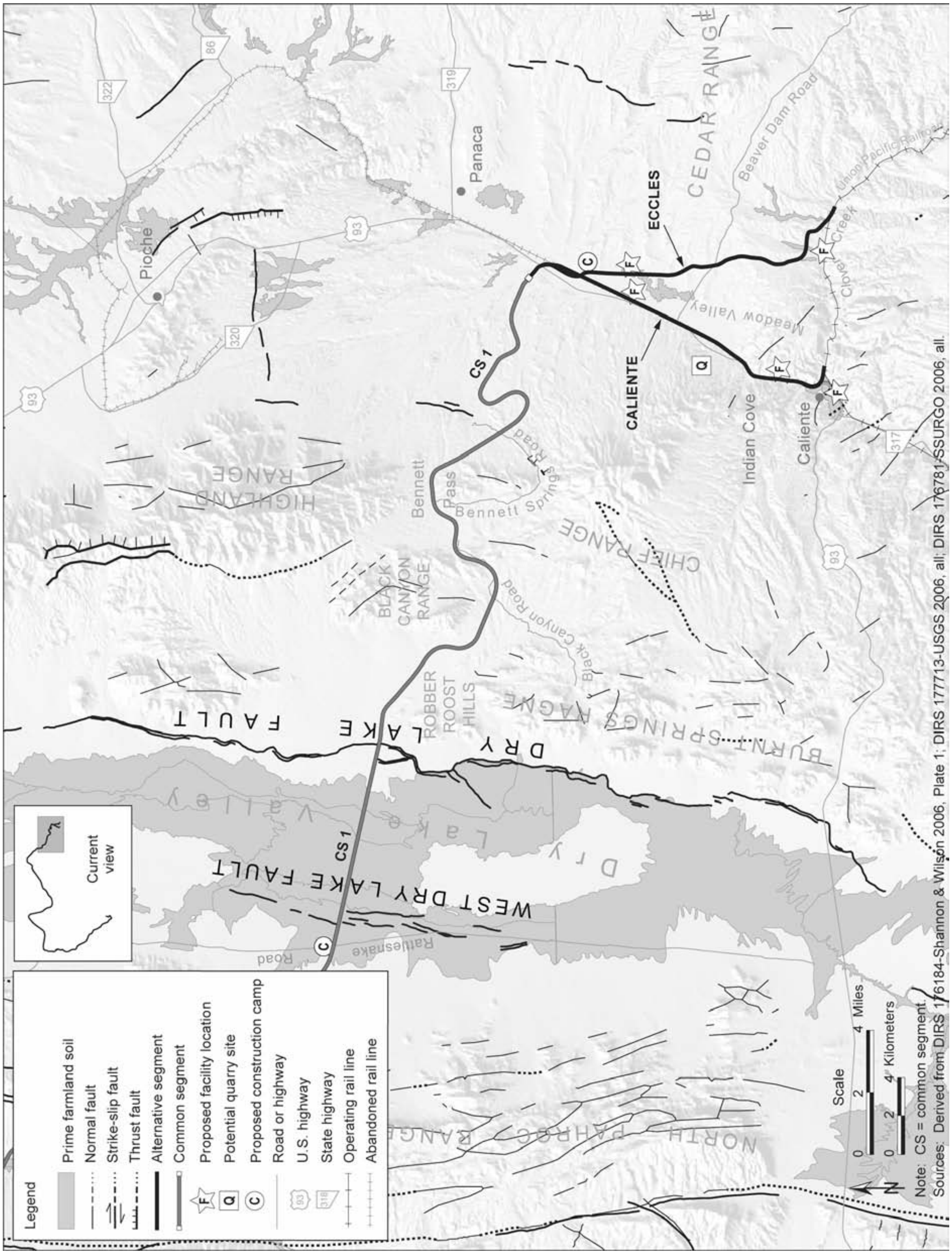


Figure 3-6. Physiographic features of the common segment and alternative segments within map area 1.

and 3-7). Bennett Pass, at an elevation of about 1,730 meters (5,700 feet) above mean sea level, separates the Highland and Black Canyon Ranges to the north from the Chief Range to the south. This segment of the Caliente rail alignment would travel through Bennett Pass, then south of the Black Canyon Range and curve around Robber Roost Hills and the Burnt Springs Range. The segment would then cross Dry Lake Valley, a wide, nearly flat depression with elevations generally ranging from 1,400 to 1,420 meters (4,600 to 4,660 feet) above mean sea level.

Turning northwest, Caliente common segment 1 would enter the northern section of the North Pahroc Range. In this area, elevations generally range from 1,600 to 1,700 meters (5,200 to 5,600 feet) above mean sea level. The segment would then head north along the east side of the White River Valley for about 10 kilometers (6.2 miles) and would cross the dry White River and proceed northwest of State Route 318, north of the Seaman Range, in the vicinity of Timber Mountain. The northern portion of the Seaman Range trends northwesterly and merges at the north end of Coal Valley with the Golden Gate Range, which trends north-northeasterly. North of this point, the Golden Gate Range merges with the broad expanse of White River Valley (see Figure 3-7). The Caliente rail alignment would go around the rugged Seaman Range. In this area, Caliente common segment 1 would encounter elevations ranging from 1,500 to 1,650 meters (5,000 to 5,400 feet) above mean sea level.

3.2.1.3.2.2 Geology. Bedrock at the surface along Caliente common segment 1 is quite variable. The segment would cross old sedimentary rocks in the eastern mountain passes and more recent volcanic rocks around the North Pahroc and Golden Gate Ranges (DIRS 176184-Shannon & Wilson 2006, Table 5). The valleys are covered with modern-day ***alluvium***, and most contain playas.

Most earthquakes in the area have been of magnitude 3.0 or less, with the exception of the Timber Mountain area, where there was an earthquake of magnitude 5.0 (see Figure 3-3). Caliente common segment 1 would cross three prominent faults in the area, the Dry Lake and the West Dry Lake faults (Figure 3-6) and faults of the North Pahroc Range (Figure 3-7). These discontinuous faults are identified by offset bedrock or alluvial deposits, and were last active more than 11,000 years ago.

The Quaternary deposits in Dry Lake Valley contain naturally occurring surface fissures that range in size from about 27 meters (90 feet) to several kilometers long and up to 4.6 meters (15 feet) wide (DIRS 176184-Shannon & Wilson 2006, pp. 43 and 44). The cracks in Dry Lake Valley appear to be related to tectonic movements caused by faulting along the east and west margins of the valley (DIRS 176184-Shannon & Wilson 2006, Plate 4).

Limestone deposits are known mineral resources in the vicinity of Caliente common segment 1 (DIRS 173841-Shannon & Wilson 2005, p. 108 and Plate 1). Warm springs are the only known energy resources near the common segment. Section 3.2.2, Land Use and Ownership, describes mining districts and mineral and energy resources along the segment.

3.2.1.3.2.3 Soils. Soils along Caliente common segment 1 are predominantly very thick, well-drained, silty loams, with some thin, well-drained, gravelly sandy loams (DIRS 176781-MO0603GSCSSGEO.000). In this area, there are also badlands, semi-***arid*** areas with steeply gullied topography caused by rapid erosion, where runoff occurs rapidly and erosion is severe. There is a wide range of soil types along Caliente common segment 1 (DIRS 176781-MO0603GSCSSGEO.000). Soil depths vary from thin to very thick. Most of the well-drained soils in the White River area occur on ***fan piedmonts***, ***fan remnants***, and ***fan skirts***.

> **Fan piedmonts, fan remnants,** and **fan skirts** refer to locations within a large ***alluvial fan***. Fan piedmonts refer to the area along the base of a mountain slope. Fan remnants refer to parts of an older alluvial fan that remain after erosion has removed most of the fan. Fan skirts refer to the area along the base of the alluvial fan in a valley.

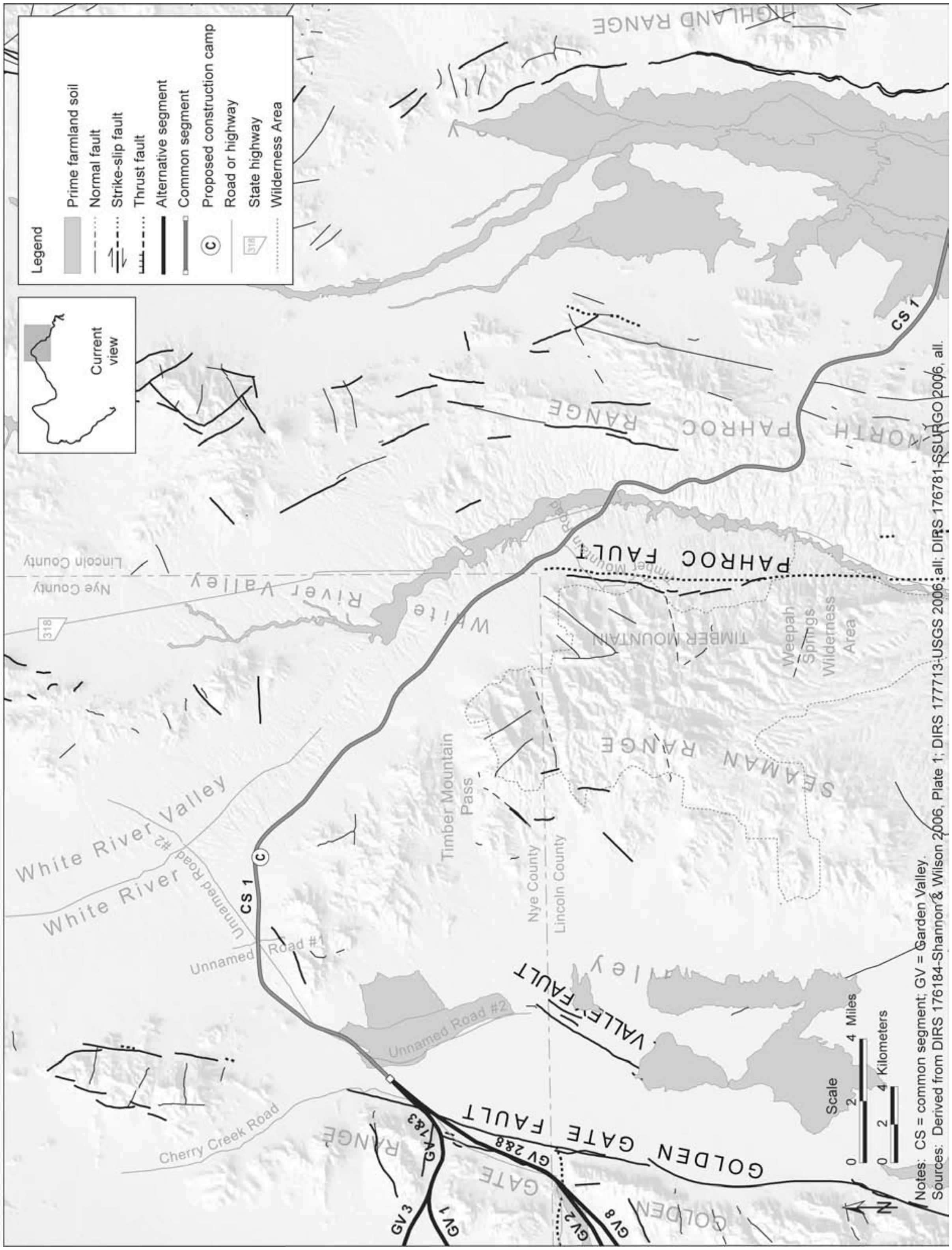


Figure 3-7. Physiographic features of the common segment and alternative segments within map area 2.

Soils classified as prime farmland make up 2.6 percent of the soils along Caliente common segment 1. Soils with the erodes easily characteristic comprise 18 percent of the soils. None of the available soils data include soils with the blowing soil characteristic.

3.2.1.3.3 *Garden Valley Alternative Segments*

3.2.1.3.3.1 Physiography. All of the Garden Valley alternative segments would cross the Golden Gate Range and pass through Garden Valley, which is a broad, nearly flat depression. From north to south along the Golden Gate Range, there are two unnamed gaps and two named gaps (Water Gap and Murphy Gap). Garden Valley alternative segments 1 and 3 would cross the Golden Gate Range through the northernmost unnamed gap. This gap, a relatively gentle pass, has an elevation of about 1,600 meters (5,200 feet) above mean sea level. Garden Valley alternative segments 2 and 8 would cross Golden Gate Range farther to the south at Water Gap, which has an elevation of 1,580 meters (5,200 feet) (Figure 3-8).

3.2.1.3.3.2 Geology. The Garden Valley alternative segments would cross a variety of sedimentary and volcanic rocks in gaps of the Golden Gate Range. The floor of Garden Valley is covered with thick alluvial sediments. The Garden Valley alternative segments would cross the northernmost exposure of the Golden Gate Fault. This fault is a complex zone that consists of discontinuous traces extending along the eastern border of the Golden Gate Range. It is uncertain when this fault was last active; however there is record of movement occurring about 15,000 years ago (DIRS 177713-MO0607LFAFUS96.000, Fault Number 1393).

Other than gravel and alluvial materials present on the floor of Garden Valley, the Garden Valley alternative segments would not cross any known commercial mineral deposits.

3.2.1.3.3.3 Soils. The Nye and Lincoln County soil surveys indicate that soils in the area of Garden Valley are mostly very thick and well-drained, and occur on fan piedmonts (DIRS 176781-MO0603GSCSSGEO.000).

Some soils classified as prime farmland are found along the alternative segments. Less than 1 percent of soils along Garden Valley alternative segment 2 are prime farmland, less than 1 percent along Garden Valley alternative segments 1 and 3, and no prime farmland soils along Garden Valley alternative segment 8. Soils with the erodes easily characteristic range from 13 percent for Garden Valley alternative segment 1, 22 percent for Garden Valley alternative segment 2, 12 percent for Garden Valley alternative segment 3, to 14 percent for Garden Valley alternative segment 8 (Table 3-3). The alternative segments also contain blowing soils, 5.7 percent along Garden Valley alternative segment 1, 6.1 percent along Garden Valley alternative segment 2, 2.1 percent along Garden Valley alternative segment 3, and 6 percent along Garden Valley alternative segment 8.

3.2.1.3.4 *Caliente Common Segment 2 (Quinn Canyon Range Area)*

3.2.1.3.4.1 Physiography. The area of Caliente common segment 2 is dominated by the Worthington Mountains to the south and east and the rugged Quinn Canyon and Reveille Ranges to the north (see Figures 3-8 and 3-9). This common segment would pass from Garden Valley to Sand Springs Valley and through foothills of the Quinn Canyon Range to Railroad Valley. Elevations in this area generally range from 1,620 to 1,800 meters (5,300 to 5,900 feet) above mean sea level.

3.2.1.3.4.2 Geology. Caliente common segment 2 would primarily cross recent alluvial deposits through the valleys, and sedimentary bedrock along the southern tip of the Quinn Canyon Range. There are few recorded earthquakes within the vicinity of the rail alignment in this area. The alignment would

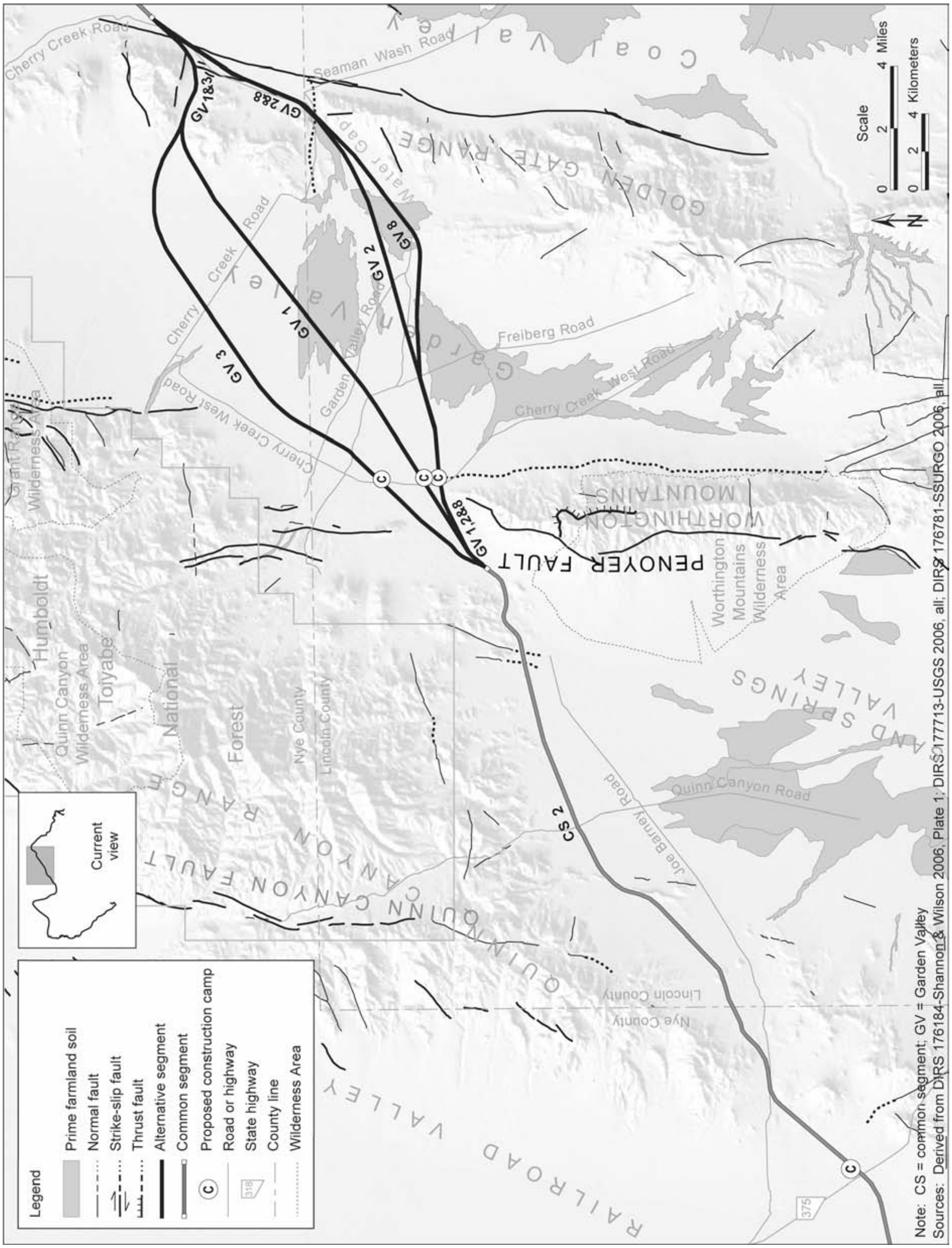


Figure 3-8. Physiographic features of the common segment and alternative segments within map area 3.

not cross recent fault traces or approach any energy resources. Other than gravel used for construction purposes, there is no commercial production in the area.

3.2.1.3.4.3 Soils. Caliente common segment 2 contains soils composed largely of fine sand underlain by ***hardpan*** (a layer of hard subsoil that prevents the ***infiltration*** of water or roots). The soils are thick to moderately thick and fine-textured (DIRS 176781-MO0603GSCSSGEO.000). The soils are formed on alluvium derived from volcanic rocks.

About 16 percent of the soils have the erodes easily characteristic. The data indicate that there are no prime farmland soils or soils with the blowing soil characteristic in this area.

3.2.1.3.5 *South Reveille Alternative Segments*

3.2.1.3.5.1 Physiography. South Reveille alternative segments 2 and 3 would enter Reveille Valley south of the Reveille Range (see Figure 3-9). The valley floor is relatively uniform, with elevations ranging from about 1,700 to 1,830 meters (5,700 to 6,000 feet) above mean sea level.

3.2.1.3.5.2 Geology. The South Reveille alternative segments would cross recent alluvium and volcanic flows. The alternative segments would not cross any Quaternary fault scarps, and there have been few earthquakes recorded in the area within the last 150 years. Recently, there has been some prospecting for gold and silver in the area around the alternative segments. However, there is a low potential for mineral resources in the area. Section 3.2.2, Land Use and Ownership, describes land uses, including mineral exploration. There are no known energy resources around the alternative segments.

Potential quarry NN-9A would be in the southern portion of Reveille Valley. The site would be about 32 to 48 kilometers (20 to 30 miles) from State Route 375, the nearest paved road. The quarry pit would mine a basalt ridge and the plant facilities would be in the valley below (DIRS 176172-Nevada Rail Partners 2006, pp. B-2 and B-3).

Potential quarry NN-9B also would be in the southern portion of Reveille Valley, about 2 kilometers (1.2 miles) southeast of the site of potential quarry NN-9A. The quarry pit would mine a separate basalt ridge, with the plant facilities in the valley below, next to the South Reveille alternative segment 2 rail ***siding*** (DIRS 176172-Nevada Rail Partners 2006, pp. C-1 and C-2).

3.2.1.3.5.3 Soils. South Reveille Valley is dominated by very thick, well-drained, fan piedmont soils. These soils are derived from volcanic breccia and tuff. Nineteen percent of the soils along South Reveille alternative segment 2 have soils with the erodes easily characteristic; 15 percent of the soils along South Reveille alternative segment 3 have that characteristic. Additionally, 6.3 percent of South Reveille alternative segment 2 soils have the blowing soils characteristic; South Reveille alternative segment 3 contains none. There are no prime farmland soils along either of the South Reveille alternative segments.

3.2.1.3.6 Caliente Common Segment 3 (Reveille Valley to Mud Lake)

3.2.1.3.6.1 Physiography. The physiography of Caliente common segment 3 is characterized, from east to west, by the Reveille Valley, Stone Cabin Valley, Cactus Flat, Ralston Valley, and Mud Lake (see Figures 3-9 and 3-10). The Reveille Range would border the common segment on the east. The Hot Creek Range (the extension of the Kawich Range north of Warm Springs Summit) would border this common segment to the north. Caliente common segment 3 would cross Cow Canyon near Warm Springs Summit. Warm Springs, a cluster of hot springs, discharges just east of Warm Springs Summit in the Kawich Range. The Maintenance-of-Way Trackside Facility would be next to the rail alignment in the northern section of Cactus Flat. The Maintenance-of-Way Headquarters Facility would be 8.0 kilometers (5.0 miles) south of Tonopah, adjacent to U.S. Highway 95.

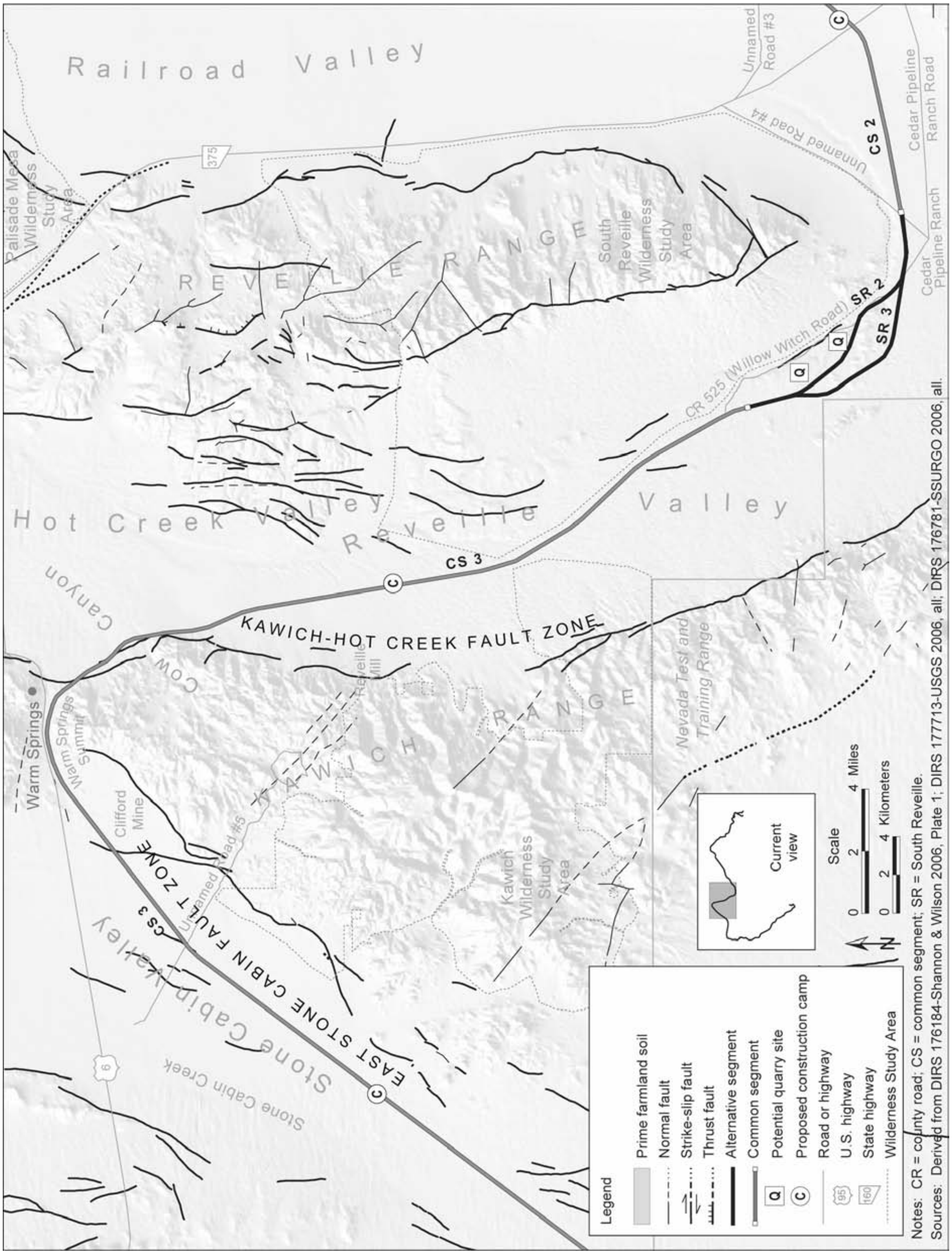


Figure 3-9. Physiographic features of the common segments and alternative segments within map area 4.

Rail alignment elevations would range from 1,650 to 1,900 meters (5,400 to 6,200 feet) above mean sea level at Warm Springs Summit and 1,600 to 1,700 meters (5,200 to 5,600 feet) above mean sea level around Mud Lake.

3.2.1.3.6.2 Geology. Caliente common segment 3 would cross the length of Reveille Valley. Reveille Valley, a ***graben*** (a basin formed between normal faults), developed from displacements along the West Reveille fault and the western Hot Creek Reveille fault. At Warm Springs Summit, the common segment would cross young volcanic rocks that make up most of the Kawich Range. Stone Cabin Valley, Cactus Flat, and Ralston Valley consist of Quaternary alluvial materials, with some playa deposits in the lowest elevations of northern Cactus Flat and southern Ralston Valley. Runoff in southern Ralston Valley flows to Mud Lake, another playa. Some Quaternary alluvial deposits in Reveille Valley have been displaced by these faults, indicating movement within the past 1.6 million years.

Caliente common segment 3 would parallel the Kawich-Hot Creek fault zone along the eastern side of the Hot Creek and Kawich Ranges. Displacement along this fault has occurred throughout the Quaternary, most recently about 130,000 years ago (DIRS 177713-MO0607LFAFUS96.000, Fault Number 1355). The common segment would both parallel and cross the East Stone Cabin fault zone, which forms the northwestern border of the Kawich Range with Stone Cabin Valley (see Figure 3-9). The most recent movement along this fault was also about 130,000 years ago (DIRS 177713-MO0607LFAFUS96.000, Fault Number 1354).

There are several commercial minerals found in the area around Caliente common segment 3 (DIRS 173841-Shannon & Wilson 2005, Plate 1). The Warm Springs summit area has documented sources of gold, silver, base metals, barite, and turquoise. As described in Section 3.2.2, Land Use and Ownership, there are also several mining districts in the area. There are also hot springs in the Warm Springs Summit area. Other than gravel and alluvial materials present on the floor of Stone Cabin Valley, Cactus Flat, and Ralston Valley, Caliente common segment 3 would not cross any known commercial mineral deposits.

3.2.1.3.6.3 Soils. Soils along Caliente common segment 3 occur on alluvial fan remnants, skirts, piedmonts, and in the eastern portion, on alluvial flats (DIRS 176781-MO0603GSCSSGEO.000). They are derived from various sources, including wind-blown sand, mixed alluvium, and fine-grained playa deposits.

Soils with the erodes easily characteristic comprise about 17 percent of the soils, and soils with the blowing soil characteristic comprise about 32 percent of the soils (see Table 3-3). As part of the pre-construction process, stability tests would ensure that fine-grained playa soils would be suitable for construction. The proposed rail alignment would not cross any soils considered to be prime farmland.

3.2.1.3.7 Goldfield Alternative Segments

3.2.1.3.7.1 Physiography. The physiography of the Goldfield area is dominated by the Goldfield Hills (see Figure 3-10) and the extensive surface and underground mine workings associated with the mining district. The Goldfield area also includes part of the Mud Lake basin to the north and the Montezuma Valley and Malpais Mesa to the west. There are several prominent hills, ridges, and plateaus in the area, which the Goldfield alternative segments would either cross or go around. The central Goldfield alternative segment, Goldfield 1, would wind through the central part of Goldfield Hills, coming within about 1.9 kilometers (1.2 miles) of Black Butte, Espina Hill, and Blackcap Mountain. Goldfield alternative segments 3 and 4 would weave through the western section of the Goldfield Hills, using passes and valleys to maintain an appropriate ***grade*** (see Figure 3-10). The alternative segments would reach elevations ranging from 1,800 to 1,900 meters (6,000 feet to 6,200 feet) above mean sea level.

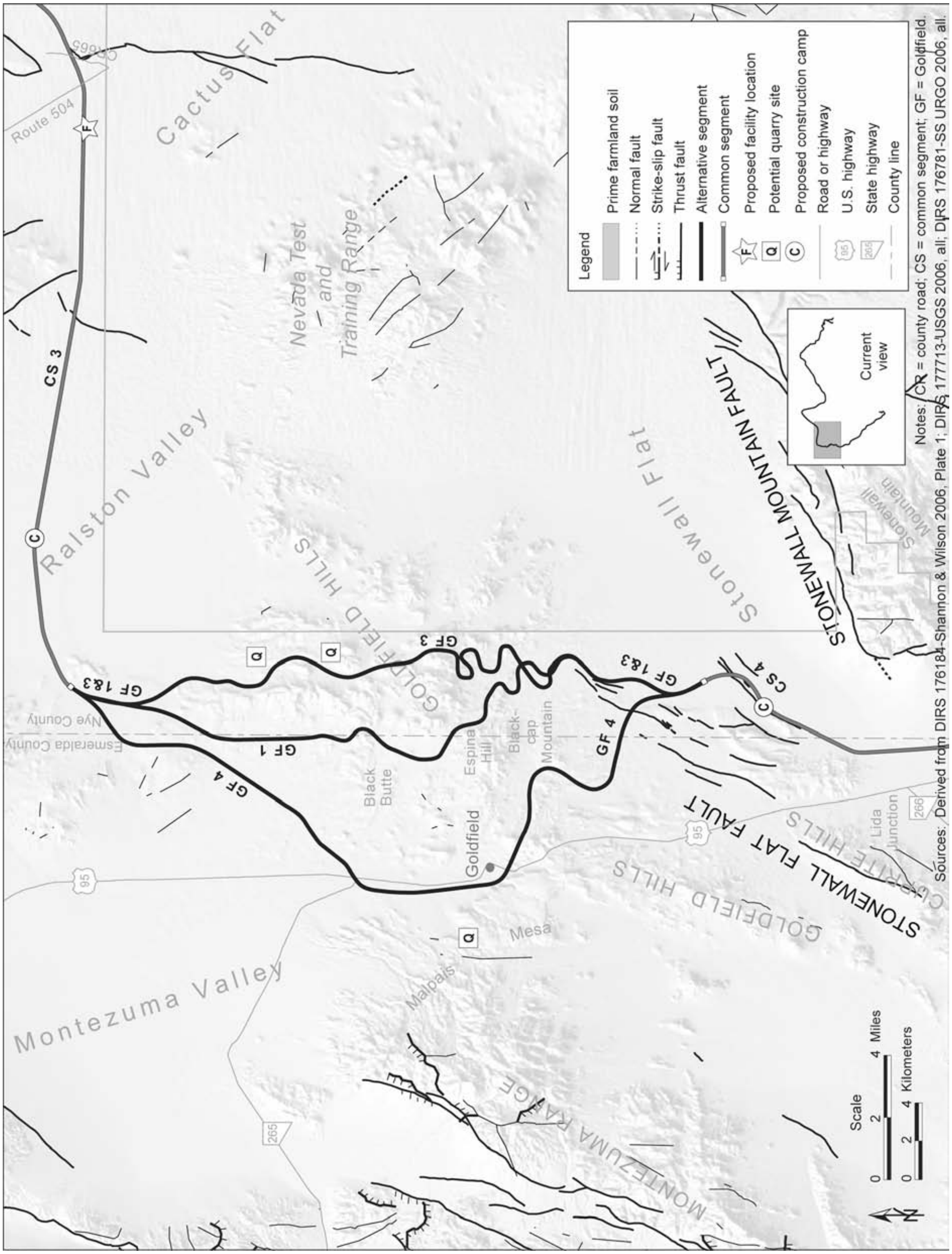


Figure 3-10. Physiographic features of the common segments and alternative segments within map area 5.

3.2.1.3.7.2 Geology. In the Goldfield area, the principal outcrops consist of young volcanic rocks. A combination of heat, water, and fractures in the bedrock contributed to the alteration and mineralization of the area volcanic rocks. This has resulted in an area with metallic mineral deposits (DIRS 173841-Shannon & Wilson 2005, pp. 68 to 70). The Goldfield Mining District has been extensively mined for gold, silver, and copper ore since the early 1900s. Nonmetallic minerals such as zeolite are also found in the area. Section 3.2.2, Land Use and Ownership, describes the local mining districts. There are no geothermal or other energy resources near the Goldfield alternative segments.

Potential quarry NS-3A would be on the basalt hills and surrounding valley northeast of Goldfield along Goldfield alternative segment 3. The quarry pit would encompass two hills on either side of a wash, with the plant facilities located in the valley below. Potential quarry NS-3B would be next to the site of NS-3A along Goldfield alternative segment 3 in a valley flanked by hills. The quarry pit would be adjacent to the rail alignment, and the plant facility would be to the east in the valley. Potential quarry ES-7 would be on Malpais Mesa, west of Goldfield along Goldfield alternative segment 4 (DIRS 176172-Nevada Rail Partners 2006, Figures 3-C and 3-D).

All of the Goldfield alternative segments would cross the northeastern edge of the Stonewall Flat fault zone. These faults offset bedrock in the Cuprite Hills, and are generally not well understood. The last fault movement was calculated to have occurred within the last 130,000 years (DIRS 177713-MO0607LFAFUS96.000, Fault Number 1089).

3.2.1.3.7.3 Soils. Soils along the Goldfield alternative segments include those derived from loose volcanic rock alluvium (DIRS 176781-MO0603GSCSSGEO.000). This area has well drained to excessively drained soils on mountains, hills, and fan piedmonts.

Soils with the blowing soil characteristic range from about 7.5 percent along Goldfield alternative segment 4 to 9.1 percent along Goldfield alternative segment 3; there are no soils with the erodes easily characteristic along any of the Goldfield alternative segments (see Table 3-3). None of the Goldfield alternative segments would cross prime farmland soils.

3.2.1.3.8 *Caliente Common Segment 4 (Stonewall Flat Area)*

3.2.1.3.8.1 Physiography. The physiography of Caliente common segment 4 is characterized by Stonewall Flat and Lida Valley, both depressions with numerous alkali flats (see Figures 3-10 and 3-11), and elevations between 1,400 and 1,500 meters (4,700 and 4,900 feet) above mean sea level. Stonewall Mountain is also a prominent feature that borders the common segment on the east.

3.2.1.3.8.2 Geology. In Stonewall Flat, a graben formed in part by the northeast-trending Stonewall Mountain Fault, Caliente common segment 4 would mostly cross fan and stream-channel alluvium, in addition to a small outcrop of volcanic rocks of Stonewall Mountain (DIRS 176184-Shannon & Wilson 2006, Table 5). There has been some seismic activity around the Cuprite Hills and at Stonewall Mountain within the past 150 years (see Figure 3-3).

There are metallic minerals, including copper, silver, and gold, along this common segment. The deposits occur in sedimentary and volcanic rocks that have been altered by hot fluids. Quartz veins are also mined for silica. Drilling in the Cuprite Hills suggests the existence of a large geothermal system in the area, with multiple warm heat-flow wells drilled in the Cuprite Hills (DIRS 173841-Shannon & Wilson 2005, Plate 1). Except for alluvium, there are no construction materials along the common segment.

3.2.1.3.8.3 Soils. Soils along Caliente common segment 4 are derived from alluvium and occur on fan piedmonts, fan skirts, and drainage ways (DIRS 176781-MO0603GSCSSGEO.000). Soils with the blowing soil characteristic comprise 1.4 percent of the soils along this common segment. Soils with the erodes easily characteristic comprise about 41 percent of the soils. Caliente common segment 4 would not cross any prime farmland soils.

3.2.1.3.9 *Bonnie Claire Alternative Segments*

3.2.1.3.9.1 Physiography. The physiography of the Bonnie Claire area is characterized by the southern boundary of Lida Valley and the northern portion of Sarcobatus Flat, which are depressions with numerous alkali flats. Pahute Mesa would be to the east of the alternative segments; Stonewall Mountain would be to the northeast (see Figure 3-11). Bonnie Claire alternative segment 2 would pass to the east of an unnamed 1,500-meter (4,900-foot)-high bedrock knoll that separates Sarcobatus Flat and Lida Valley; Bonnie Claire alternative segment 3 would pass this knoll to the west (DIRS 176184-Shannon & Wilson 2006, Figure 3). Elevations in this area range from about 1,250 to 1,400 meters (4,100 to 4,600 feet) above mean sea level.

3.2.1.3.9.2 Geology. The Bonnie Claire alternative segments would cross the eastern portion of the southwestern Nevada volcanic field. Bonnie Claire 3 would cross a mixture of young volcanic rocks and ash-flow sedimentary rocks, while Bonnie Claire 2 would primarily cross alluvium on the western edge of Sarcobatus Flat (DIRS 176184-Shannon & Wilson 2006, Table 5).

The two alternative segments would bypass a sequence of interconnected unnamed faults. These faults are not well studied, although recent seismic activity has been recorded in the area. In 1999, there was a magnitude 5.3 earthquake in the area between the Bonnie Claire alternative segments. As seen in Figure 3-3, many aftershocks were recorded in the area, most between magnitudes 2.0 and 3.5. Since then, earthquakes immediately around the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 176184-Shannon & Wilson 2006, Plate 4).

Metallic minerals such as gold and copper have been found within the volcanic rocks around the Bonnie Claire alternative segments. The Wagner Mining District is in this area, and is discussed in more detail in Section 3.2.2, Land Use and Ownership.

There are no energy or geothermal resources in the area surrounding the Bonnie Claire alternative segments, and other than gravel and alluvial materials present on the floor of Lida Valley, the Bonnie Claire alternative segments would not cross any known mineral deposits.

3.2.1.3.9.3 Soils. Soils along Bonnie Claire alternative segments 2 and 3 are derived from alluvium and ***colluvium***, and are found on hills, alluvial fan piedmonts, and fan skirts. Soils are mainly identified for Bonnie Claire alternative segment 3, because soil data are not available for the area around the Nevada Test and Training Range.

Soils with the erodes easily characteristic comprise 27 and 25 percent of the soils for Bonnie Claire alternative segments 2 and 3, respectively. Available data do not indicate any soils with the blowing soil or prime farmland characteristic.

3.2.1.3.10 Common Segment 5 (Sarcobatus Flat Area)

3.2.1.3.10.1 Physiography. The physiography of common segment 5 consists of most of Sarcobatus Flat. Pahute Mesa would be to the northeast (see Figure 3-11). Coba Mountain is a prominent feature in the area, and extends from common segment 5 to the southwest (see Figure 3-12). Rail alignment elevations in the Sarcobatus Flat area would range from 1,200 to 1,250 meters (3,900 feet to 4,100 feet) above mean sea level.

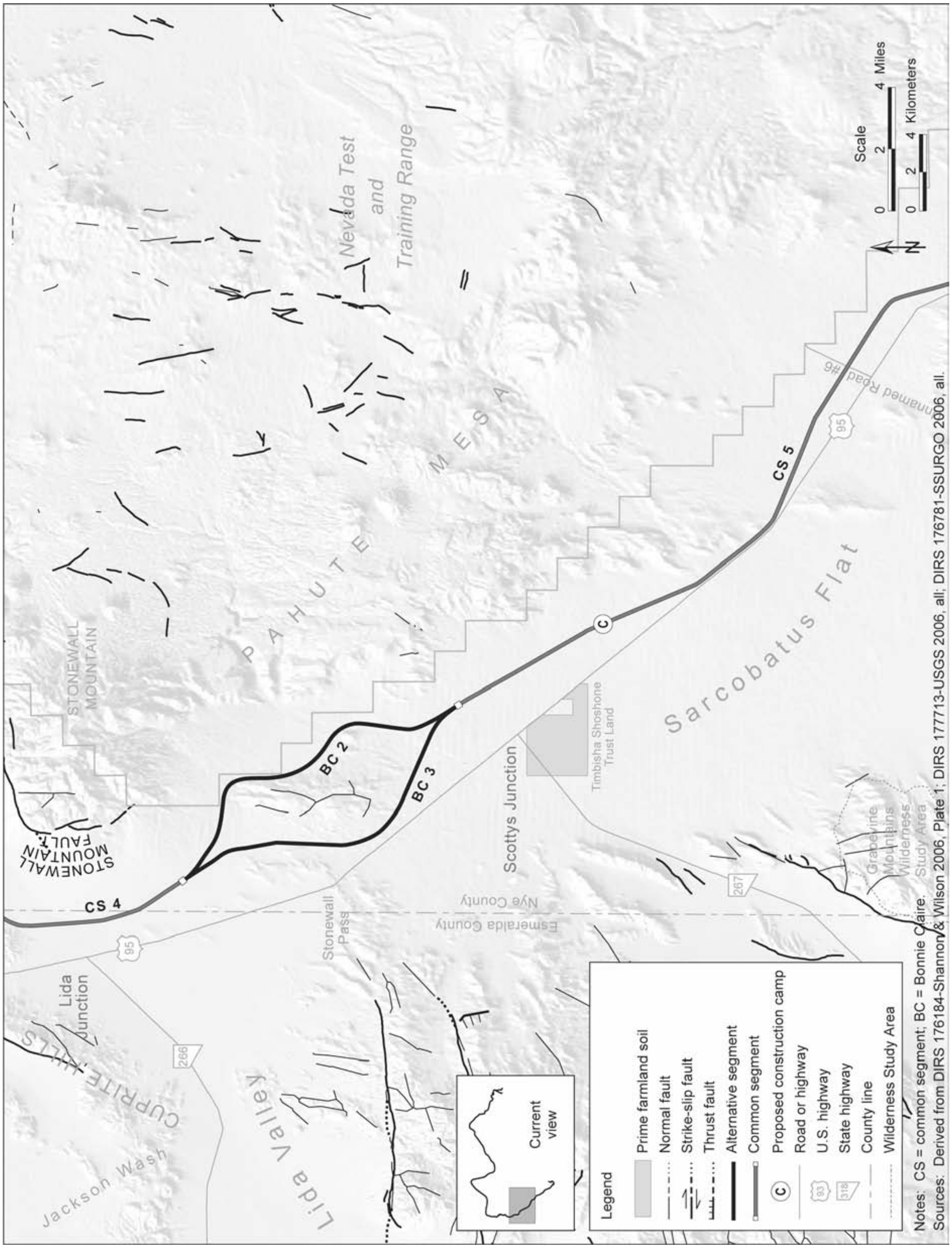


Figure 3-11. Physiographic features of the common segments and alternative segments within map area 6.

3.2.1.3.10.2 Geology. Common segment 5 would cross Quaternary alluvium and mid-Tertiary ash-flow tuffs, minor lava flows, and reworked materials associated with the southwestern Nevada volcanic field. The common segment would not cross Quaternary faults (see Figures 3-11 and 3-12). Commercial minerals found within the area include gold and silver (DIRS 173841-Shannon & Wilson 2005, pp. 51 and 52). Additionally, an actively mined, relatively large gravel pit at the alluvial fan boundary between Pahute Mesa and Sarcobatus Flat would be within 0.8 kilometer (0.5 mile) of the rail alignment in this area.

Geothermal occurrences in Sarcobatus Valley include one warm spring and one hot well, which would be about 0.20 kilometer (0.12 mile) from the rail alignment.

3.2.1.3.10.3 Soils. Area soils are derived from alluvial deposits and are well drained. They occur on alluvial flats and fan piedmonts. Soils with the blowing soil characteristic comprise about 2.6 percent of the soils. There are no soils along common segment 5 with the erodes easily or prime farmland characteristics.

3.2.1.3.11 *Oasis Valley Alternative Segments*

3.2.1.3.11.1 Physiography. Oasis Valley alternative segments 1 and 3 would be in Oasis Valley, which is incised by the Amargosa River, an ***ephemeral stream***, and tributary washes (see Figure 3-12). Elevations range from about 1,200 to 1,300 meters (3,900 to 4,200 feet) above mean sea level. At the northwest end, the alternative segments would cross alluvial fans extending from Pahute Mesa on the north and Oasis Mountain (in Bullfrog Hills) on the south.

3.2.1.3.11.2 Geology. The two Oasis Valley alternative segments would cross sedimentary rocks overlain in part by recent sediment from alluvial fans and Amargosa River floodplain deposits. Small outcrops of young volcanic rocks from the southwestern Nevada volcanic field area are also exposed. The rail alignment would not cross Quaternary faults, commercial mineral operations, geothermal resources or materials suitable for construction purposes.

3.2.1.3.11.3 Soils. Soils along Oasis Valley alternative segments 1 and 3 are derived from alluvium and are well drained to somewhat excessively drained. Soils occur on fan skirts and fan piedmonts. Oasis Valley 1 contains approximately 13 percent soils with the blowing soil characteristic, while Oasis Valley 3 contains approximately 5.3 percent of blowing soils. There are no prime farmland or erodes easily soils along either of the Oasis Valley alternative segments.

3.2.1.3.12 Common Segment 6 (Yucca Mountain Approach)

3.2.1.3.12.1 Physiography. The physiography of common segment 6 is characterized by Beatty Wash, Crater Flat, and several ridges and valleys that make up Yucca Mountain, Busted Butte, and Jackass Flats (see Figure 3-12). The common segment would go around the east side of Busted Butte, with Fortymile Wash and most of Jackass Flats to the east. North of Busted Butte, it would cross a series of washes and valleys flanked by multiple ridges, where it would terminate near Yucca Mountain. Rail alignment elevations would range from about 1,300 meters (4,300 feet) at Tram Ridge to 1,000 meters (3,300 feet) above mean sea level at the base of Busted Butte (DIRS 176184-Shannon & Wilson 2006, Figure 3, Sheets 70 and 71).

3.2.1.3.12.2 Geology. This area is in the southern edge of the southwestern Nevada volcanic field. Common segment 6 would cross a variety of alluvial deposits and sedimentary rocks, and young volcanic rocks. Faults in the area increase in number closer to the Yucca Mountain uplands. The fault traces generally trend to the north, including the Bare Mountain Fault and the eastern and western Yucca

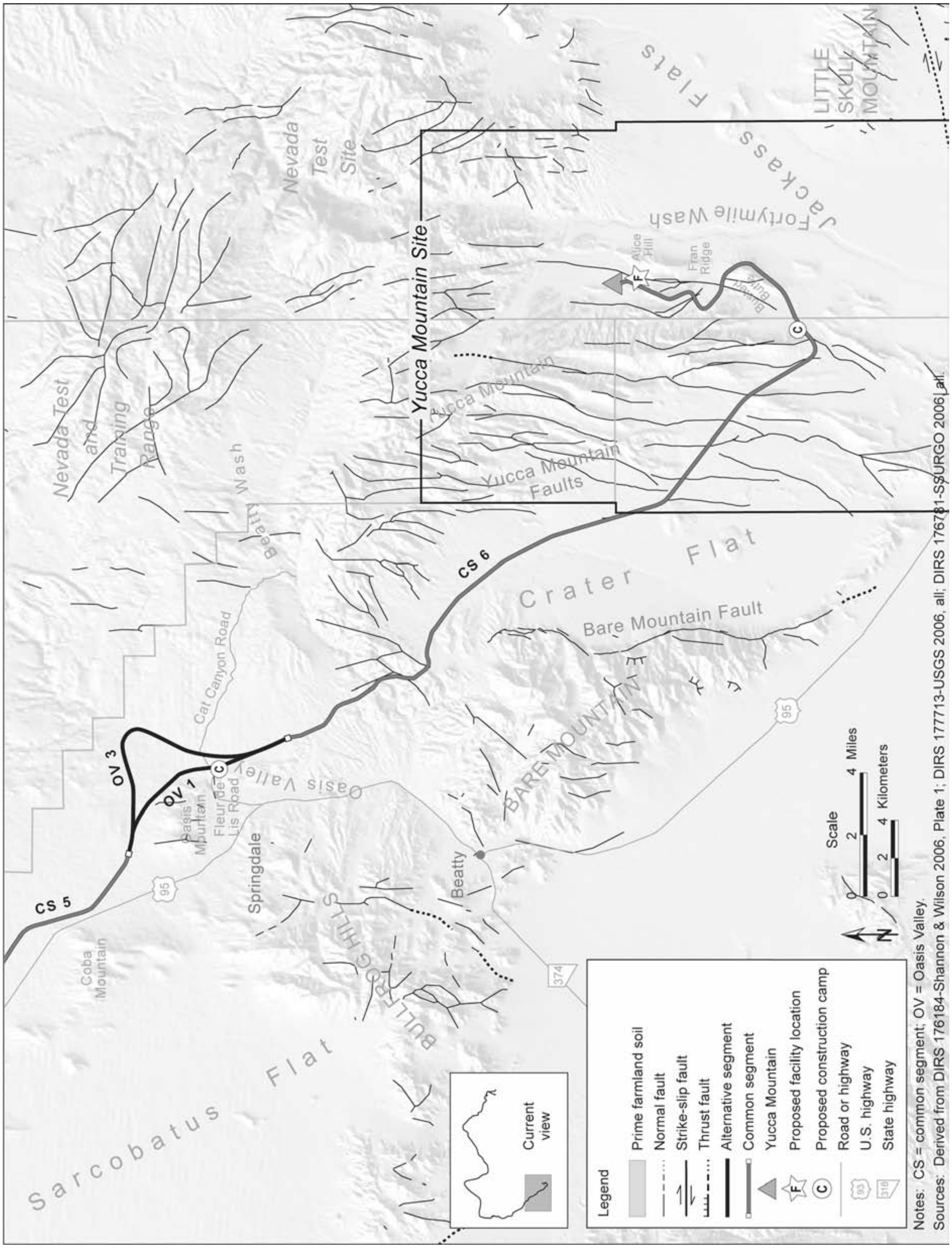


Figure 3-12. Physiographic features of the common segments and alternatives segments within map area 7.

Mountain fault groups. Displacements along faults are characterized in terms of the amount of movement per seismic event. For the set of block-bounding faults of primary significance to the ***Yucca Mountain Site***, these surface values range from 0 to 1.7 meters (0 to 5.6 feet) per event (DIRS 155970-DOE 2002, Table 3-8).

DOE has monitored seismic activity at the Nevada Test Site since 1978. The largest recorded earthquake within 50 kilometers (30 miles) of Yucca Mountain was the Little Skull Mountain earthquake in 1992 (DIRS 169734-BSC 2004, p. 4-34 and Figure 4-19), which had a magnitude of 5.6 (DIRS 169734-BSC 2004, p. 4-38). DOE buildings on the Nevada Test Site were damaged and there was also damage in Beatty, Town of Amargosa Valley, and Mercury, Nevada. DOE would continue to monitor the seismic activity around Yucca Mountain with an array of monitoring stations spread throughout the area.

The bedrock around common segment 6 contains metallic minerals, such as gold and silver, and nonmetallic deposits, including fluorspar and silica (DIRS 173841-Shannon & Wilson 2005, pp. 38 to 45). There are also several hot springs around the Beatty Wash area, some of which are used by a hotel (DIRS 173841-Shannon & Wilson 2005, Plate 1).

3.2.1.3.12.3 Soils. Soils along common segment 6 occur on fan piedmonts, skirts, and fan remnants. The soils derived from Tertiary volcanic rocks and Quaternary alluvium are well drained to somewhat excessively drained. Soils on alluvial flats are derived from lake deposits and are well drained. None of the soils along common segment 6 contain prime farmland, blowing soil, or soils with the erodes easily characteristic.

3.2.2 LAND USE AND OWNERSHIP

This section describes the affected environment for land use and ownership along and adjacent to the Caliente rail alignment. At the recommendation of the U.S. Bureau of Land Management (BLM; a cooperating agency in the preparation of this Rail Alignment EIS), DOE organized this section by types of land uses rather than by rail line segments to enable the reader to quickly review issues of concern to them. The section provides an overview of land uses on private, American Indian, and public lands. The BLM and DOE manage public land the Caliente rail alignment would cross. The uses of public land discussed in detail in this section include grazing (within BLM-designated ***grazing allotments***), mineral and energy extraction, and recreation. This section also discusses land access and existing utility rights-of-way.

Section 3.2.2.1 describes the region of influence for land use and ownership; Section 3.2.2.2 describes private land, including relevant land-use plans; Section 3.2.2.3 describes American Indian land; Section 3.2.2.4 describes public lands, BLM ***resource management plans***, and project-related land ***withdrawals***; and Section 3.2.2.5 describes the general environmental setting and land-use characteristics along the Caliente rail alignment.

Other sections of this Rail Alignment EIS describe additional subjects related to land use. Section 3.2.1, Physical Setting, describes farmland and prime farmland in more detail; Section 3.2.7, Biological Resources, describes ***herd management areas***; and Section 3.2.11, Utilities, Energy, and Materials addresses utilities. Section 3.4 describes American Indian interests in and views on the Proposed Action.

3.2.2.1 Region of Influence

The region of influence for land use and ownership is the nominal width of the rail line construction right-of-way, and includes all private land (including patented ***mining claims***), American Indian lands, and public land that would be fully or partially within the construction right-of-way. The land use and ownership region of influence also includes the locations of construction and operations support facilities outside the nominal width of the rail line construction right-of-way.

Although the ***operations right-of-way*** would be smaller than the construction right-of-way, DOE evaluated the construction right-of-way as the basis for identifying potential land-use impacts because:

- It provides a more conservative estimate of the amount of land that would be utilized than the operations right-of-way, providing an upper bound for analysis.
- The construction phase encompasses the most intensive land use in terms of noise, human activity, and disruptions to land access.
- The construction right-of-way footprint would be the basis for the initial right-of-way applications submitted to the BLM for the project.

3.2.2.2 Private Land

Private lands in Lincoln, Nye, and Esmeralda Counties are either clustered in towns and along highways, or they are widely scattered. Private land makes up a very small portion of these counties. Figure 3-13 provides an overview of privately owned lands near the Caliente rail alignment.

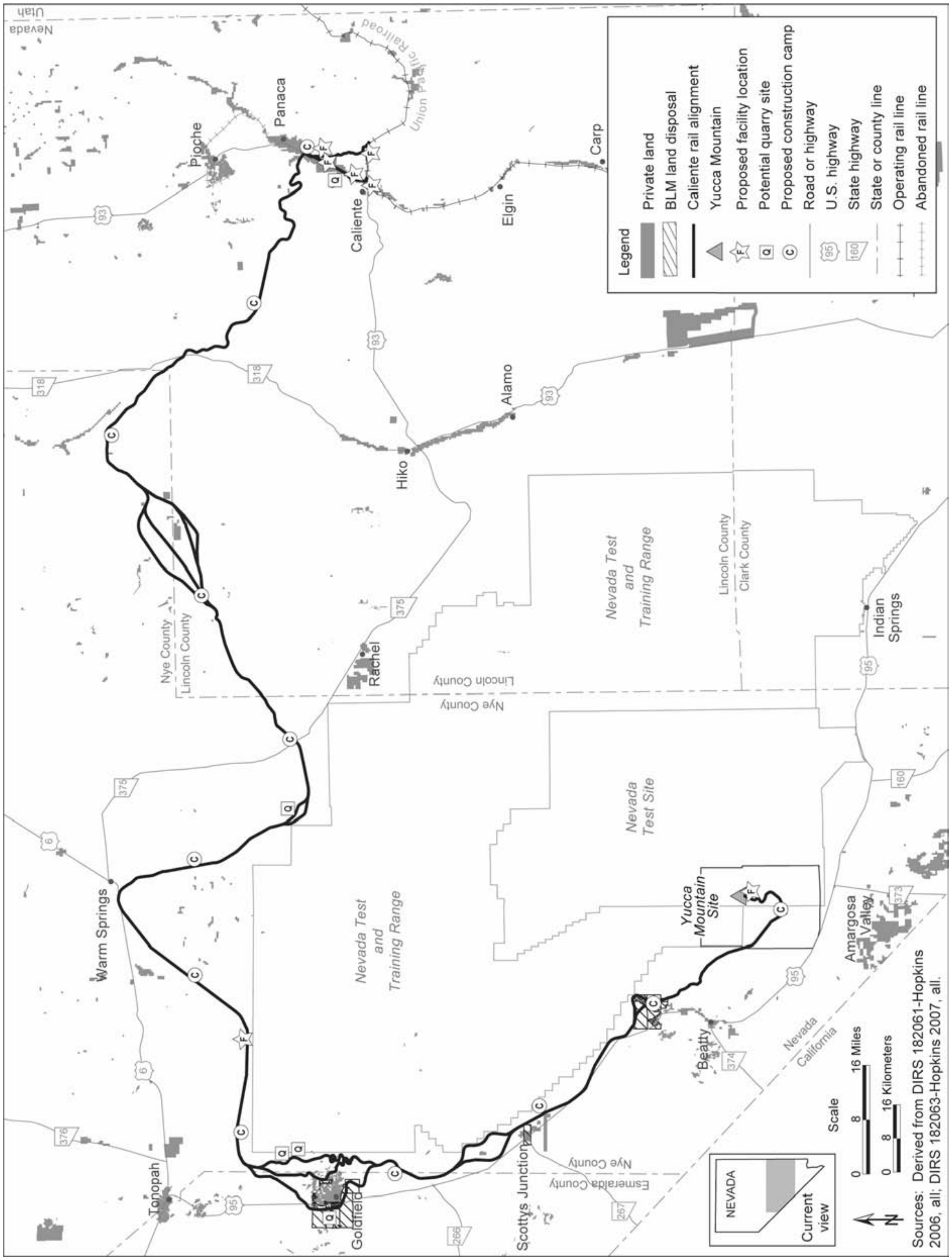


Figure 3-13. Private land along the Caliente rail alignment.

3.2.2.2.1 County Land-Use Plans

The Caliente rail alignment would cross parts of Lincoln, Nye, and Esmeralda Counties. County plans that affect land use along the rail alignment include the *Lincoln County Master Plan* (DIRS 174520-State of Nevada 2001, all), *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all), and *Esmeralda County Master Plan* (DIRS 176770-Duval et al. 1976, all).

3.2.2.2.1.1 Lincoln County. The *Lincoln County Master Plan* guides the county's growth, management of natural resources, provisions for public services and facilities, and the protection of public health, safety, and welfare. Lincoln County is the third largest county in Nevada, covering approximately 28,000 square kilometers (11,000 square miles), and the Federal Government manages more than 97 percent of that land (DIRS 174520-State of Nevada 2001, p. 3-5). The BLM manages most public land in the county; the U.S. Forest Service manages the portions of the Humboldt-Toiyabe National Forest that fall within the county. Lincoln County is primarily rural and most residents live in Pioche (also the county seat), Panaca, Alamo, the City of Caliente, and the communities of Rachel, Hiko, Ash Springs, Richardville, Caselton, and Ursine. The rest of Lincoln County is sparsely settled.

3.2.2.2.1.2 Nye County. Nye County has an area of approximately 47,000 square kilometers (18,000 square miles) and is the largest county in Nevada. The Federal Government manages almost 93 percent of the county's land. Federally owned or managed lands in Nye County include the Nevada Test and Training Range, the Nevada Test Site, BLM-administered public land, a portion of Death Valley National Park, and portions of the Humboldt-Toiyabe National Forest. Private lands in Nye County are used for residential, commercial, and industrial purposes largely, but not exclusively, within the boundaries of unincorporated towns, and agricultural and mining uses both inside and outside these towns. The *Nye County Comprehensive Plan* guides growth and development, but is not equivalent to a zoning ordinance, nor does it regulate the use of land. However, the Nye County Board of Commissioners may choose to enact a zoning ordinance or other growth-management mechanisms to accomplish certain objectives of the plan. The plan also serves as a framework for local land-use plans and other growth-management mechanisms (DIRS 147994-McRae 1994, all).

3.2.2.2.1.3 Esmeralda County. The BLM manages more than 92 percent of the approximately 9,300 square kilometers (3,600 square miles) in Esmeralda County. Two percent of the land in Esmeralda County is National Forest land, and a small portion of the county falls within Death Valley National Park. Less than 5 percent of the land in the county is privately owned. The two most heavily populated areas in Esmeralda County at the issuance of the *Esmeralda County Master Plan* were Goldfield and Silver Peak (DIRS 176770-Duval et al. 1976, p. 25). Goldfield is the county seat for Esmeralda County; there are no incorporated cities in the county. Under the *Esmeralda County Master Plan*, land use has been divided into three basic categories: multiple use, agriculture, and urban expansion. The multiple-use category is suggested for those areas where federal or state ownership is expected to remain. Grazing, mining and prospecting, and recreation activities are recommended under the multiple-use concept. The plan also recommends that residential and commercial development be concentrated in the existing communities of Goldfield and Silver Peak, where public facilities can be most economically concentrated (DIRS 176770-Duval et al. 1976, p. 73).

3.2.2.2.2 Local Land-Use Planning

The initial design phase for the Caliente rail alignment emphasized avoiding towns and populated areas wherever feasible. Caliente and Goldfield are the most densely populated places along the Caliente rail alignment. Zoning and land use within Caliente is governed by the *City of Caliente Master Plan* (Caliente Master Plan) (DIRS 157312-Sweetwater and Anderson 1992, all). Goldfield does not have a master plan or zoning plan.

3.2.2.2.2.1 City of Caliente. The Caliente alternative segment would pass through the City of Caliente, which is in Lincoln County along U.S. Highway 93 and encompasses approximately 5.5 square kilometers (1.9 square miles) (DIRS 176855-U.S. Census Bureau 2003, p. 5). City services include restaurants, gas stations, motels, a small casino, and a variety of stores. Land uses within the City of Caliente include residential, governmental (administrative), commercial, industrial, agricultural, and recreational.

Commercial and industrial uses comprise approximately 11 percent of the land use and residential areas encompass approximately 9 percent of the land in the city (DIRS 157312-Sweetwater and Anderson 1992, p. 27). There are agricultural operations on approximately 0.3 square kilometer (80 acres) of land (approximately 8 percent) within Caliente, primarily within floodplains (DIRS 157312-Sweetwater and Anderson 1992, p. 24). Roads and utilities make up approximately 17 percent of land use in Caliente. Though vacant land occupies approximately 44 percent of the city land base, steep slopes and floodplains have limited the city's development potential.

Union Pacific Railroad Mainline tracks (Caliente Line) cross Caliente in approximately a northeast to south direction. Caliente has long been a central maintenance and switching center for railroad operations. The Caliente Line, at full capacity, operates 25 to 30 trains a day (DIRS 176807-Union Pacific 2005, all).

The Caliente Master Plan outlines strategies for both steady and rapid growth. Overall the plan fosters the following key development concepts (DIRS 157312-Sweetwater and Anderson 1992, p. 49):

- Caliente's role will continue to be residential, with tourism, the service industry, the [existing] railroad, and associated activities as primary economic activities.
- Residential expansion should occur primarily on open land to the north of U.S. Highway 93 (toward the cemetery) and should be predominantly single-family.
- The existing commercial core should be rehabilitated and continue as the commercial hub of Caliente.
- Small-scale, clean industrial uses should be promoted. A large site for major economic centers should be located north of the city out of the mouth of Antelope Canyon.
- Caliente should develop and improve recreational and tourist attractions.

One goal outlined in the master plan that could be specifically relevant to the Caliente rail alignment because it addresses rail operations is (DIRS 157312-Sweetwater and Anderson 1992, p. 54):

> If Caliente is to be a distribution point for goods brought into the county, trains should be switched onto the Pioche Spur Line and materials unloaded at a location north of the City. This will reduce disruption to the community due to noise, traffic, dust, or trains blocking the vehicle crossing.

The *Lincoln County Master Plan* states that the NTS Development Corporation is cooperating with the City of Caliente in the development of the Meadow Valley Industrial Park, to be located along U.S. Highway 93 and the Union Pacific Railroad in Caliente (DIRS 174520-State of Nevada 2001, pp. 24 and 25).

The City of Caliente has an undated zoning map developed by Design Concepts West showing zones for residential areas, administrative and professional areas, commercial areas, industrial areas, and parks and recreational areas. Most of the land adjacent to the Union Pacific Railroad tracks is zoned general commercial or industrial. There are exceptions adjacent to the former Pioche and Prince Branchline north of the Caliente Hot Springs, where the Lincoln County Hospital, senior citizens apartments, and a trailer court are immediately west of U.S. Highway 93. There is no zoning designation for the land that encompasses the former Pioche and Prince Branch (DIRS 180121-DC West [n.d.], all).

3.2.2.2.2.2 Goldfield. Goldfield alternative segment 4 would pass through Goldfield. Goldfield, an unincorporated town, is the county seat for Esmeralda County. The Goldfield census county division encompasses an area of more than 3,900 square kilometers (1,500 square miles) (DIRS 176855-U.S. Census Bureau 2003, p. 5). During its most prominent mining period at the beginning of the 20th Century, a number of passenger and freight railroad lines served Goldfield. The Goldfield Historic District, listed on the *National Register of Historic Places* in 1982 and entered onto the *Nevada State Register of Historic Places* on December 7, 2005, is in Goldfield and roughly bounded by Fifth Street, Miner Avenue, Spring Street, Elliot Street, and Crystal Avenue (DIRS 176854-National Register of Historic Places 1982, all). Although there is no zoning plan for Goldfield, the historic nature of its buildings and features are generally protected by the designation of its historic district. The Goldfield Historic District would be about 0.7 kilometer (0.4 mile) northwest of the Goldfield alternative segment 4 construction right-of-way.

3.2.2.2.3 Private Parcels

Most of the privately owned lands closest to the Caliente rail alignment are in or near Caliente and Goldfield. Figure 3-13 shows privately owned lands in or near the Caliente rail alignment. Note that patented mining claims are also private land, and are reflected in this private land information.

Table 3-4 lists the number of privately owned parcels of land that would be within the construction right-of-way of each Caliente alternative segment and common segment. Figures 3-14 through 3-25 show privately owned land along the Caliente rail alignment. Figures 3-15 through 3-18 show detailed land parcel maps for the Caliente and Eccles alternative segments.

Table 3-4. Private land that would be within or intersect the Caliente rail alignment construction right-of-way.

Rail line segment[a]	Number of parcels	Total area across parcels (square kilometers)[b]
Eccles alternative segment	11	0.32
Caliente alternative segment	32	0.31
Potential quarry CA-8B (siding only)[c]	2	0.18
Staging Yard at Caliente-Indian Cove	6	0.73
Staging Yard at Caliente-Upland	17	0.45
Caliente common segment 1	1	0.002
Goldfield alternative segment 1[c]	6	0.38
Goldfield alternative segment 3[c]	2	0.001
Goldfield alternative segment 4[d]	37	0.23
Oasis Valley alternative segment 1	1	0.02

a. No other segments would intersect private land.
b. To convert square kilometers to acres, multiply by 247.10.
c. All parcels are patented mining claims.
d. Four of the parcels are patented mining claims.

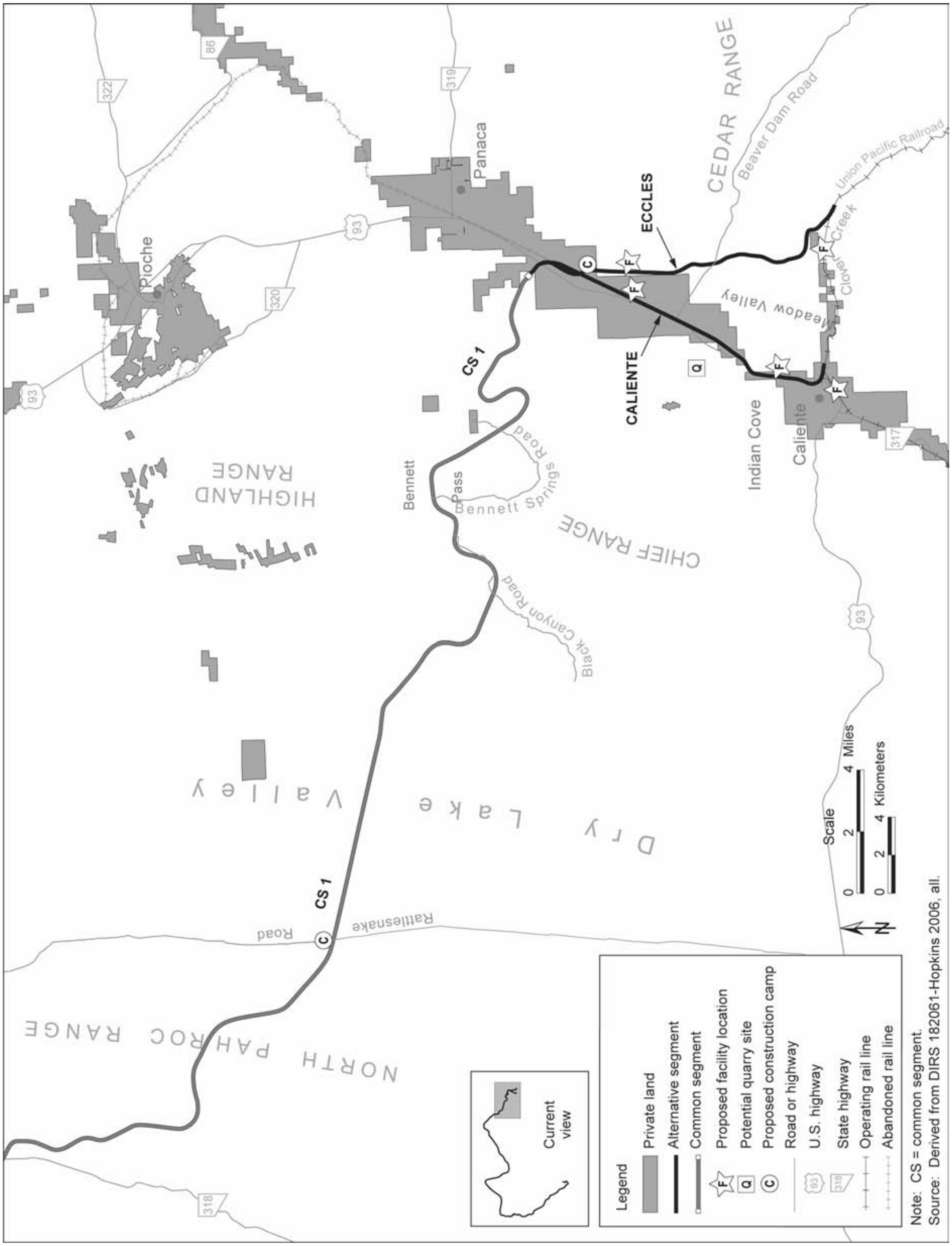


Figure 3-14. Private land within map area 1.

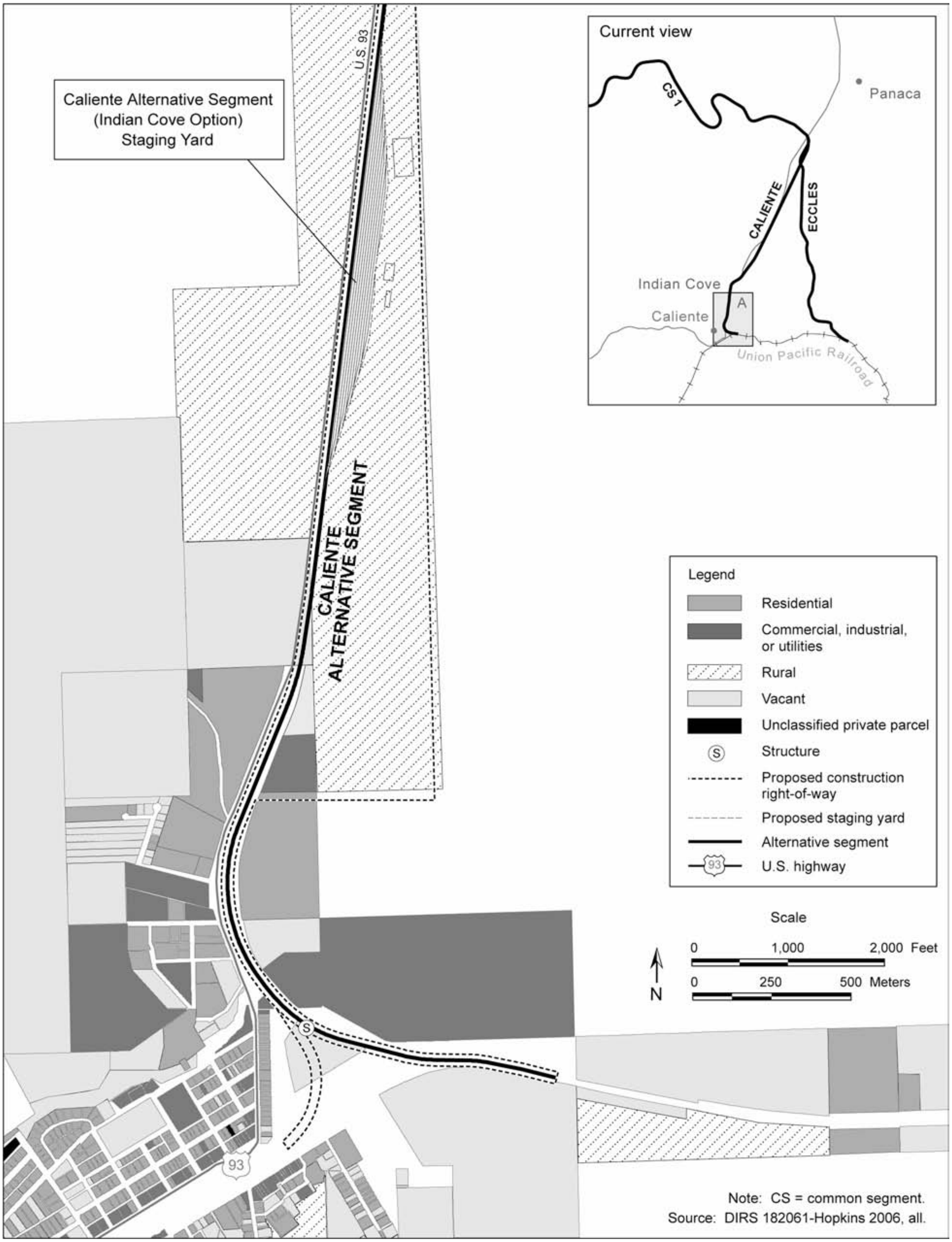


Figure 3-15. Private land, Caliente alternative segment map view A.

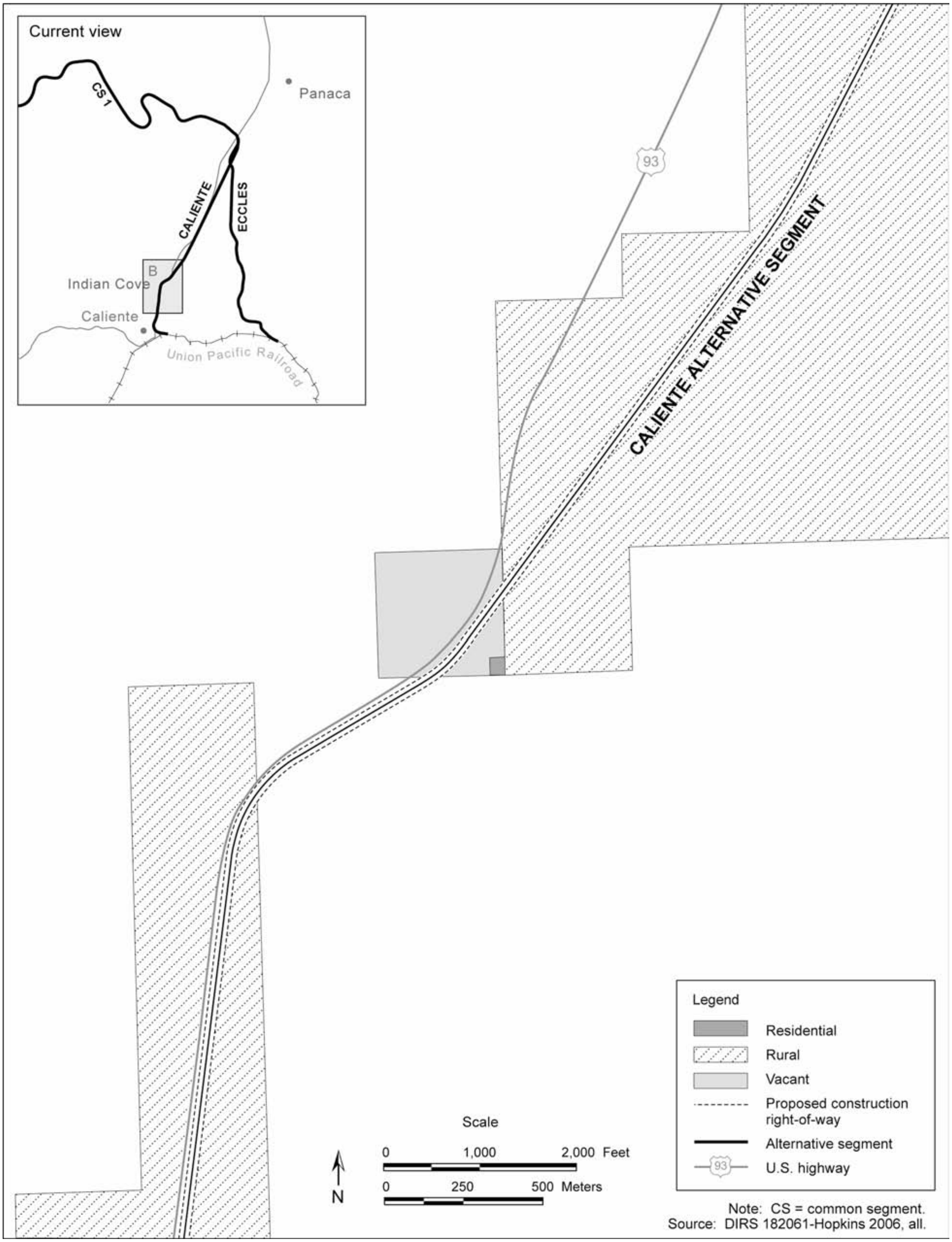


Figure 3-16. Private land, Caliente alternative segment map view B.

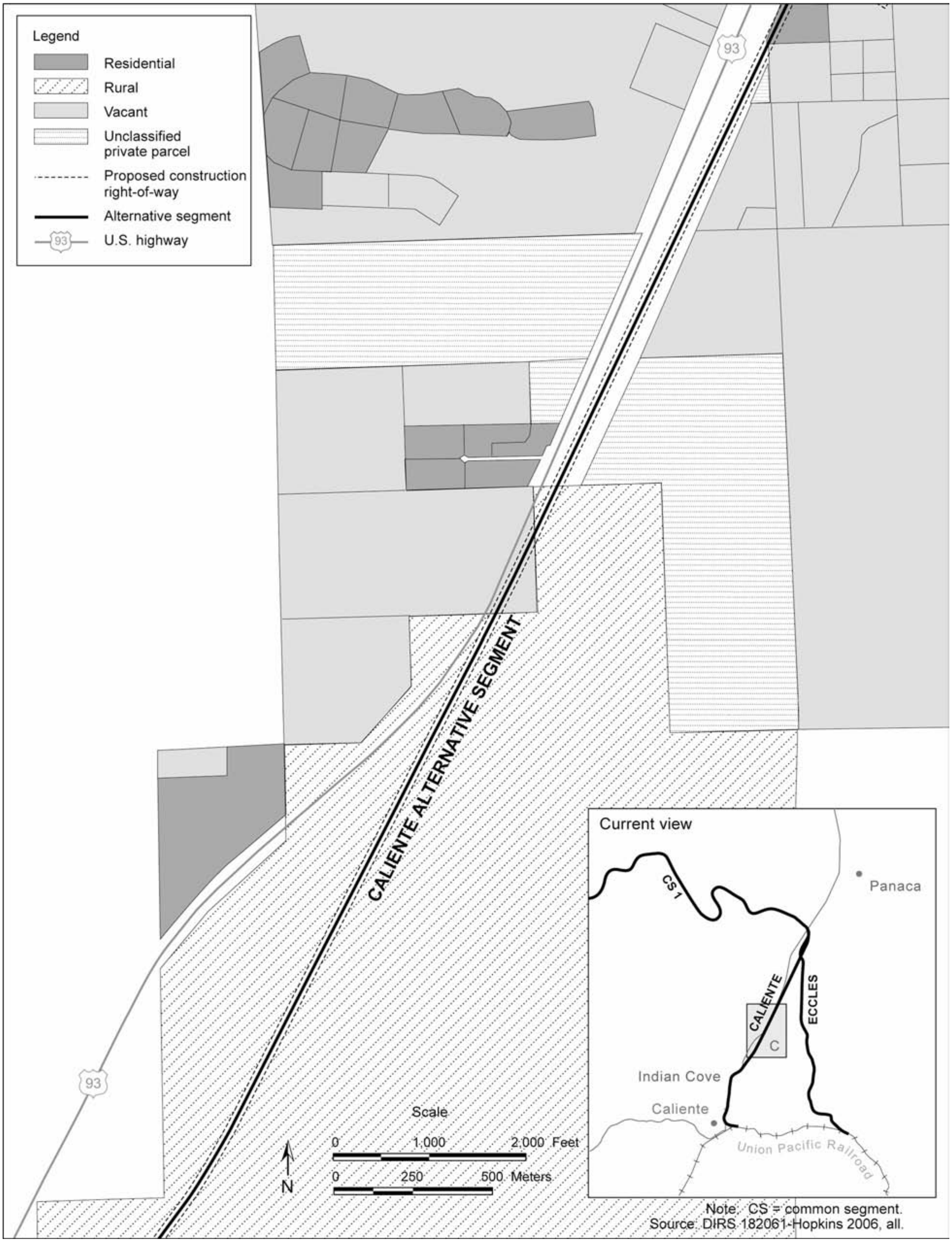


Figure 3-17. Private land, Caliente alternative segment map view C.

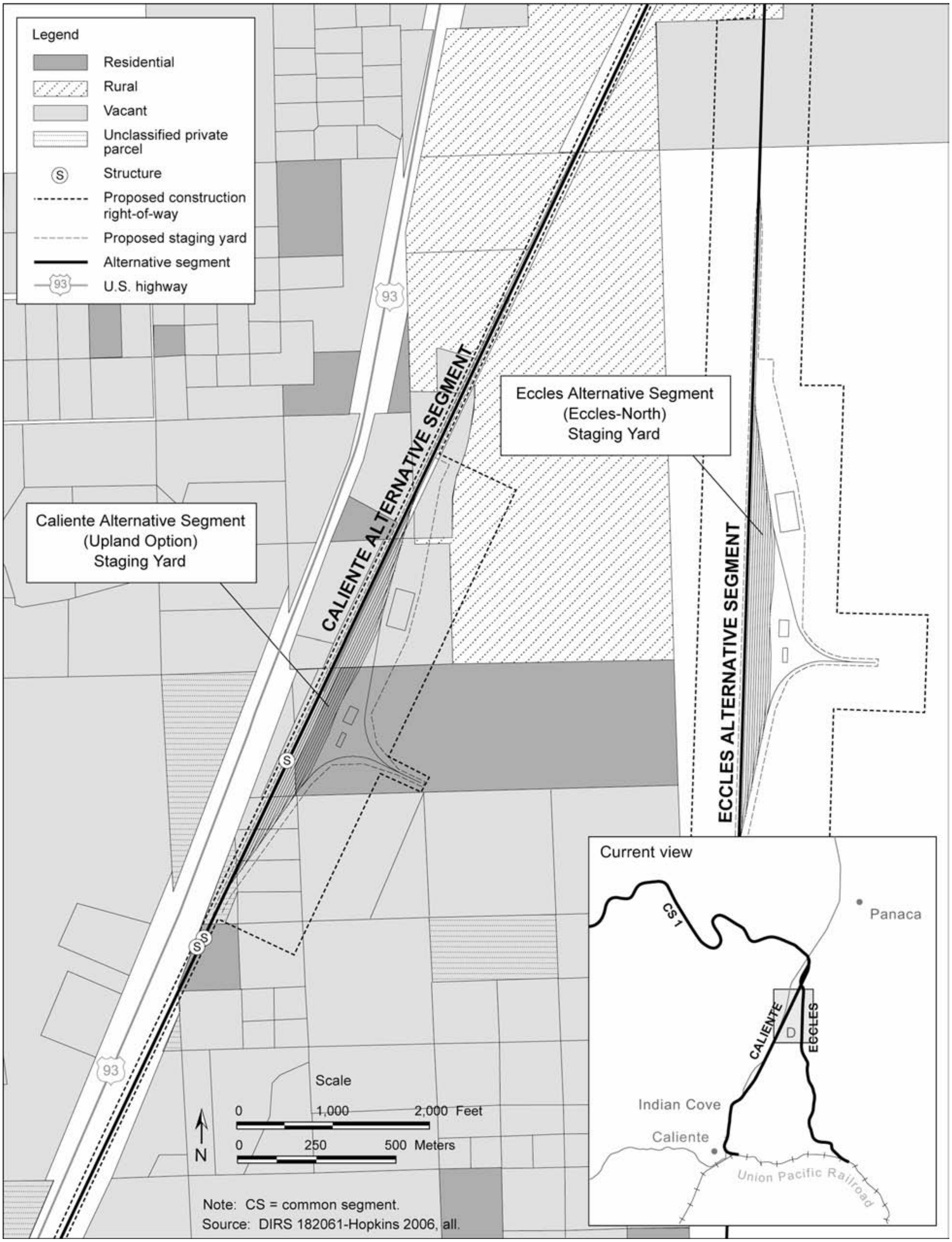


Figure 3-18. Private land, Caliente and Eccles alternative segments map view D.

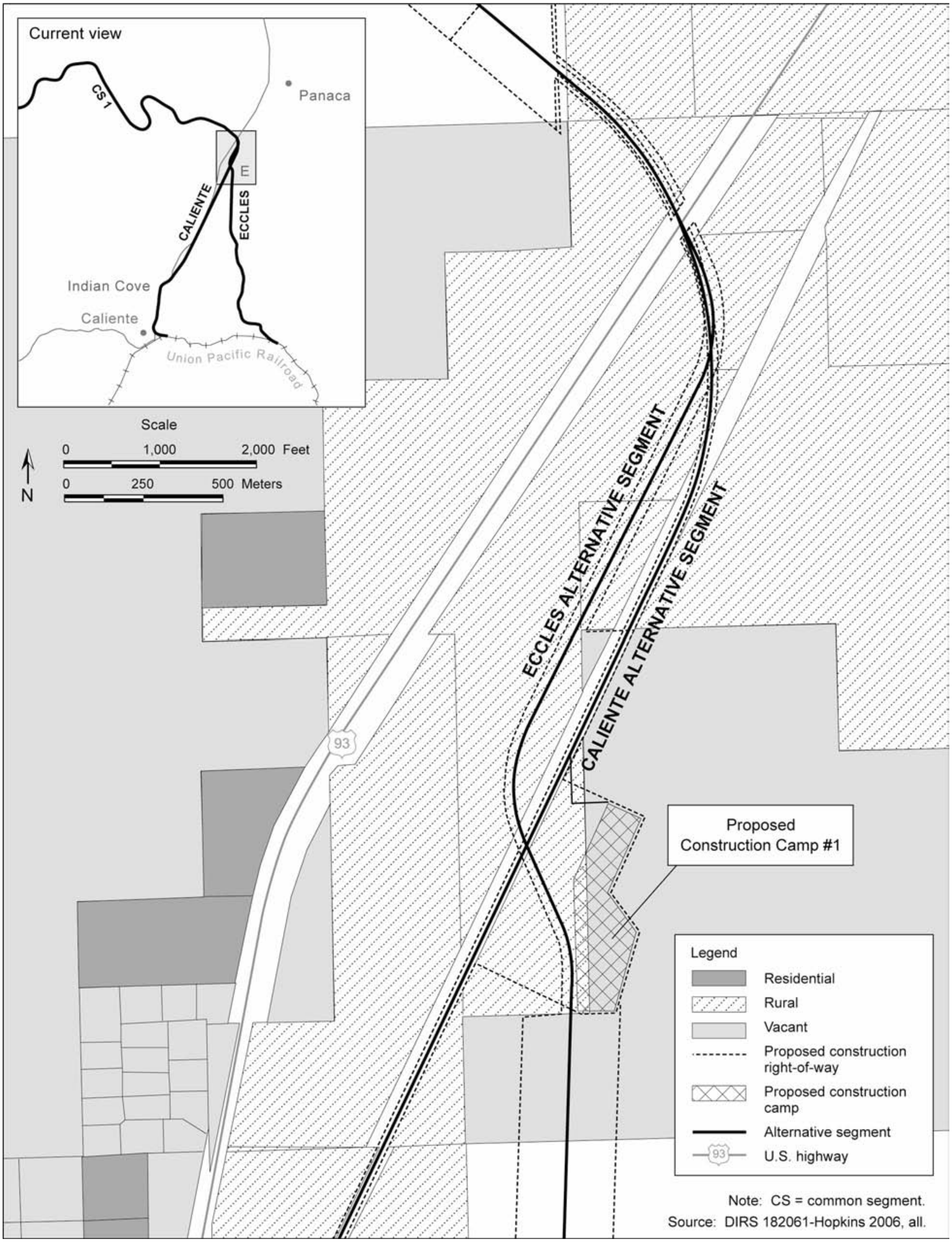


Figure 3-19. Private land, Caliente and Eccles alternative segments map view E.

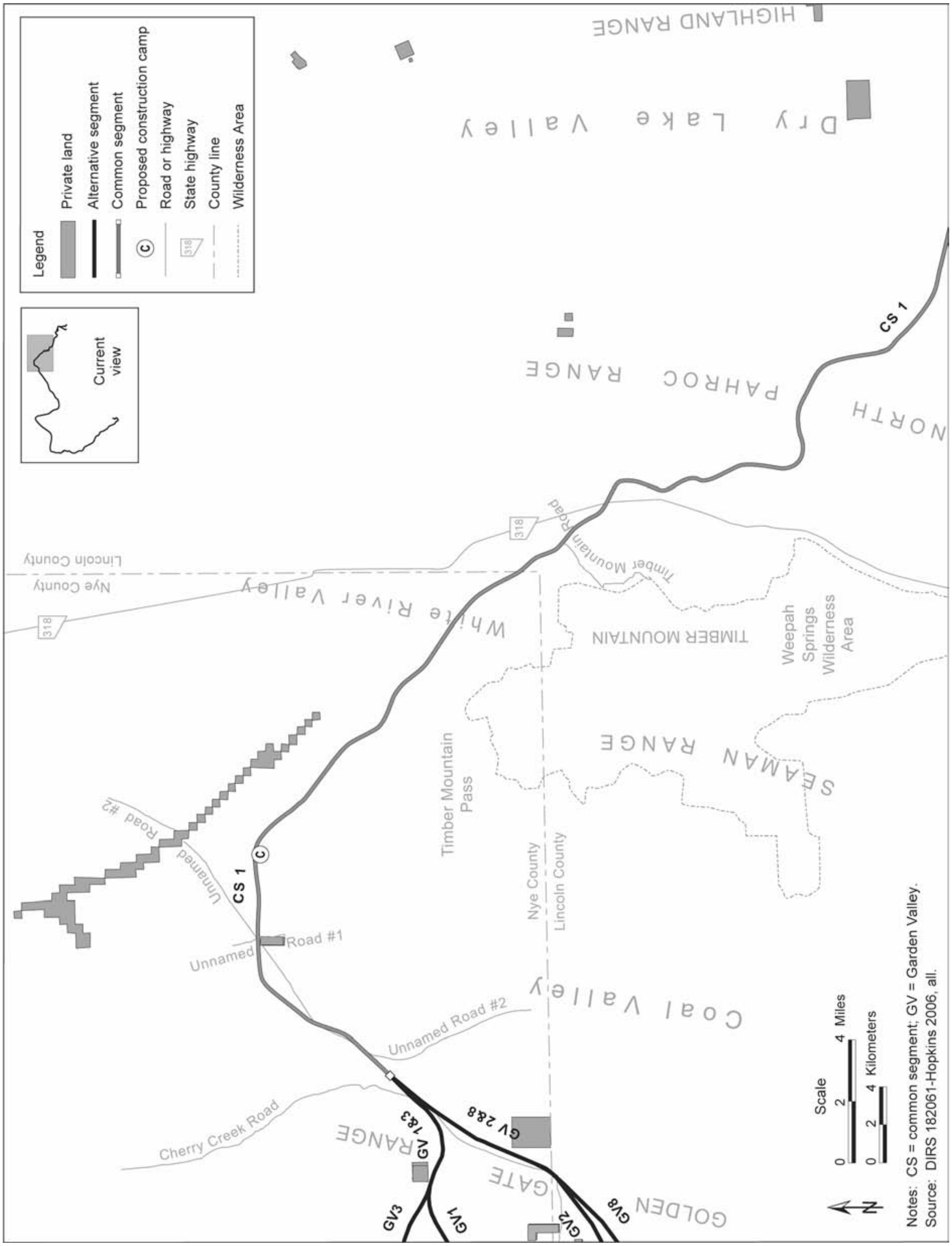


Figure 3-20. Private land within map area 2.

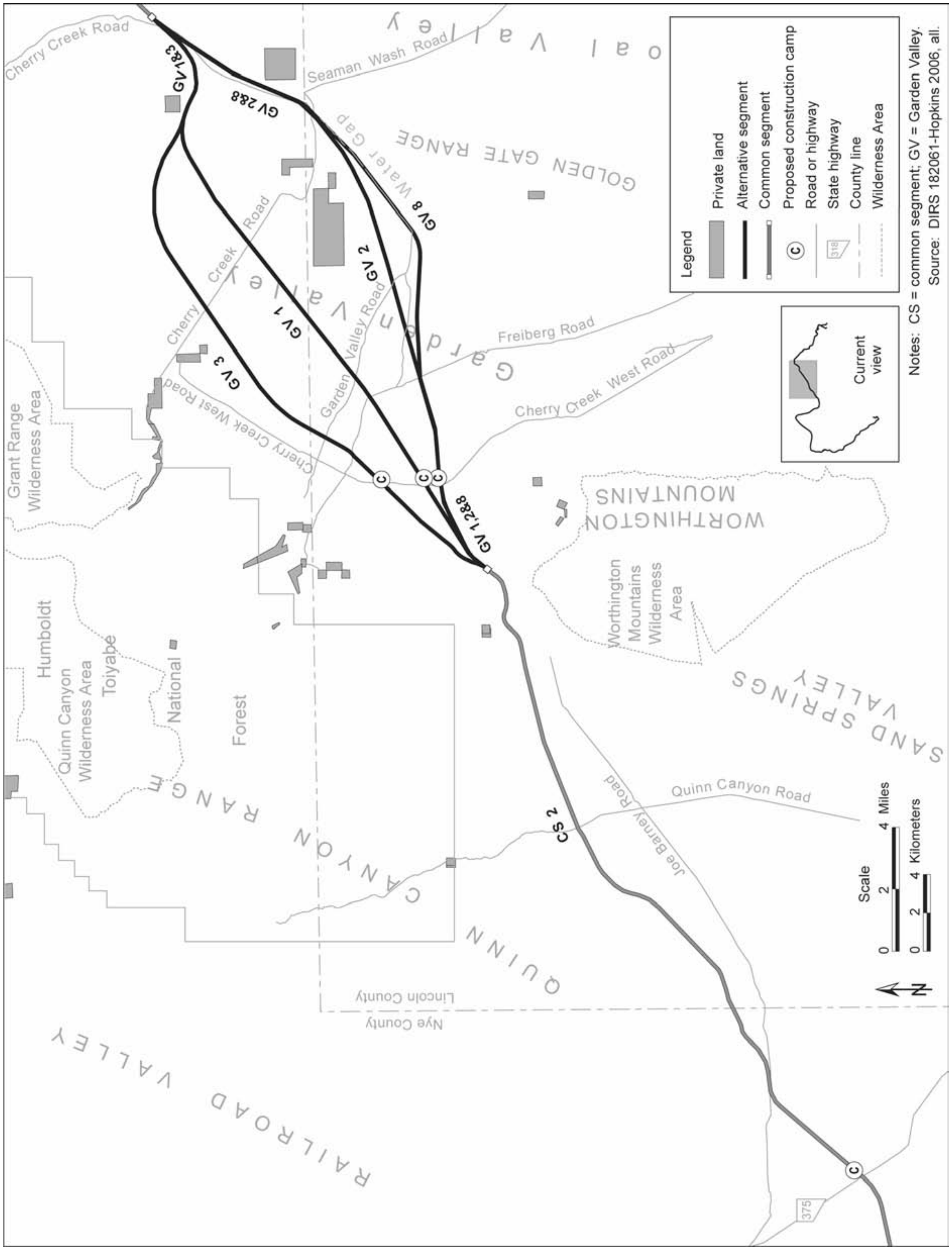
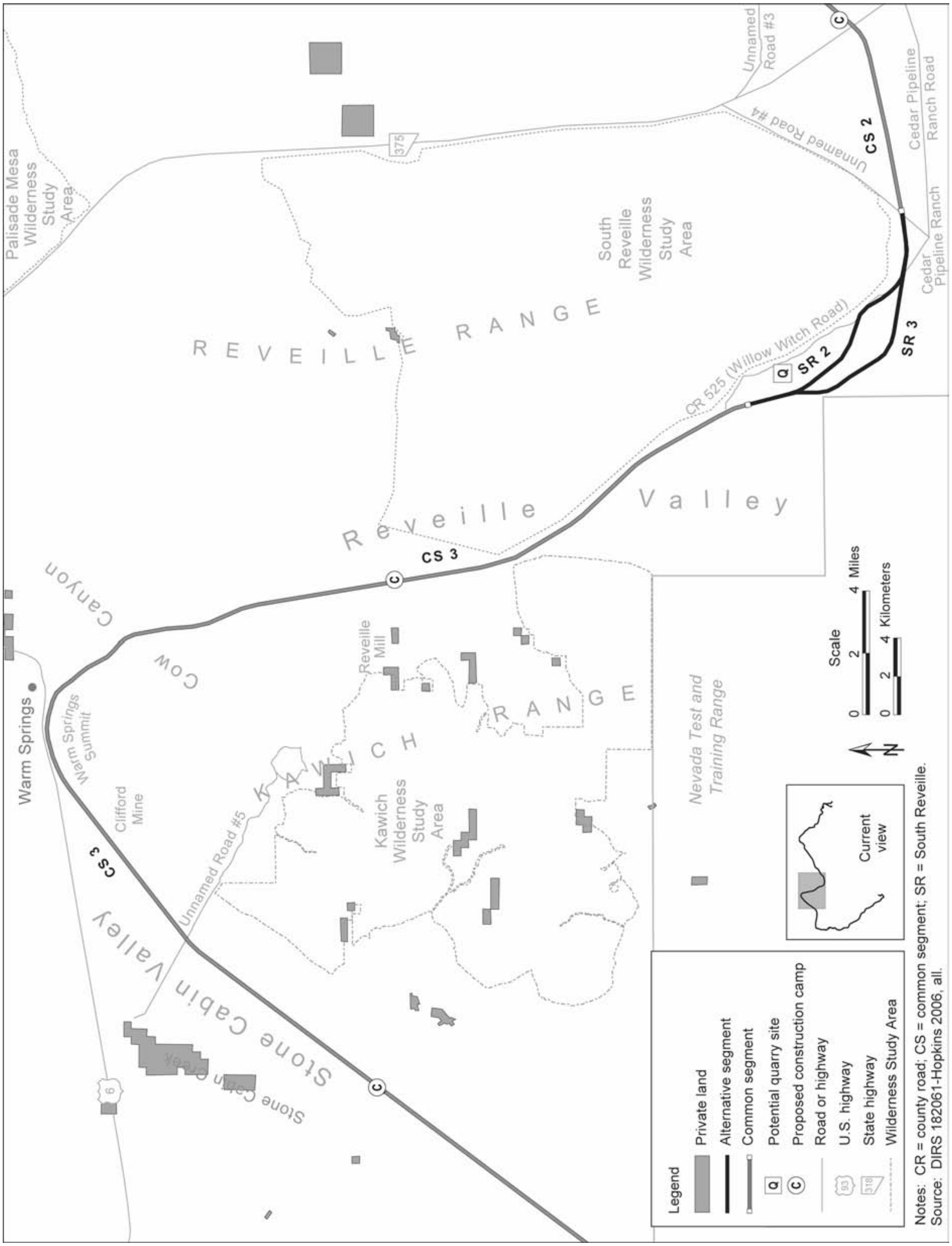


Figure 3-21. Private land within map area 3.



Notes: CR = county road; CS = common segment; SR = South Reveille.
Source: DIRS 182061-Hopkins 2006, all.

Figure 3-22. Private land within map area 4.

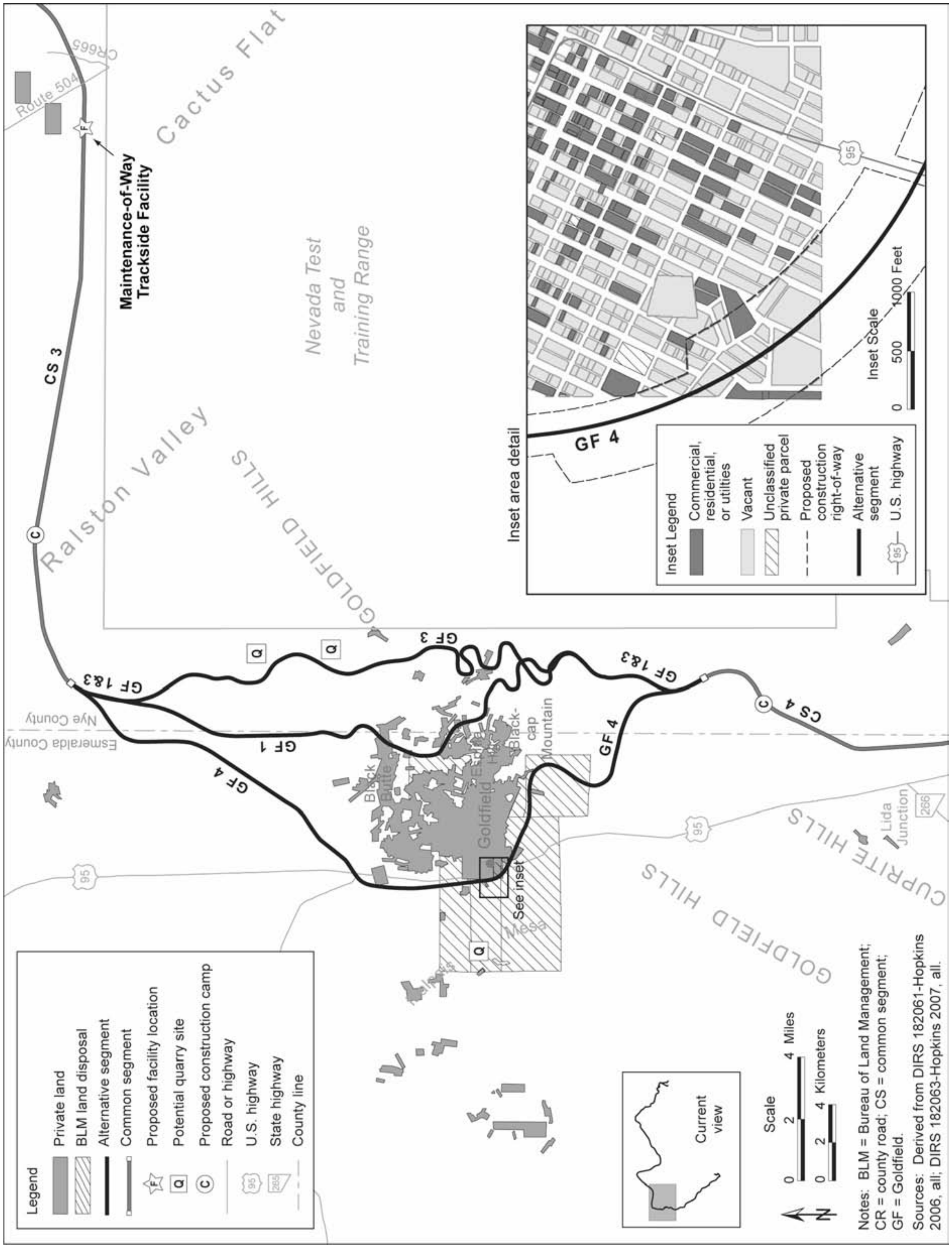


Figure 3-23. Private land within map area 5.

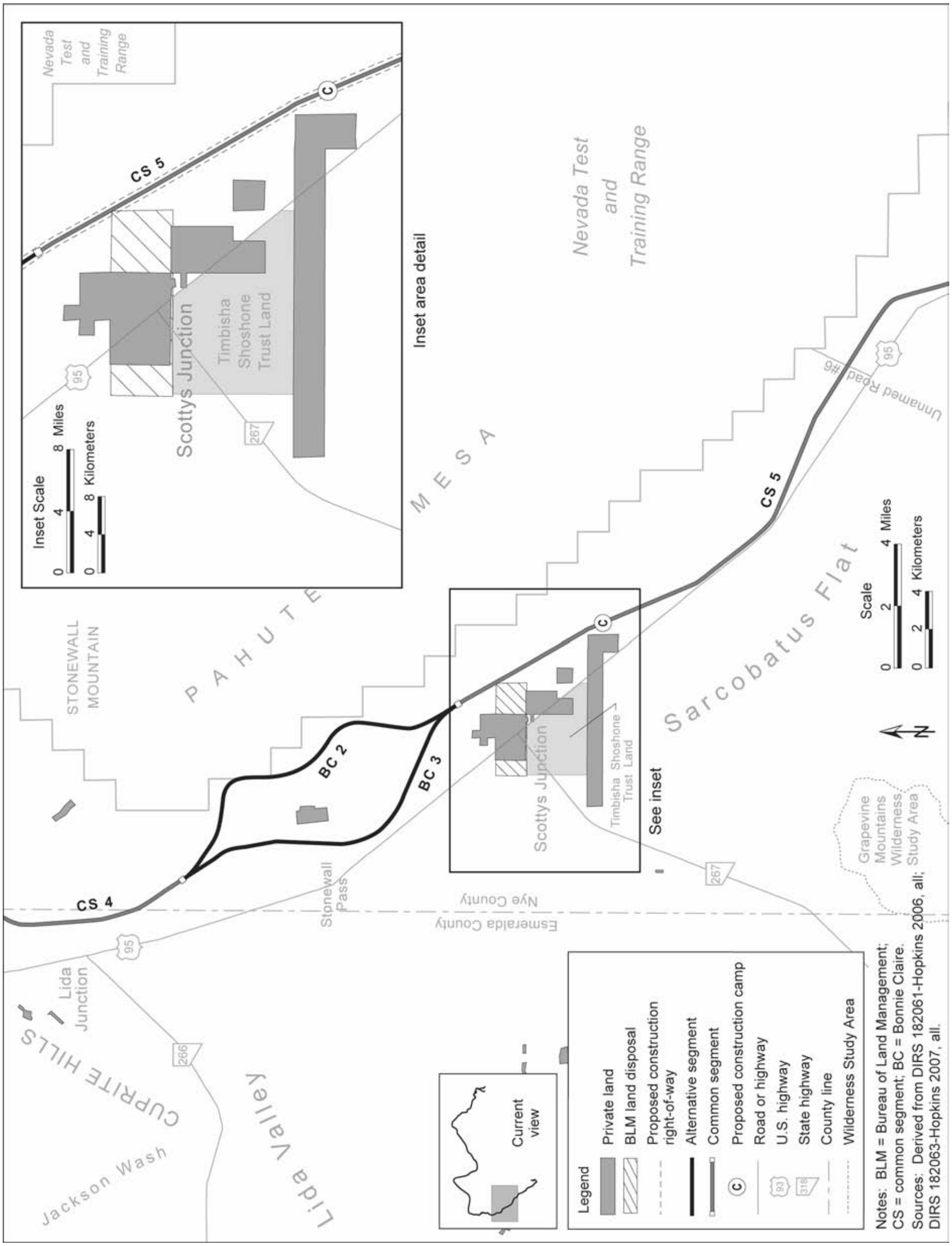


Figure 3-24. Private land within map area 6.

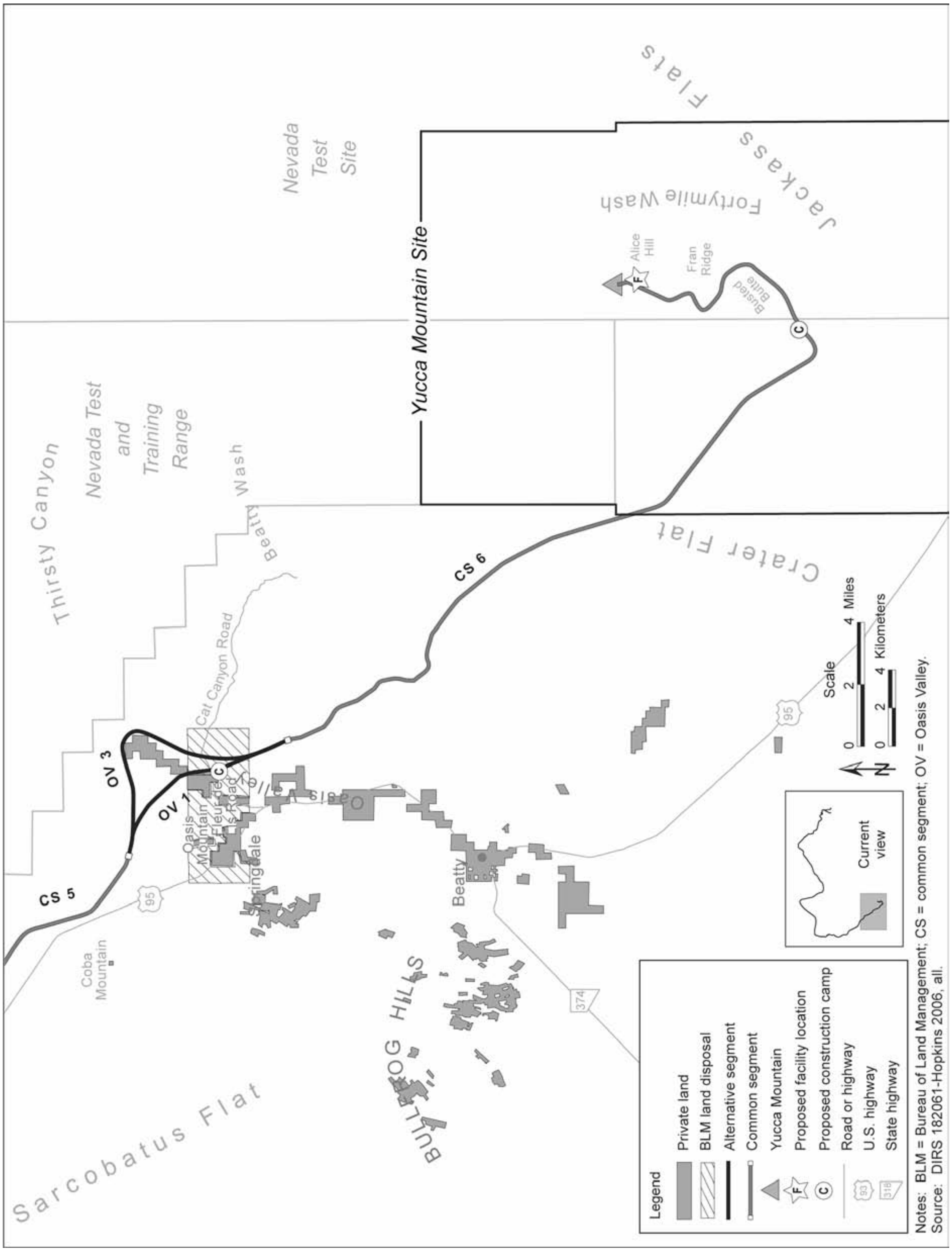


Figure 3-25. Private land within map area 7.

3.2.2.2.4 Pioche and Prince Branchline

There is an abandoned rail line from the former Union Pacific Railroad, Pioche and Prince Branchline in Caliente, which runs north generally parallel to U.S. Highway 93 (see Figure 3-14). The Union Pacific Railroad acquired the primary segments of right-of-way comprising the Pioche and Prince Branchline between 1901 and 1907. The Railroad retired the line on February 11, 1984, and received a certification of abandonment from the Interstate Commerce Commission to discontinue part of its operation in Nevada on the spur (DIRS 176910-IDT 2006, p. 7).

To be conservative in the assessment of potential land-use impacts, DOE assumed that all of the land underlying this abandoned rail line is privately owned. However, it is important to note that DOE is considering using this abandoned rail line for the proposed rail line to minimize potential impacts to environmental resources, such as wetlands.

3.2.2.3 American Indian Land

The closest American Indian land to the Caliente rail alignment would be the Timbisha Shoshone Trust Land. The Timbisha Homeland Act transferred 31.4 square kilometers (7,754 acres) of land into trust for the Timbisha Shoshone Tribe. The land is not contiguous; it is made up of five separate parcels in California and Nevada. The parcel near Scottys Junction covers approximately 11.39 square kilometers (2,800 acres).

During the first public scoping period for this Rail Alignment EIS, the Timbisha Shoshone Tribe requested that DOE alter the Caliente rail alignment to avoid their land (DIRS 174558-Sweeney 2004, all). DOE adjusted the proposed ***rail route*** based on this request, and the segment nearest the Timbisha Shoshone Trust Land near Scottys Junction, common segment 5, would be more than 3 kilometers (2 miles) east, as shown in Figure 3-24.

3.2.2.4 Public Land

Several agencies manage public lands near or encompassing the Caliente rail alignment, including the BLM, DOE, the U.S. Department of Defense, and the U.S. Forest Service.

The BLM and DOE manage approximately 159 square kilometers (39,000 acres) and 4.1 square kilometers (1,100 acres), respectively, of land that would be within the rail line construction right-of-way. The U.S. Department of Defense and the U.S. Forest Service manage lands near the Caliente rail alignment, but those lands would be outside the rail line construction right-of-way.

3.2.2.4.1 BLM-Administered Land

Approximately 97 percent of the lands along the Caliente rail alignment are BLM-administered public lands. Therefore, the proposed railroad project would in large part be subject to BLM land-use plans. The BLM manages public lands under the multiple-use concept, which balances the present and future needs of the American people. The BLM implements this concept through resource management plans, which are long-range, comprehensive land-use plans intended to provide for multiple uses and identify planning objectives and policies for designated areas. Resource management plan objectives are implemented through activity plans, such as allotment management plans and wildlife habitat management plans.

BLM resource management plans that apply to the Caliente rail alignment are included in the following:

- *Draft - Resource Management Plan/Environmental Impact Statement for the Ely District* (Draft Ely District Resource Management Plan; DIRS 174518-BLM 2005, all)
- *Tonopah Resource Management Plan and* ***Record of Decision*** (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)
- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

The BLM issued the Draft Ely District Resource Management Plan in June 2005. The Caliente and Eccles alternative segments, all of Caliente common segment 1, all of the Garden Valley alternative segments, and the beginning of Caliente common segment 2 would be within the area covered by the Draft Ely District Resource Management Plan. Most of the rail alignment would then pass through lands covered by the Tonopah Resource Management Plan. A portion of common segment 6 would pass through lands covered by the Las Vegas Resource Management Plan; the section of common segment 6 that would be on the Nevada Test Site also falls within the BLM Las Vegas area but is managed by DOE. Table 3-5 lists the distances each Caliente rail alignment segment would pass through lands administered by the various BLM districts.

Areas of Critical Environmental Concern are places within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, and other natural systems or processes, or to protect life and safety from natural hazards (DIRS 181386-BLM 2001, p. 2).

To construct and operate the proposed railroad along the Caliente rail alignment, DOE would apply for a BLM ***right-of-way grant***. Section 503 of the Federal Land Policy and Management Act (DIRS 181386-BLM 2001; 43 United States Code [U.S.C.] 1761) authorized the BLM to grant, issue, or renew rights-of-way over, upon, under, or through public lands. BLM policy is to encourage prospective applicants to locate their proposals within existing corridors. Resource management plans describe these corridors and right-of-way avoidance areas – areas for which the BLM would avoid granting new rights-of-way unless there are no other options. ***Areas of Critical Environmental Concern*** are generally considered right-of-way avoidance areas.

Resource management plans also designate areas of potential land disposal (sale) within their management areas. Therefore, DOE must assess whether a railroad along the Caliente rail alignment would conflict with or adversely affect BLM land-disposal plans. Section 203(a) of the Federal Land Policy and Management Act allows for public land to be sold (disposed of) if it meets one of the following criteria:

- The land is difficult or uneconomic to manage as a part of the public lands.
- The land is not suitable for management by another federal department or agency.
- The land was acquired for a specific purpose and it is no longer required for that, or any other, federal purpose.
- Disposal of the land will serve important public objectives that can be achieved prudently or feasibly only if the land is removed from public ownership and these objectives outweigh other public objectives or values that will be served by maintaining the land in federal ownership.

Table 3-5. Caliente rail alignment crossing distances within each BLM resource management plan area.

Rail line segment	Ely District/Draft Resource Management Plan area (kilometers)[a,b]	Battle Mountain District/Tonopah Resource Management Plan area (kilometers)	Las Vegas District/Resource Management Plan area (kilometers)
Caliente alternative segment	18	0	0
Eccles alternative segment	19	0	0
Caliente common segment 1	110	0	0
Garden Valley alternative segment 1	35	0	0
Garden Valley alternative segment 2	35	0	0
Garden Valley alternative segment 3	37	0	0
Garden Valley alternative segment 8	37	0	0
Caliente common segment 2	31	19	0
South Reveille alternative segment 2	0	19	0
South Reveille alternative segment 3	0	19	0
Caliente common segment 3	0	110	0
Goldfield alternative segment 1	0	47	0
Goldfield alternative segment 3	0	50	0
Goldfield alternative segment 4	0	53	0
Caliente common segment 4	0	11	0
Bonnie Claire alternative segment 2	0	21	0
Bonnie Claire alternative segment 3	0	19	0
Common segment 5	0	40	0
Oasis Valley alternative segment 1	0	10	0
Oasis Valley alternative segment 3	0	14	0
Common segment 6	0	38	13
Total rail alignment distance by BLM district (shortest to longest alignment)	198 to 201	316 to 327	13

a. To convert kilometers to miles, multiply by 0.62137.
b. Individual segment lengths are rounded to two significant figures.

Sections 3.2.2.4.1.1 through 3.2.2.4.1.3 describe the planning areas and objectives of the applicable Resource Management Plans in relation to lands and realty, corridors, and access and recreation.

3.2.2.4.1.1 Draft Ely District Resource Management Plan. The Ely District Planning Area consists of public lands in White Pine County, Lincoln County, and a portion of Nye County in east-central Nevada. This district was previously subdivided into three resource areas (Egan, Schell, and Caliente) but would be managed as a single administrative unit under this Resource Management Plan. The Ely Field Office manages approximately 46 square kilometers (11 million acres) of public lands out of the approximately 56 square kilometers (14 million acres) within the boundaries of the district (DIRS 174518-BLM 2005, Executive Summary p. 7). Of this planning area, the BLM manages 5,400 square kilometers (1.34 million acres) in Nye County, 18,000 square kilometers (4.44 million acres) in White Pine County, and 23,000 square kilometers (5.62 million acres) in Lincoln County (DIRS 174518-BLM 2005, pp. 2.5-112). Draft management objectives (under the Draft Resource Management Plan preferred alternative) related to land tenure adjustments, corridors, and access are listed below (DIRS 174518-BLM 2005, Section 2.5.12).

- Land and realty
  - Retain public land or interest in land that would contribute to the restoration and health of land within the district.
  - Existing or newly designated Areas of Critical Environmental Concern totaling approximately 1,400 square kilometers (350,000 acres) would be withdrawn from ***surface entry***. (There are no Areas of Critical Environmental Concern within the Caliente rail alignment region of influence; the closest Area of Critical Environmental Concern would be 60 kilometers [37 miles] away.)
  - Dispose of land in designated areas (approximately 390 square kilometers [96,000 acres]). (Some of this land could be in the vicinity of the Caliente and Eccles alternative segments.)
- Corridors
  - Designated corridors would be 0.8 kilometer (0.5 mile) wide.
  - Proactively designate new corridors and communication sites.
  - Land Use Authorizations (rights-of-way, permits, leases, and easements) would be issued on a case-by-case basis. Areas of Critical Environmental Concern would be avoidance or exclusion areas.
- Access and recreation
  - Off-highway vehicle use would be restricted to designated roads and trails; recreation management on approximately 3,000 square kilometers (730,000 acres) would emphasize off-highway vehicle use of designated roads and trails.
  - Emphasis would be to promote recreation across a wide spectrum of opportunities, both developed and undeveloped.

3.2.2.4.1.2 Tonopah Resource Management Plan. Located in south-central Nevada in Nye and Esmeralda Counties, the Tonopah Planning Area encompasses approximately 25,000 square kilometers (6.1 million acres) of public land and approximately 670 square kilometers (165,000 acres) of private land. Significant resources and program emphases include locatable minerals, livestock grazing, wild horses and burros, realty, cultural resources, and wildlife (DIRS 173224-BLM 1997, p. 1). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below.

- Land and realty
  - Discretionary disposal of approximately 274 square kilometers (68,000 acres) of public land (DIRS 173224-BLM 1997, p. 2). Approximately 931 square kilometers (230,000 acres) have been identified for potential disposal in the vicinity of Goldfield, about 23 square kilometers (5,800 acres) have been identified for potential disposal near Scottys Junction, and approximately 160 square kilometers (39,000 acres) have been identified for potential disposal near Beatty (acreage based on BLM GIS data, DIRS 181617-Hopkins 2007).
- Corridors
  - Approximately 1,100 kilometers (670 miles) designated for transportation and utility corridors in the planning area (DIRS 173224-BLM 1997, p. 2).
  - Rights-of-way allowed (if compatible with values) on approximately 600 square kilometers (150,000 acres) (DIRS 173224-BLM 1997, p. 2). (There are no right-of-way exclusion areas within the Caliente rail alignment region of influence.)

  - Designated right-of-way corridors within the planning area will be 5 kilometers (3 miles) wide except where there are topographic constraints. Grants for rights-of-way are still required for facilities placed within designated corridors. Designation of a corridor does not mean that future rights-of-way are restricted to corridors, nor does it mean that the BLM has committed to approving all right-of-way applications within corridors (DIRS 173224-BLM 1997, p. A-38).
- Access and recreation
  - Vehicles unrestricted on 77 percent of the planning area.
  - Vehicles limited to existing roads and trails in primitive and semi-primitive non-motorized and semi-primitive motorized areas.
  - Designates seven Special Recreation Management Areas (DIRS 173224-BLM 1997, p. 2).

3.2.2.4.1.3 Las Vegas Resource Management Plan. The Las Vegas Resource Management Plan provides a comprehensive framework for managing approximately 13,000 square kilometers (3.3 million acres) of public lands in Clark County and the southern portion of Nye County administered by the BLM Las Vegas Field Office. Approximately 2,830 square kilometers (700,000 acres) of this planning area is in Nye County. Significant resources and program emphases in the plan include threatened and ***endangered species***; land disposal actions; wilderness management; wildlife habitat; special status species; ***riparian*** areas; forestry and vegetative products; livestock grazing; wild horses and burros; land acquisition priorities; rights-of-way; cultural resources; hazardous materials management; recreation; utility corridors; and minerals (DIRS 176043-BLM 1998, p. 2). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below (DIRS 176043-BLM 1998, Appendix A, p. 16).

- Land and realty
  - Dispose of approximately 710 square kilometers (175,000 acres) of public lands through sale, exchange or recreation and public-purpose patent to provide for the orderly expansion and development of southern Nevada.
  - All public lands within the planning area, unless otherwise classified, segregated or withdrawn, and with the exception of Areas of Critical Environmental Concern and ***Wilderness Study Areas***, are available for land-use leases and permits at the discretion of the BLM.
  - Terminate or modify any unused, outdated, or unnecessary classifications/segregations and withdrawals on public lands to reduce the area of segregation in the plan area.
  - Acquire private lands to enhance the recovery of special status species, protect valuable resources, and facilitate the management of adjacent BLM lands.
- Corridors

  All Areas of Critical Environmental Concern and all lands within 0.4 kilometer (0.25 mile) of significant caves, exclusive of any designated corridors, are designated as right-of-way avoidance areas. (There are no Areas of Critical Environmental Concern within the Caliente rail alignment region of influence; the closest area is 140 kilometers [84 miles] south of common segment 6.)
- Access and recreation
  - Ensure that a wide range of recreation opportunities are available for recreation users in concert with protecting the natural resources on public lands that attract users.
  - Provide opportunities for off-road vehicle use while protecting wildlife habitat, cultural resources, hydrological and soil resources, non-motorized recreation opportunities, natural and aesthetic values, and other uses of the public land.

The Las Vegas Proposed Resource Management Plan/Final Environmental Impact Statement briefly mentions the Yucca Mountain Project in sections titled "Income and Employment" and "Social Setting, Attitudes, and Values." In the Income and Employment section the document notes that there could be population growth in Amargosa Valley as a result of construction and operation of the Yucca Mountain Project. In the Social Setting, Attitudes, and Values section the document notes that people residing in Las Vegas (urbanites) expressed a higher concern than people residing in rural locations about wildlife and ***ecosystem*** values when recording their risk assessment for the proposed Yucca Mountain Project in a 1995 social research survey conducted by the University of Nevada Las Vegas (DIRS 176043-BLM 1998, pp. 3-81 and 3-82).

3.2.2.4.2 Project-Related Public Land Withdrawals

The BLM announced Public Land Order 7653 on December 28, 2005 (70 *Federal Register* [*FR*] 76854). The Order withdrew approximately 1,249 square kilometers (308,600 acres) of public lands within the Caliente rail corridor from surface and mineral entry for 10 years to allow DOE to evaluate the lands for the potential construction, operation, and maintenance of the proposed railroad to Yucca Mountain. The withdrawal applies only to BLM-administered public lands. The withdrawal area extends approximately 0.8 kilometer (0.5 mile) from either side of the centerline of the proposed rail alignment. The actions covered by this withdrawal meet the BLM definition of ***casual use*** as set forth in 43 Code of Federal Regulations (CFR) 2801.5. On January 10, 2007, the BLM announced that DOE had filed an application requesting a second land withdrawal (72 *FR* 1235). The Department filed the application to cover post-scoping changes in the Caliente rail alignment and to address the addition of the Mina rail alignment. The application requested the withdrawal of an additional 842 square kilometers (208,037 acres) of public lands from surface and mineral entry through December 27, 2015, so DOE could evaluate the lands for the potential construction, operation, and maintenance of a railroad to Yucca Mountain. Chapter 6 of this Rail Alignment EIS includes detailed information about the land withdrawal process.

The BLM granted DOE a right-of-way reservation (N-47748) for Yucca Mountain ***site characterization*** activities (DIRS 102218-BLM 1988, all). This reservation comprises 210 square kilometers (52,000 acres). The land in this reservation is open to public use, with the exception of about 20 square kilometers (5,000 acres) near the site of the proposed ***repository*** that were withdrawn in 1990 from the mining and mineral leasing laws to protect the physical integrity of the repository block. The lands in

Withdrawal: Withholding an area of federal land from settlement, sale, location, or surface entry under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program

Casual use: Activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements. Examples of casual use include surveying, marking routes, and collecting data to use to prepare grant applications.

Right-of-way: The public lands the BLM authorizes a holder to use or occupy under a grant.

Grant: Any authorization or instrument (for example, easement, lease, license, or permit) the BLM issues under Title V of the Federal Land Policy and Management Act (43 U.S.C. 1761 *et seq.*).

Mineral entry closure: The land is not available for the location of mining claims because the land has been withdrawn from public use, including the operation of the General Mining Law (DIRS 181386-BLM 2001, 43 CFR 3830.5).

Surface entry closure: Land closed to surface entry cannot be used for appropriation of any non-federal interest or claim (other than mining claims), land sales, any public land disposal action, or other action that would cause the title for the land to be transferred away from the Federal Government (DIRS 176452-DOE 2005; 43 CFR 3809.5).

this reservation are not withdrawn from the mining and mineral leasing laws and contain a number of ***unpatented mining claims*** (DIRS 155970-DOE 2002, p. 3-9). This existing right-of-way reservation would be the basis for the planned land withdrawal for the Yucca Mountain Site, as described in the *Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DIRS 155970-DOE 2002, DOE/EIS-0250F-S1), where the land would transfer from BLM administrative responsibility to DOE control.

3.2.2.4.3 Department of Defense-Managed Land, Nevada Test and Training Range

The U.S. Department of Defense administers the Nevada Test and Training Range, which the U.S. Air Force uses for training. The Caliente rail alignment would not cross onto the Nevada Test and Training Range land. Detailed information about land use and resources on the Nevada Test and Training Range is available in the *Proposed Nevada Test and Training Range Resource and Management Plan and Final Environmental Impact Statement* (DIRS 178103-BLM 2003, all).

The airspace above the Nevada Test and Training Range and some adjacent locations consist of the Desert and Reveille Military Operations Areas and five "restricted areas": R-4806E, R-4806W, R-4807A, R-4807B, and R-4809 (DIRS 103472-USAF 1999, p. 3.1-2).

Airspace to the east of the Nevada Test and Training Range is designated as the Desert Military Operations Area and airspace to the north is designated as the Reveille Military Operations Area. These Areas are used for air-to-air intercept training, which consists of high speed operations, abrupt maneuvers, and supersonic flight. These areas are not considered restricted airspace and civil aircraft, under certain restrictions, are permitted to fly through a military operations area when it is in use while exercising certain precautions. Civil aircraft are allowed in these locations because the types of military flight maneuvers conducted in these areas are considered nonhazardous and therefore, compatible, with other airspace uses (DIRS 103472-USAF 1999, pp. 3.1-4 and 3.1-6). Portions of the Caliente rail alignment that would be on land under the Desert Military Operations Area include the Caliente and Eccles alternative segments; Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8; Caliente common segment 2, South Reveille alternative segments 2 and 3; and a portion of Caliente common segment 3. More than half the length of common segment 3 would be on land under the Reveille Military Operations Area.

Restricted airspace consists of areas where nonparticipating aircraft are subject to restriction during scheduled periods when hazardous activities are being performed. Restricted areas designated as joint use by the Federal Aviation Administration allow air traffic control to route non-participating aircraft through this airspace when it is not in use or when appropriate separation can be provided. Those areas not designated as joint use cannot be accessed by either nonparticipating civil or military aircraft at any time (DIRS 103472-USAF 1999, p. 3.1-3).

Restricted area R-4807A is designated joint use and land beneath it is comprised of an electronic battlefield with numerous tactical targets and manned electronic combat threat simulators. Portions of the Caliente rail alignment that would be on land below R-4807A include portions of common segment 5; the Oasis Valley alternative segments 1 and 2; and a portion of common segment 6 (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6).

Restricted area R-4808S is controlled by DOE for Nevada Test Site activities and is designated joint use. The Federal Aviation Administration Los Angeles Air Route Traffic Control Center also uses R-4808S for civil aircraft overflights (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6). A portion of common segment 6 would be on land below R-4808S as it approached the Yucca Mountain Site.

3.2.2.4.4 DOE-Managed Land, Nevada Test Site

Portions of common segment 6 and some railroad operations support facilities would be on Nevada Test Site land (see Figure 3-25), which DOE administers. Detailed information about current and future uses of the Nevada Test Site is available in *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all). As discussed previously, land that makes up the proposed Yucca Mountain Site would be withdrawn and transferred to DOE control. Currently, a Memorandum of Agreement between the DOE National Nuclear Security Administration and the Office of Civilian Radioactive Waste Management allows the use of about 230 square kilometers (58,000 acres) on the Nevada Test Site for Yucca Mountain Project activities.

3.2.2.4.5 U.S. Forest Service Land

The Caliente rail alignment would pass within 3.2 kilometers (2 miles) of a portion of the Humboldt-Toiyabe National Forest, which the Ely Ranger District of the U.S. Forest Service manages and which would be outside the rail line construction right-of-way.

3.2.2.5 General Environmental Setting and Land-Use

Major public land uses along the Caliente rail alignment include grazing, mineral and energy extraction, and recreation. The rail alignment would cross numerous public roads and trails that provide access to public and private land and would cross BLM-authorized rights-of-way for utilities.

3.2.2.5.1 BLM Grazing Allotments

The Taylor Grazing Act of 1934 (43 U.S.C. 315-3160), as amended, authorizes the Federal Government to issue permits for grazing livestock in grazing districts to settlers, residents, and other livestock owners for an annual payment of reasonable fees. An applicant who owns a base property or controls a water source may apply to the BLM for a lease or permit to use public lands for the grazing of livestock. The BLM grazing administration regulations (43 U.S.C. 4100.0-5) define a base property as land that has the capability to produce crops or forage that can be used to support authorized livestock for a specified period of the year, or water that is suitable for consumption by livestock and is available and accessible to livestock when the public lands are used for livestock grazing. The grazing allotments are leased or permitted for 10 years and may be renewed under specific circumstances.

Livestock permitted on grazing allotments include cattle, sheep, goats, horses, and burros. Cattle and sheep are the typical livestock grazed within the Caliente rail alignment region of influence. The grazing lease or permit specifies the types and numbers of livestock based on the property acreage, the period of use, and the amount of use in ***animal unit months***. The intent of assigning animal unit months is to allow grazing on public lands without exceeding the capacity of the allotment to sustain livestock (43 CFR Part 4100).

> **Animal unit month:** A standardized unit of measurement of the amount of forage necessary for the complete sustenance of one animal for 1 month; also, a unit of measurement of grazing privileges that represents the privilege of grazing one animal for 1 month (43 CFR Part 4100).

Depending on the combination of common segments and alternative segments, the Caliente rail alignment would cross up to 24 active grazing allotments, and 3 inactive allotments (Ralston, Montezuma, and one labeled Unused) (see Figures 3-26 through 3-33). Tables 3-6 and 3-7 list information about grazing allotments within the Caliente rail alignment region of influence.

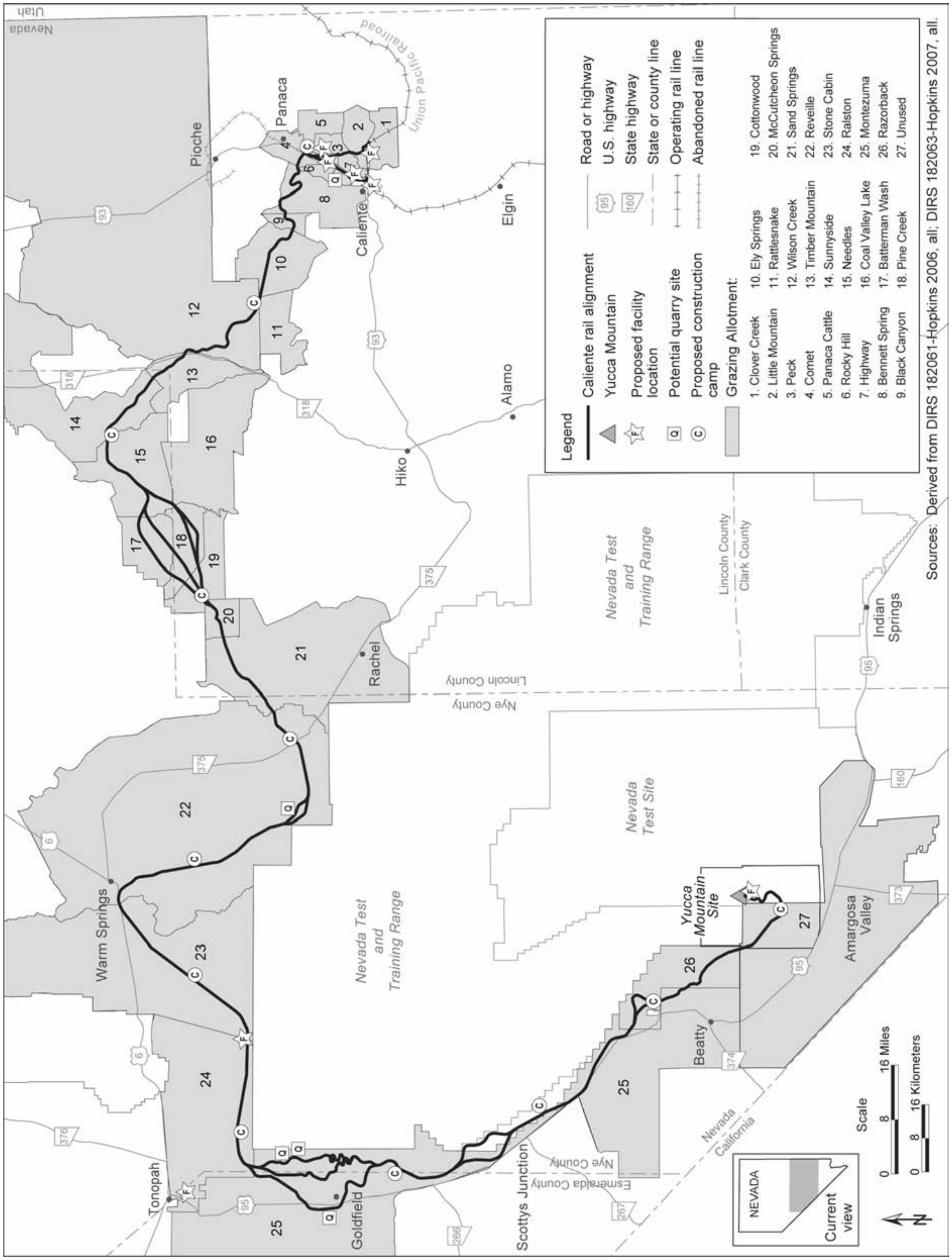


Figure 3-26. Grazing allotments along the Caliente rail alignment.

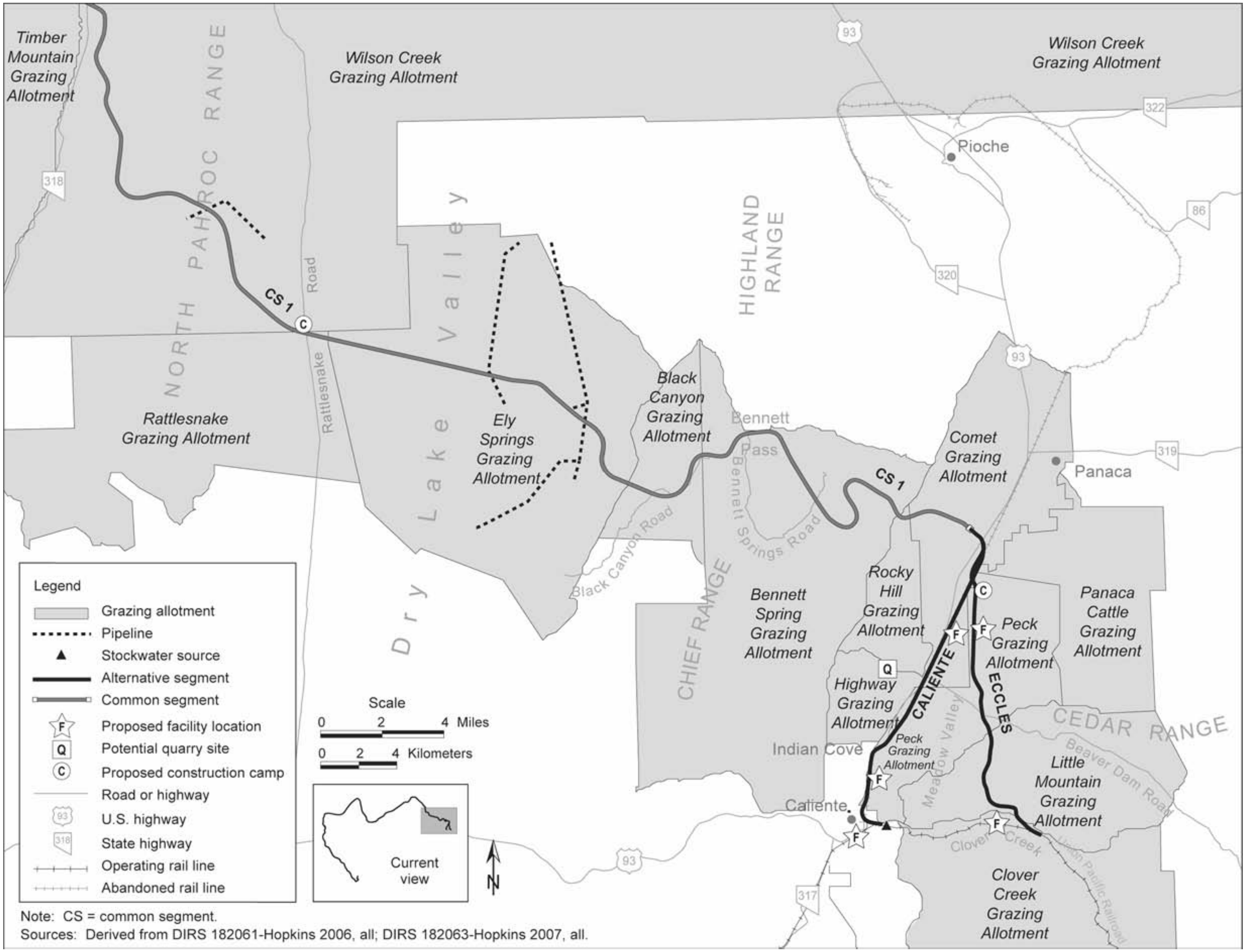
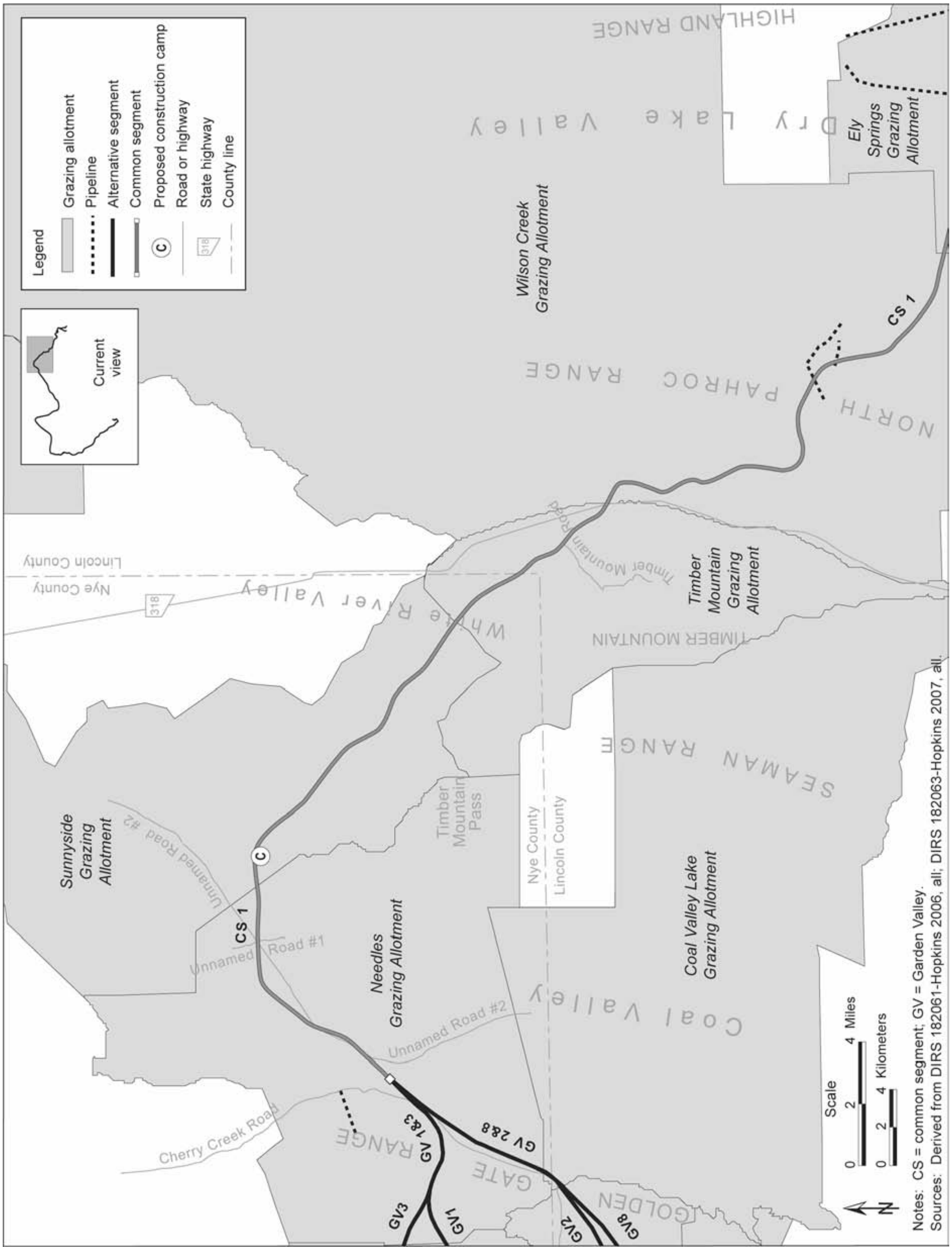


Figure 3-27. Grazing allotments with stockwater features within map area 1.



Notes: CS = common segment; GV = Garden Valley.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182063-Hopkins 2007, all.

Figure 3-28. Grazing allotments with stockwater features within map area 2.

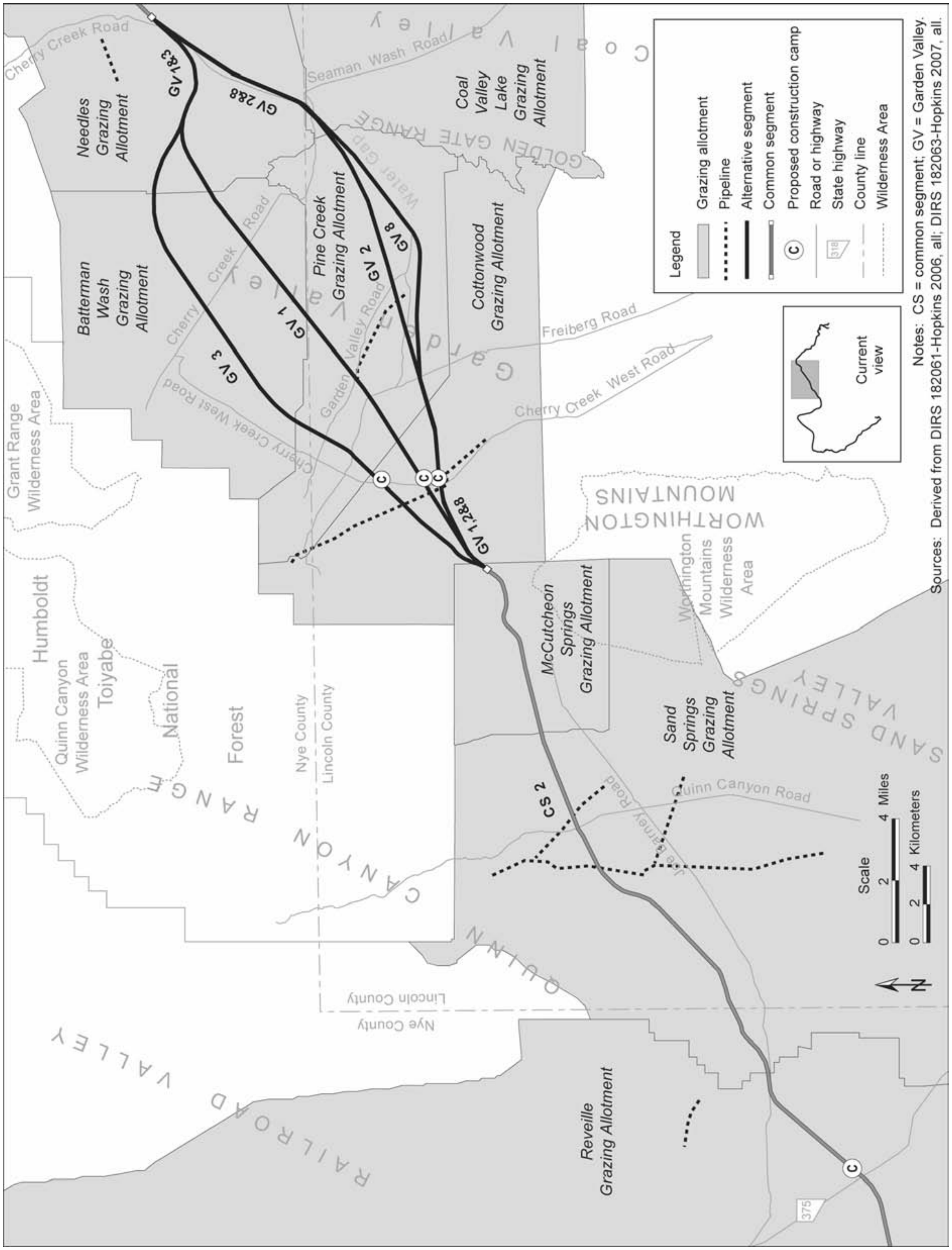
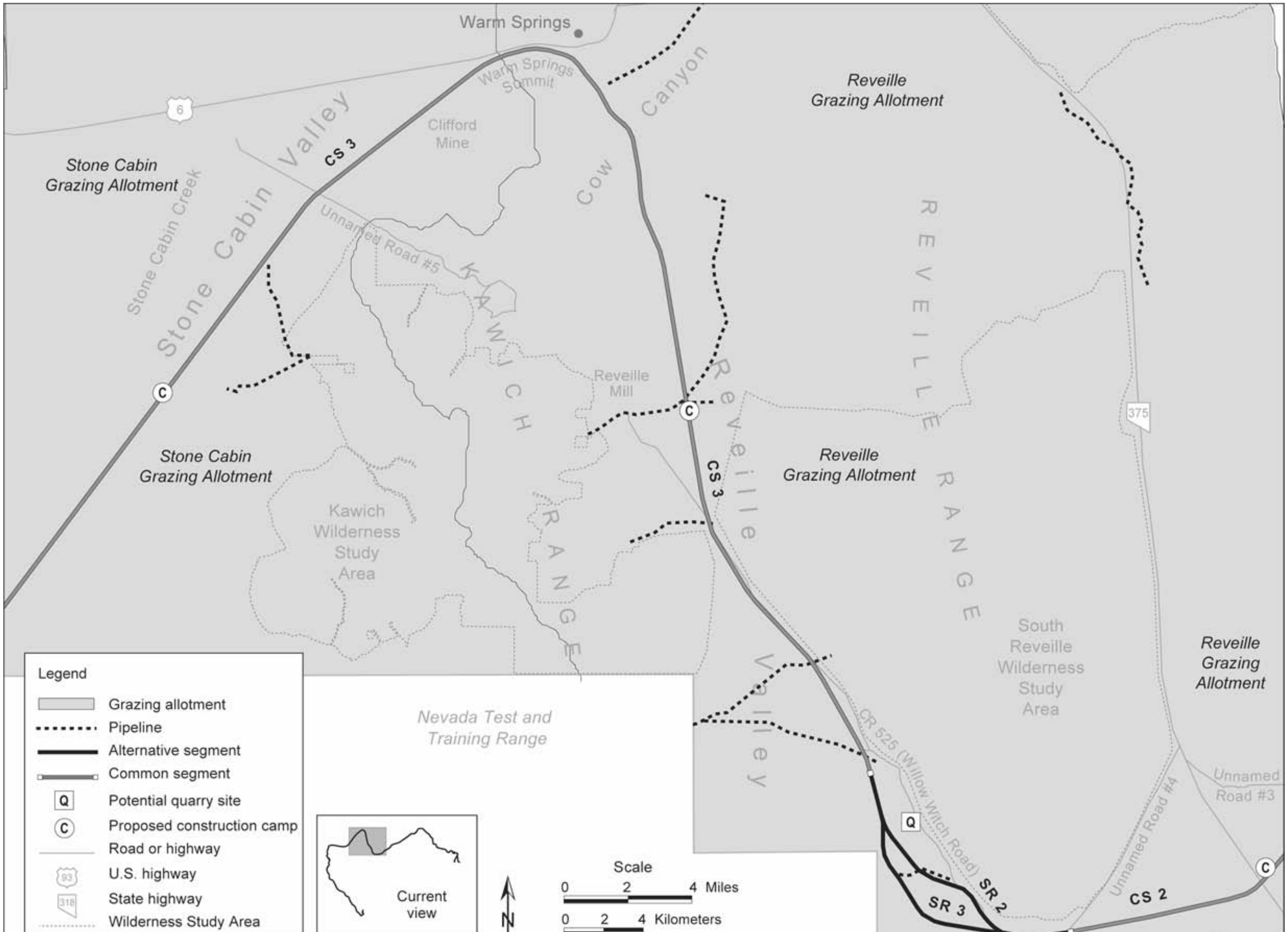


Figure 3-29. Grazing allotments with stockwater features within map area 3.



Notes: CR = county road; CS = common segment; SR = South Reveille.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182063-Hopkins 2007, all.

Figure 3-30. Grazing allotments with stockwater features within map area 4.

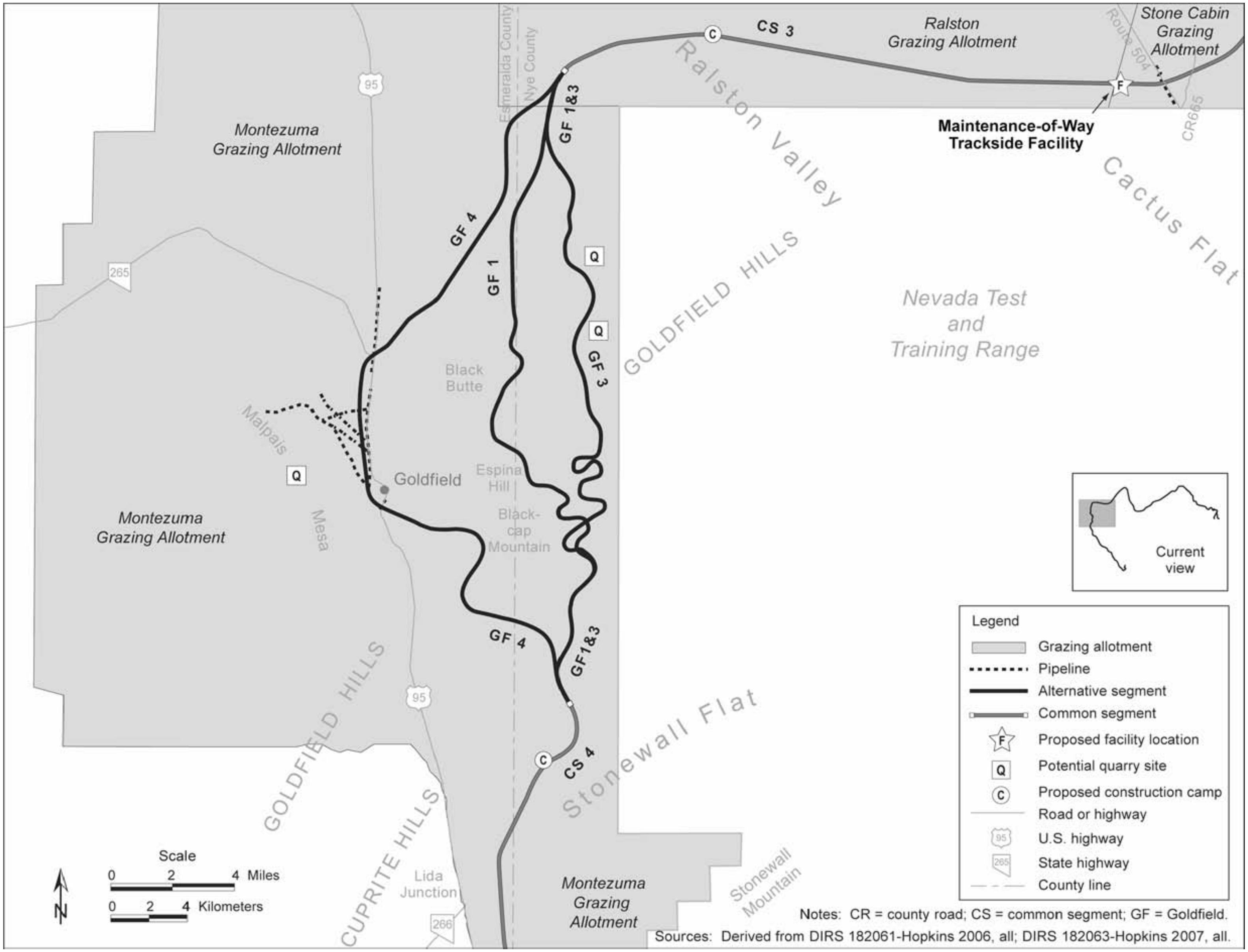


Figure 3-31. Grazing allotments with stockwater features within map area 5.

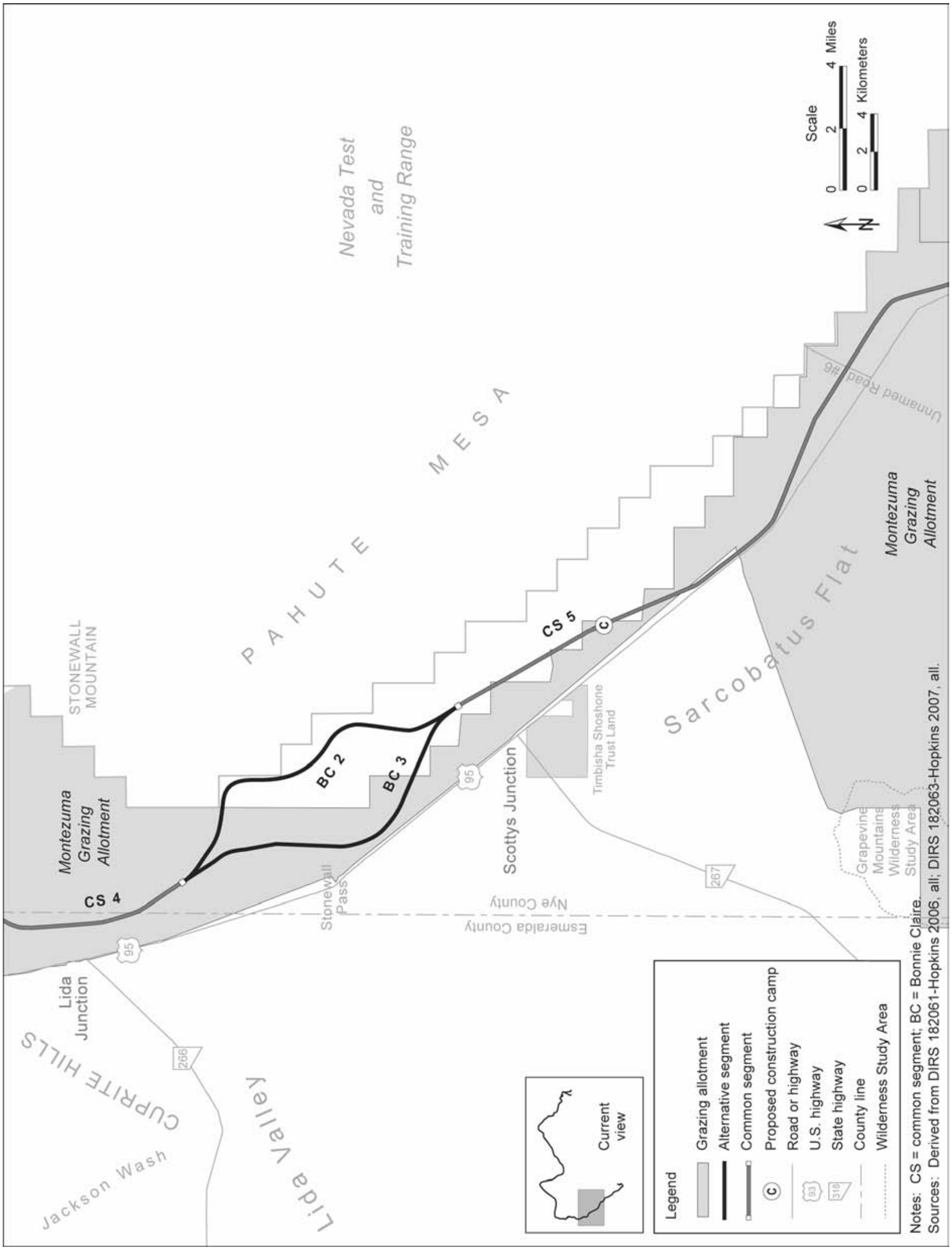
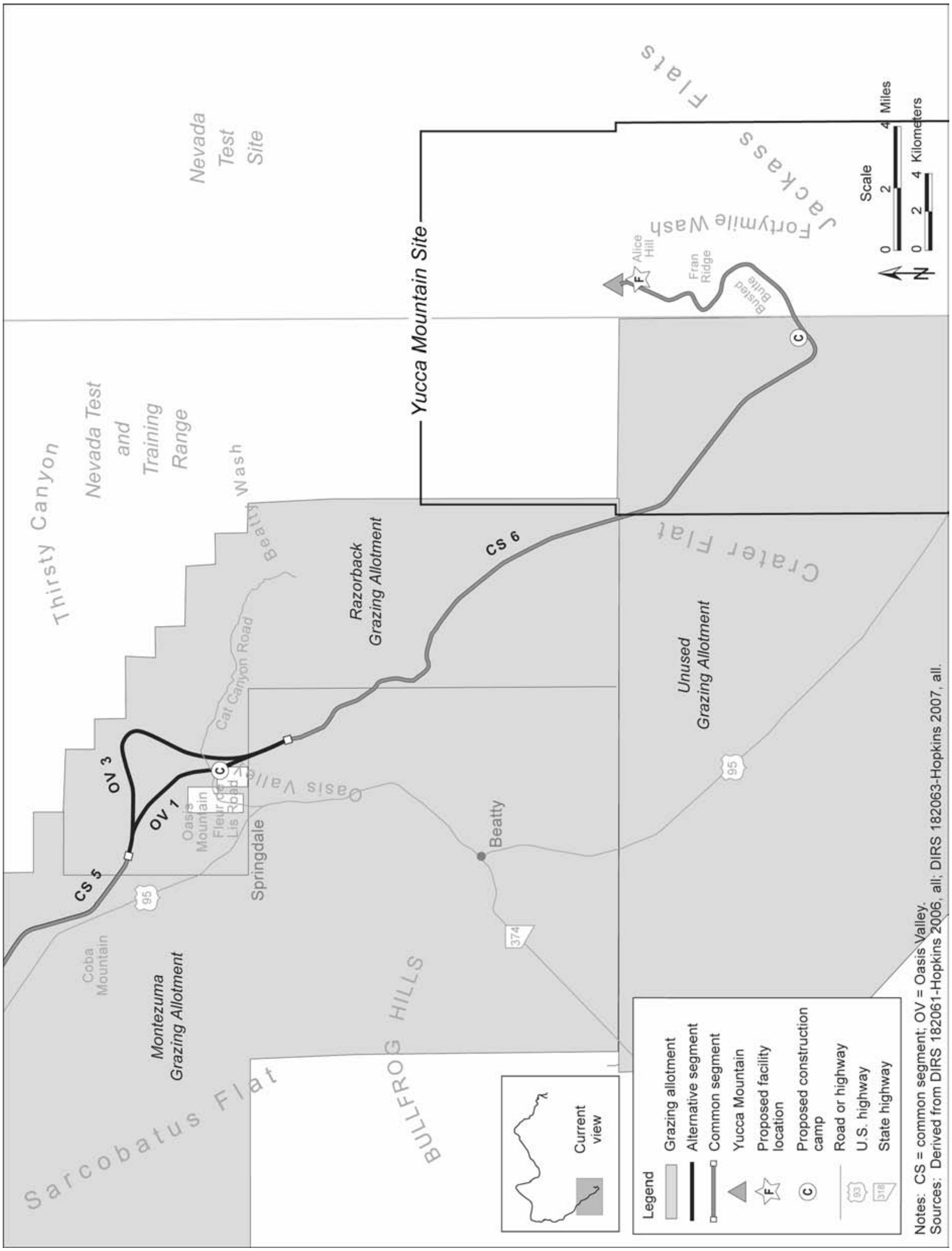


Figure 3-32. Grazing allotments with stockwater features within map area 6.



Notes: CS = common segment; OV = Oasis Valley.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182063-Hopkins 2007, all.

Figure 3-33. Grazing allotments with stockwater features within map area 7.

Table 3-6. Grazing allotment lands within the Caliente rail alignment construction right-of-way (page 1 of 3).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (kilometers)[a]	Area that would be within the construction right-of-way or disturbed (square kilometers)[b]
Eccles alternative segment	Clover Creek	1.1	0.15
Eccles alternative segment	Little Mountain	5.8	1.82
Eccles alternative segment[d]	Peck	8	2.43
Eccles alternative segment	Comet	3.2	0.44
Caliente alternative segment	Comet	8.9	0.71
Caliente alternative segment	Panaca Cattle	0.32	0.02
Construction camp 1 – Caliente alternative segment	Peck	c	0.08
Potential quarry CA-8B	Highway	c	1.25
Potential quarry CA-8B	Peck	c	0.07
Caliente common segment 1	Comet	3.7	1.1
Caliente common segment 1	Rocky Hill	0.7	0.2
Caliente common segment 1	Bennett Spring	17.1	5.07
Caliente common segment 1	Black Canyon	5.1	1.59
Caliente common segment 1	Ely Springs Cattle	18.8	5.75
Caliente common segment 1	Rattlesnake	1.8	0.53
Caliente common segment 1	Wilson Creek	24.3	7.41
Caliente common segment 1	Timber Mountain	10.3	3.11
Caliente common segment 1	Sunnyside	18	5.51
Caliente common segment 1	Needles	14.8	4.26
Garden Valley alternative segment 1	Needles	9.5	2.89
Garden Valley alternative segment 1	Batterman Wash	8.5	2.6
Garden Valley alternative segment 1	Pine Creek	7.7	2.35
Garden Valley alternative segment 1	Cottonwood	7.5	2.19
Garden Valley alternative segment 1	McCutcheon Springs	1.7	0.44
Garden Valley alternative segment 2	Coal Valley Lake	1.2	0.38
Garden Valley alternative segment 2	Pine Creek	15	4.57
Garden Valley alternative segment 2	Cottonwood	8.9	2.58
Garden Valley alternative segment 2	Needles	8.8	2.7
Garden Valley alternative segment 2	McCutcheon Springs	1.8	0.38
Garden Valley alternative segment 3	Needles	9.7	2.9
Garden Valley alternative segment 3	Pine Creek	4.4	1.4

Table 3-6. Grazing allotment lands within the Caliente rail alignment construction right-of-way (page 2 of 3).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (kilometers)[a]	Area that would be within the construction right-of-way or disturbed (square kilometers)[b]
Garden Valley alternative segment 3	Batterman Wash	14.815	4.475
Garden Valley alternative segment 3	Cottonwood	6.5	1.992.0
Garden Valley alternative segment 3	McCutcheon Springs	2.31.6	0.6850
Garden Valley alternative segment 8	Coal Valley Lake	1.4	0.42
Garden Valley alternative segment 8	Pine Creek	1165.8	4.23.96
Garden Valley alternative segments 1, 2, 3, and 8	Needles	8.82.2	2.70.48
Garden Valley alternative segments 1, 2, and 8	McCutcheon Springs	1.8	01.389
Garden Valley alternative segment 8	Cottonwood	8.9	2.6
Caliente common segment 2	Sand Springs	22.0	6.687
Caliente common segment 2	McCutcheon Springs	8.7	2.50
Caliente common segment 2	Reveille	10.911	6.80
South Reveille alternative segment 2	Reveille	1119	2.375.56
South Reveille alternative segment 3	Reveille	1219	2.846.03
Potential quarries NN-9A and NN-9B	Reveille	c	0.312
Potential quarry NN-9B	Reveille	c	1.3
Caliente common segment 3	Reveille	46	130
Caliente common segment 3	Stone Cabin	46	14
Caliente common segment 3	Ralston	28.729	8.64
Goldfield alternative segment 1	Ralston	3.52.7	1.071
Goldfield alternative segment 1	Montezuma	29.641	15.5712
Goldfield alternative segment 3	Montezuma Ralston	103.35	13.41.1
Goldfield alternative segments 1, 3, and 4	Montezuma Ralston	346.0	014.92
Goldfield alternative segment 4	Ralston	3.149	0.351.2
Goldfield alternative segment 4	Montezuma	41.245.4	10.7613.27
Caliente common segment 4	Montezuma	11	3.5
Bonnie Claire alternative segment 2	Montezuma	5.6	1.7
Bonnie Claire alternative segment 3	Montezuma	15	4.7
Common segment 5	Montezuma	28	7.9
Common segment 5	Razorback	2.3	0.71

Table 3-6. Grazing allotment lands within the Caliente rail alignment construction right-of-way (page 3 of 3).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (kilometers)[a]	Area that would be within the construction right-of-way or disturbed (square kilometers)[b]
Common segment 5	Magruder	2.9	0.24
Oasis Valley alternative segment 1	Razorback	8.0	2.3
Oasis Valley alternative segment 1	Montezuma	1.8	0.54
Oasis Valley alternative segment 3	Razorback	12	3.8
Oasis Valley alternative segment 3	Montezuma	1.8	0.53
Potential quarry NS-3A	Montezuma	c	0.35
Potential quarry NS-3B	Montezuma	c	0.14
Potential quarry ES-7	Montezuma	c	0.14
Common segment 6	Razorback	18	5.4
Common segment 6	Montezuma	6.4	2.1
Common segment 6	Unused	15	4.7

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert square kilometers to acres, multiply by 247.10.
c. Rail line would not cross allotment; however, the facility would occupy the area listed in the next column.
d. Includes construction camp 1.

Table 3-7. Features of grazing allotments within the Caliente rail alignment region of influence (page 1 of 2).

Grazing allotment	Area (square kilometers)[a]	Active animal unit months (for cattle and year-round, unless otherwise specified)	Stockwater features that would be within the region of influence[b]
Clover Creek[c]	93	613	None
Little Mountain[c]	75	400 (May 1 to October 31)	None
Peck[c]	71	397	None
Comet[c]	37	214	None
Panaca Cattle[c]	66	453	None
Highway[c]	17	118	None
Rocky Hills[c]	18		None
Bennett Spring[c]	200	3,498 sheep (October 16 to April 30)	None
Black Canyon[c]	34	1,105 (October 16 to April 30)	None
Ely Springs Cattle[c]	220	4,248	Caliente common segment 1 would cross two pipelines.
Rattlesnake[c]	120	1,180 (October 16 to May 30)	None
Wilson Creek[c,d]	4,360	34,059 cattle and 14,191 sheep	Caliente common segment 1 would cross one pipeline.

Table 3-7. Features of grazing allotments within the Caliente rail alignment region of influence (page 2 of 2).

Grazing allotment	Area (square kilometers)[a]	Active animal unit months (for cattle and year-round, unless otherwise specified)	Stockwater features within the region of influence[b]
Timber Mountain[c]	180	2,156 cattle and 217 sheep (November 1 to April 10)	None
Sunnyside[c]	890	5,402 (June 1 to October 31)	None
Needles[c]	350	1,044 cattle (October 1 to February 28) and 1,635 sheep (October 1 to April 15)	None
Batterman Wash[c]	160	1,294 cattle (November 15 to June 15) and 799 sheep (November 1 to April 30)	None
Pine Creek[c]	140	2,667 (May 1 to December 31)	Garden Valley alternative segment 2 would cross one pipeline.
Coal Valley Lake[c]	470	4,426 cattle (September 1 to May 5) and 395 sheep (November 1 to April 10)	None
McCutcheon Springs[c]	74	446	None
Sand Springs (#1066)[c]	1,010	7,055	Caliente common segment 2 would cross two pipelines.
Reveille[e]	2,660	25,730	Caliente common segment 3 would cross five pipelines.
Stone Cabin[e]	1,580	13,963	Caliente common segment 3 would cross one pipeline.
Ralston[e]	1,490		None
Montezuma[e]	2,180		Goldfield alternative segment 4 would cross six pipelines.
Razorback[e]	300	959	None
Unused[f]	2,130		None

a. To convert square kilometers to acres, multiply by 247.10. Land area values rounded to two significant digits except values over 1,000, which are rounded to the nearest 10.
b. Source: GIS for water resources.
c. Source: DIRS 174518-BLM 2005.
d. Agreement decision stating permittee will take non-use (voluntary or for conservation and protection of range lands). Therefore, total active use occurring on the allotment would be less than shown.
e. Source: DIRS 173224-BLM 1997 (area of allotment may include private land).
f. Source: DIRS 173845-Resource Concepts 2005.

Access to a water source is an essential requirement for livestock grazing in the high desert of Nevada. In accordance with the Nevada State Water Law, the State Engineer in the Nevada Division of Water Resources may issue permits for water rights to applicants who can demonstrate a beneficial use for the water. Once permitted, water rights are treated as property rights and can be bought and sold

(DIRS 178301-State of Nevada [n.d.], all). Because water rights greatly influence the uses and value of land in this generally arid region, any impacts to water rights can directly affect land use. (See Section 3.2.6 for a description of ***groundwater*** resources.)

It is essential to provide adequate water for livestock within reasonable distances of grazing areas. Stockwater is water that is physically diverted from the natural water course or storage of water for use by livestock or wildlife. There are several methods for developing stockwater, including spring developments; wells, ponds, or dugouts; and pipelines with a trough or tank for storage. Table 3-7 lists stockwater features within each Caliente rail alignment segment.

3.2.2.5.2 Mineral and Energy Resources

3.2.2.5.2.1 Mineral Resources. Commercial prospecting for minerals of value began in southern Nevada in the mid-1800s and continues to the present. Minerals currently mined include metallic and nonmetallic minerals. Gold and silver are the most valuable metallic minerals mined in Nevada. Nonmetallic minerals include borate, limestone, clay, building stones, silica, aggregates, gypsum, and salt used in industrial processes and building materials (DIRS 150524-Tingley 1998, all).

There is potential mining activity on private land (patented mining claims) and public land (unpatented mining claims). Figure 3-34 shows mining districts and areas near the Caliente rail alignment. Figures 3-34 through 3-41 show the locations of sections with unpatented mining claims in relation to the construction right-of-way.

The Caliente rail alignment would cross some ***mining areas*** and mining districts, as discussed below. Section 4.2.2.2.3 discusses potential impacts to individual mining claims.

Caliente common segment 1 would cross the northernmost portion of the Seaman Range Mining District. The vast majority of historic mining activity in the district occurred more than 5 kilometers (3 miles) south and southwest of Caliente common segment 1 (DIRS 173841-Shannon & Wilson 2005, p. 104). In the past, this district has been mined for mercury, uranium, gold, zinc, copper, and jasperoid.

The South Reveille alternative segments and Caliente common segment 3 would pass within 2 miles of the Reveille Valley Mining Area. Exploration work in this area since 1988 has focused on finding near-surface, bulk-mineable, precious metal mineralization. Redhawk Resources is conducting this exploration under a 90-year lease agreement with private owners under the Alien Gold Project (DIRS 173841-Shannon & Wilson 2005, pp. 95 and 96).

A portion of Caliente common segment 3 would cross the Clifford Mining District, which is near Warm Springs. The Clifford Mining District is generally south of U.S. Highway 6 in Stone Cabin Valley, trending southwest from Warm Springs. The geology of this district is favorable for gold and silver (DIRS 173841-Shannon & Wilson 2005, pp. 83 to 86). Ore-grade mineralization and exploration programs in the area have led to gold production.

Goldfield alternative segments 1, 3, and 4 would cross the Goldfield Mining District. Goldfield is the largest center of mining within the region of influence. The Goldfield Mining District consists of the Goldfield Main, McMahon Ridge, and Gemfield areas, and is in the Goldfield Hills to the northeast and southwest of Goldfield, Nevada. An additional area (referred to as the Tom Keane area) has been the subject of 2003 exploration efforts. The Goldfield Project, owned by Metallic Ventures Gold, Inc., consists of 385 patented and 849 unpatented claims (wholly owned or controlled) covering more than 83 square kilometers (20,600 acres) in Esmeralda and Nye Counties (DIRS 173841-Shannon & Wilson 2005, pp. 60, 62, and 72).

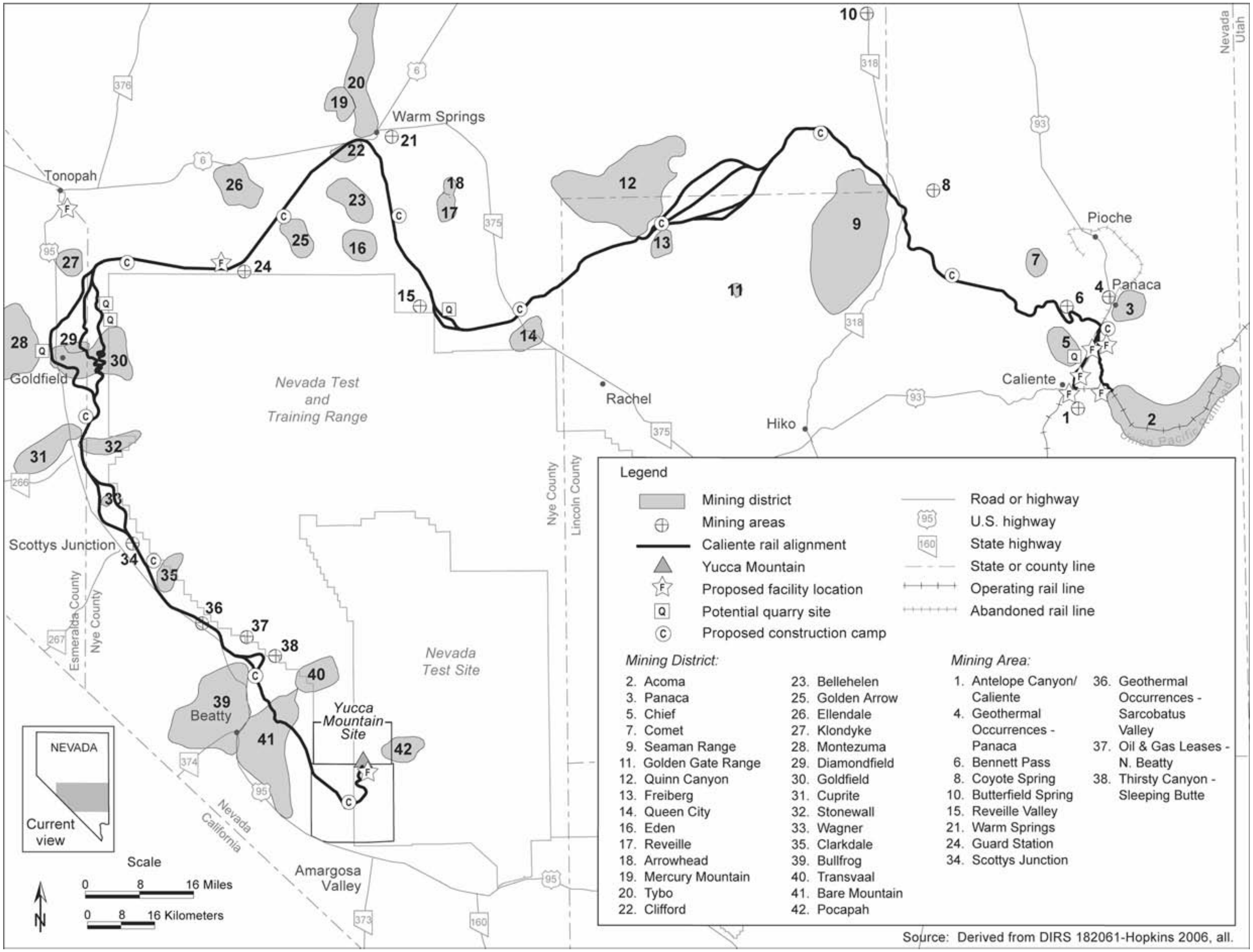


Figure 3-34. Mineral and energy resources along the Caliente rail alignment.

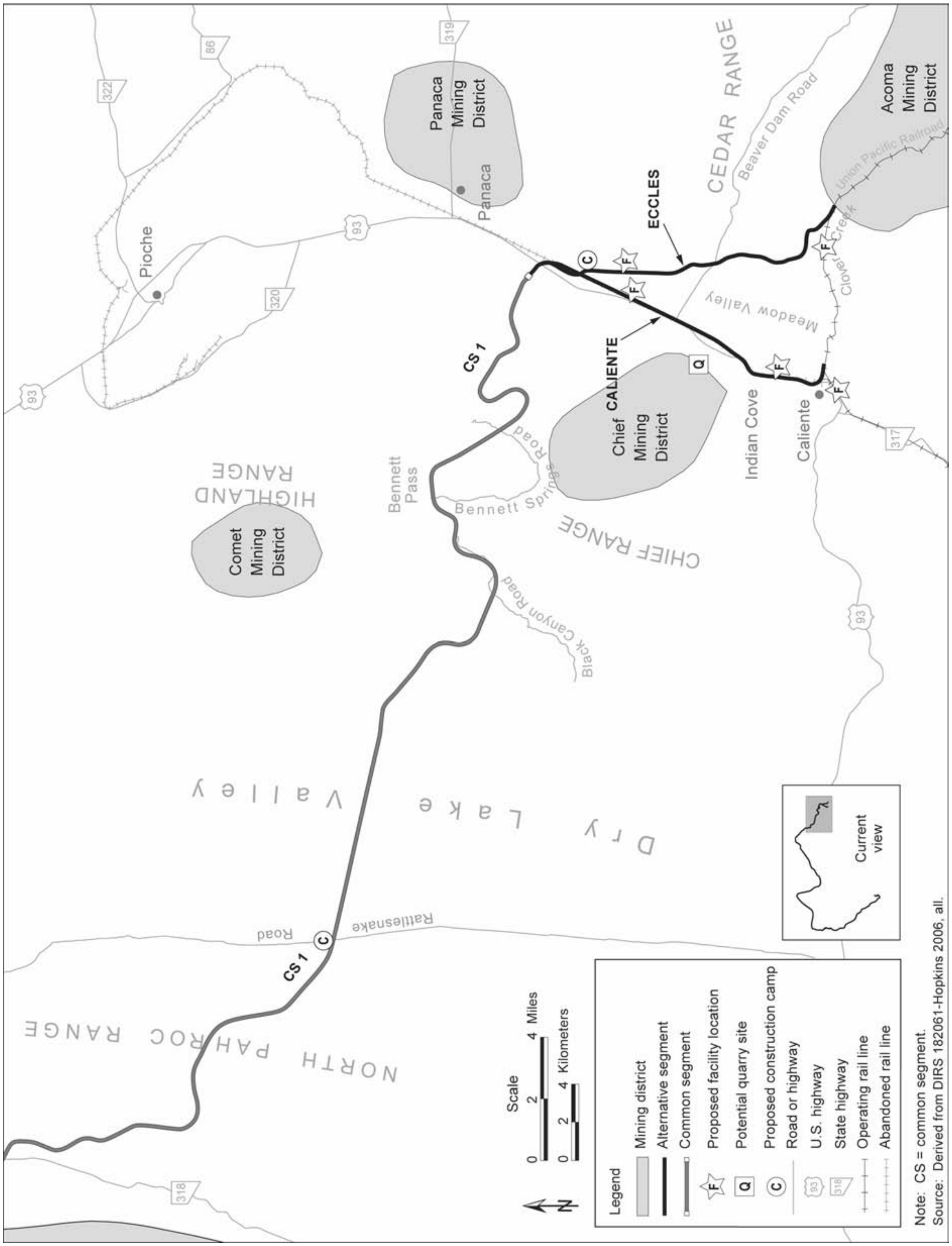
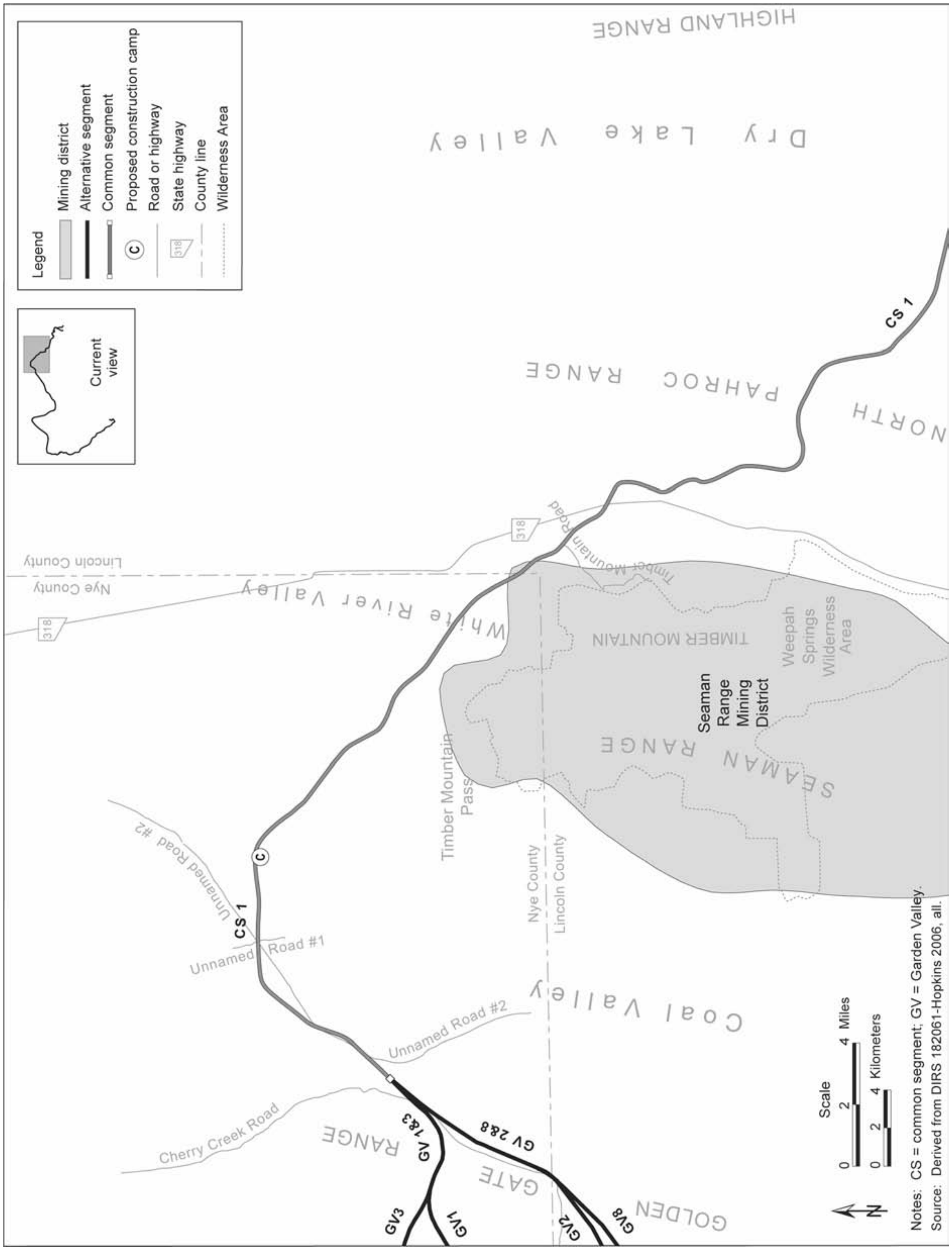


Figure 3-35. Mineral and energy resources within map area 1.



Notes: CS = common segment; GV = Garden Valley.
Source: Derived from DIRS 182061-Hopkins 2006, all.

Figure 3-36. Mineral and energy resources within map area 2.

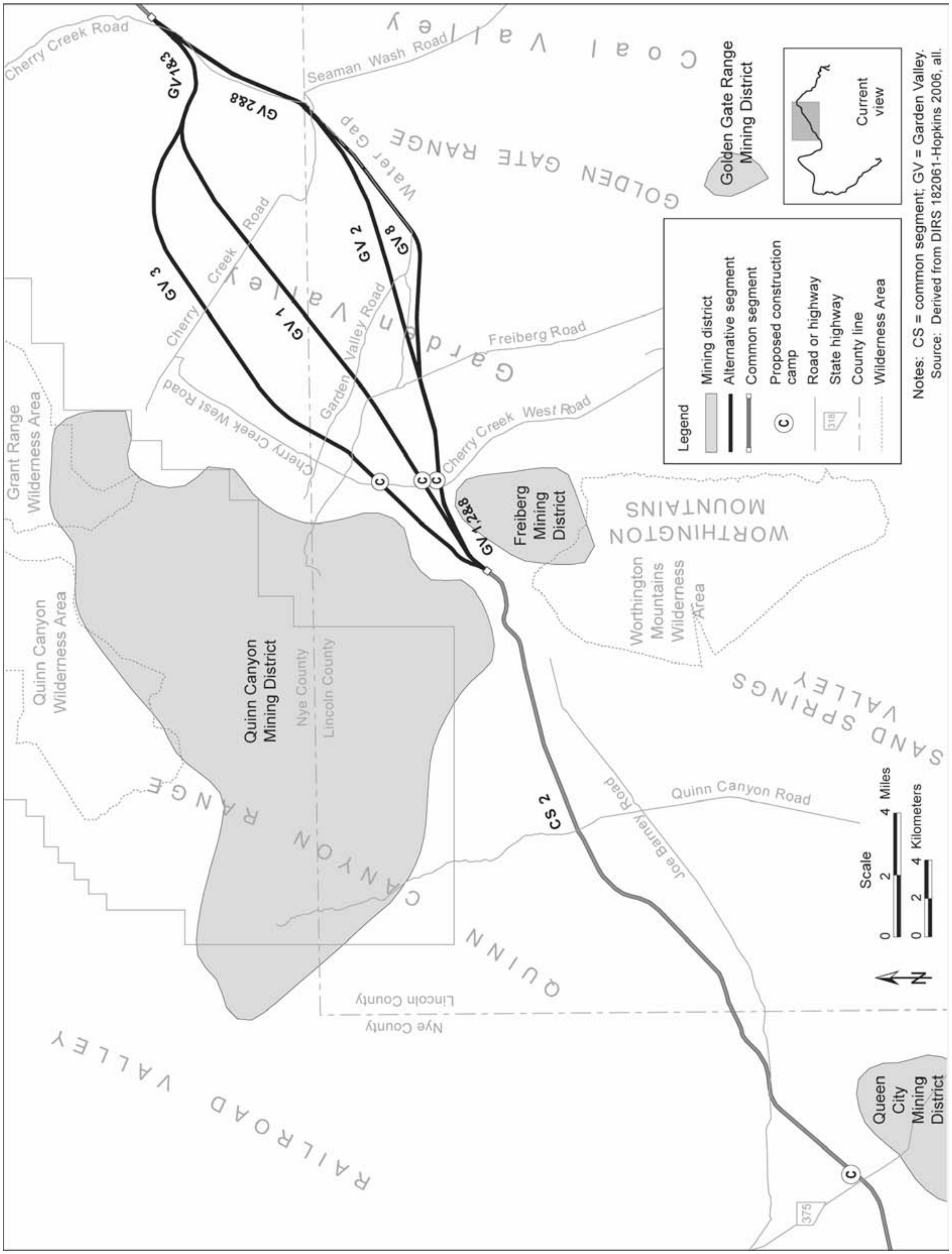


Figure 3-37. Mineral and energy resources within map area 3.

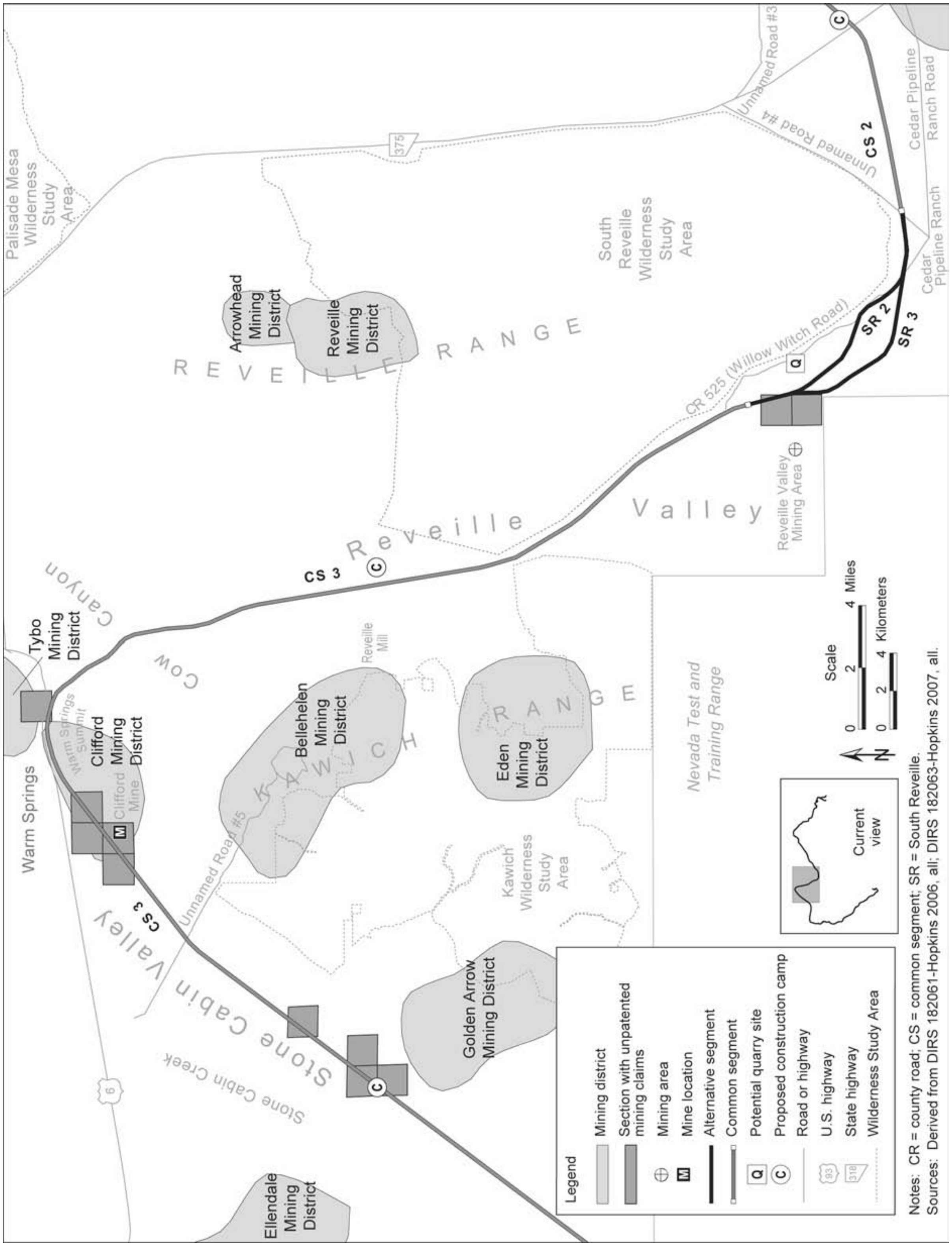


Figure 3-38. Mineral and energy resources within map area 4.

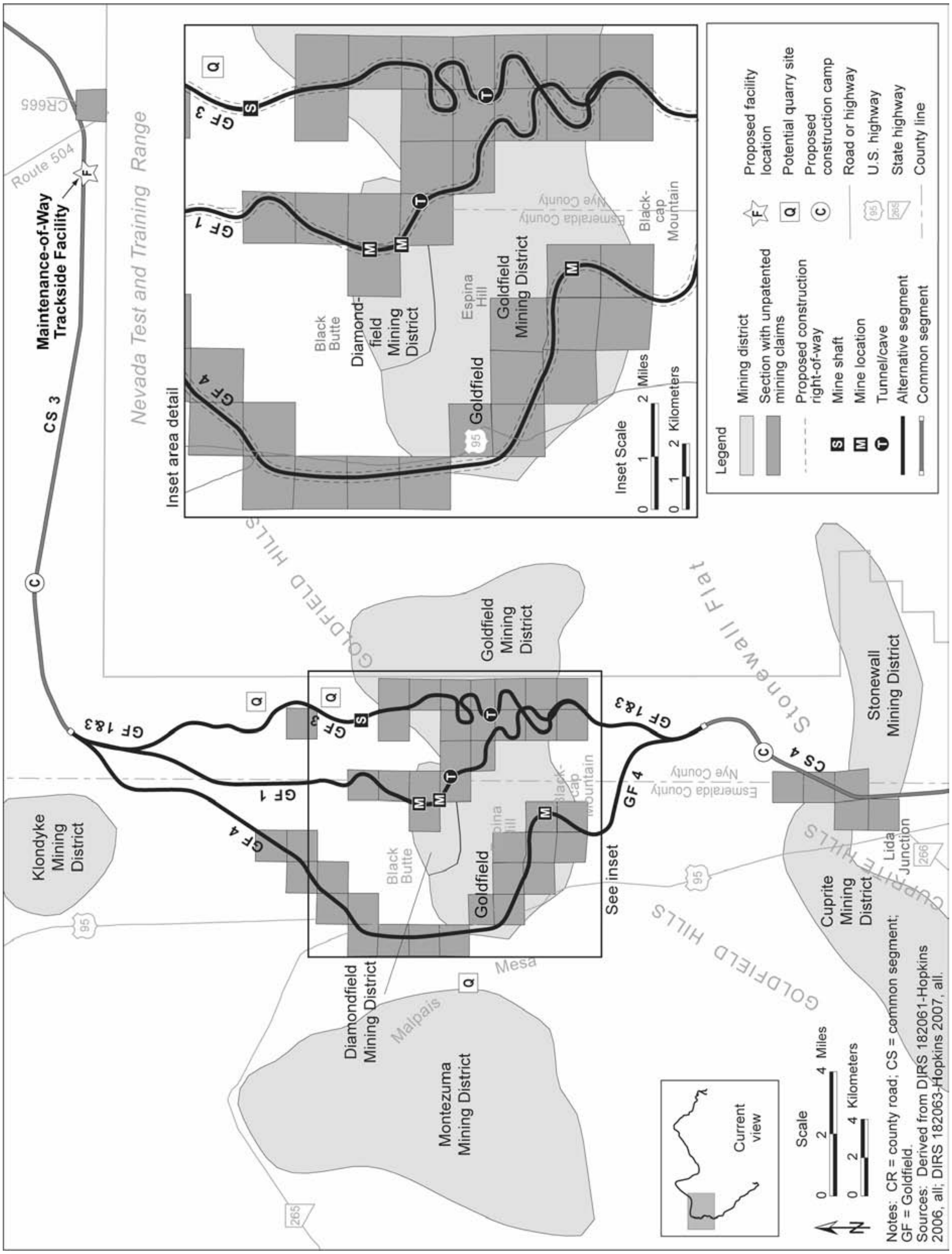


Figure 3-39. Mineral and energy resources within map area 5.

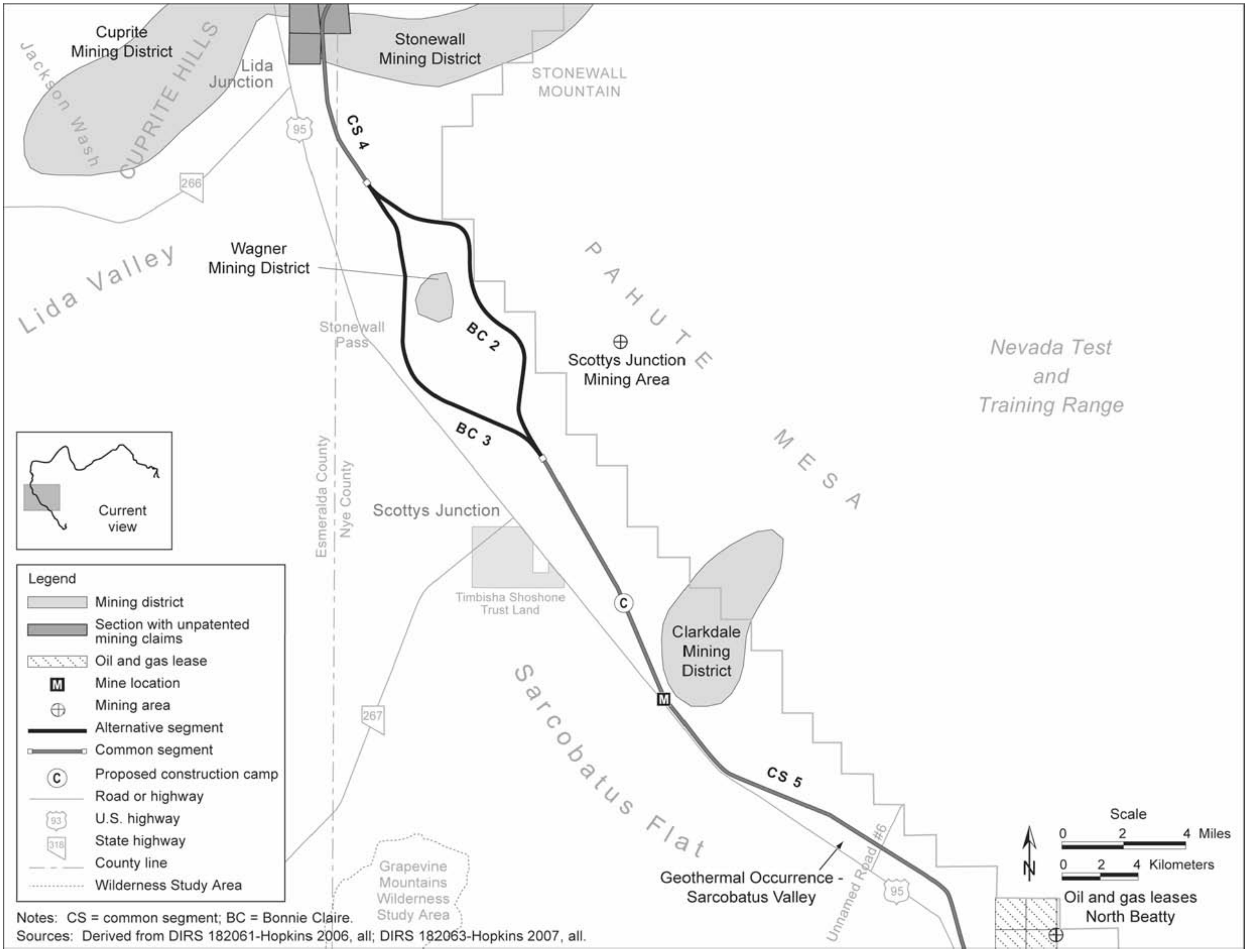
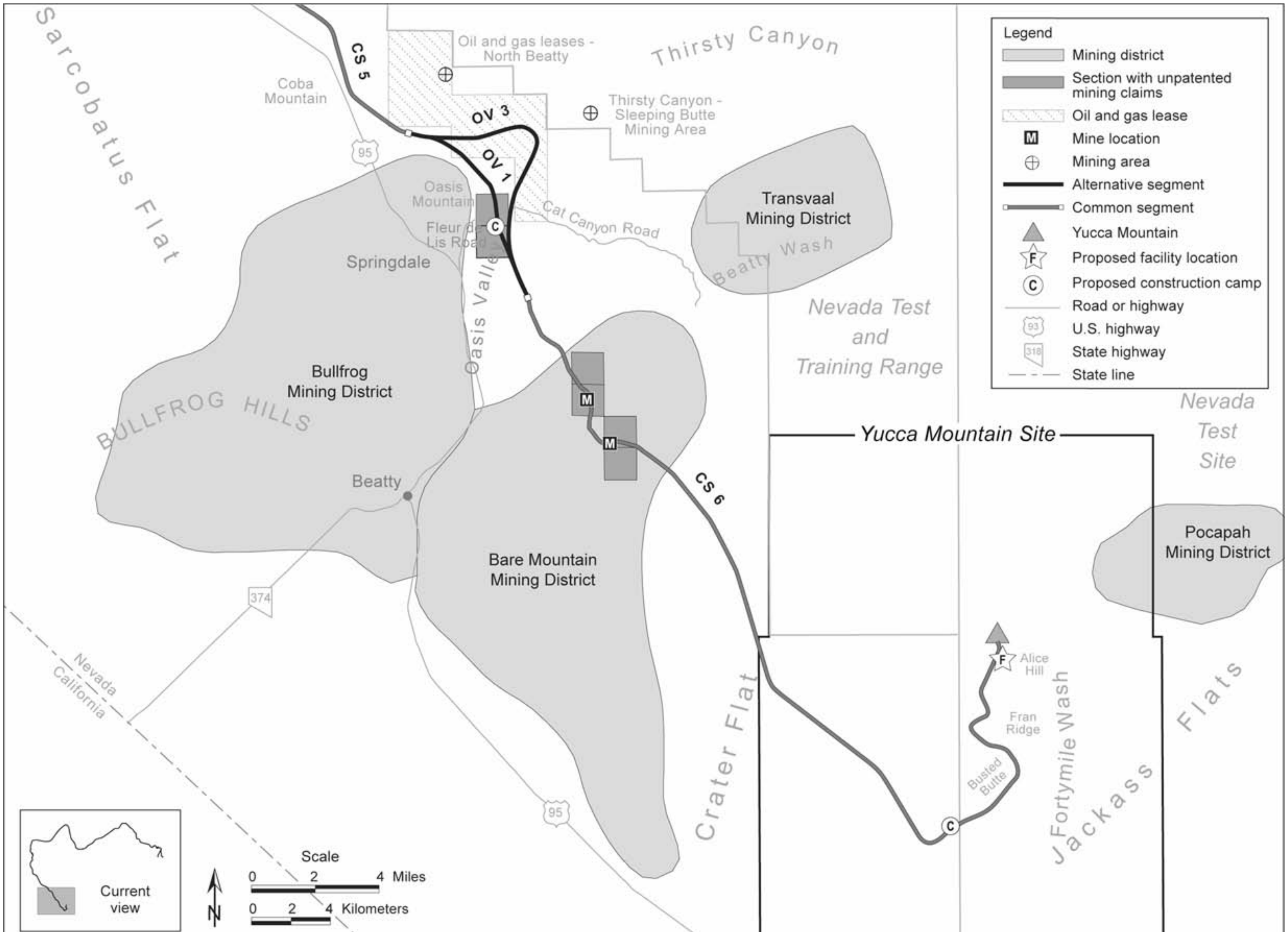


Figure 3-40. Mineral and energy resources within map area 6.



Notes: CS = common segment; OV = Oasis Valley.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182063-Hopkins 2007, all.

Figure 3-41. Mineral and energy resources within map area 7.

Goldfield alternative segment 1 would cross the Diamondfield Mining District, which is approximately 8 kilometers (5 miles) northeast of Goldfield and is approximately 1.6 kilometers (1 mile) long. There is limited published information on this district, which is known to include ore bodies containing gold and silver. The total recorded value of production of the district is approximately $50,000, but actual production could be as much as $1 million to $2 million (DIRS 173841-Shannon & Wilson 2005, p. 70).

A portion of Caliente common segment 4 would cross the westernmost portion of the Stonewall Mining District, although most of the past mining activity in this district is approximately 5 kilometers (3 miles) east of the common segment. This district was reportedly prospected for gold and silver as early as 1905 (DIRS 173841-Shannon & Wilson 2005, p. 56). Veins of gold and silver currently under exploration in this district are prominent at areas mined in the past and continue easterly away from the rail alignment.

The Bonnie Claire alternative segments would be west of the Scottys Junction Mining Area and the Wagner Mining District would lie between these segments. Neither segment's construction right-of-way would cross these mining locations. The Wagner Mining District has a number of patented mining claims although none would fall within the construction right-of-way for either Bonnie Claire alternative segment. The main rock types within the Wagner Mining District are shale, quartzite, and intercalated limestone. There was evidence of active exploration efforts in this district by several companies in 2005 (DIRS 173841-Shannon & Wilson 2005, p. 55).

The closest mining districts to common segment 5 would be Clarkdale Mining District to its east and Bullfrog Mining District to its south where it would meet the Oasis Valley alternative segments. The Oasis Valley alternative segments are between the Bullfrog Mining District and the Thirsty Canyon-Sleeping Butte Mining Area. The Clarkdale Mining District contains discontinuous, narrow zones containing some gold and silver mineralization (DIRS 173841-Shannon & Wilson 2005, p. 52). The Bullfrog Mining District contains small, localized areas of gold, silver and lesser copper mineralization (DIRS 173841-Shannon & Wilson 2005, p. 46). The Thirsty Canyon-Sleeping Butte Mining Area has been historically quarried for decorative rock and building stone (DIRS 173841-Shannon & Wilson 2005, p. 49).

Common segment 6 would cross the northeastern portion of the Bare Mountain Mining District, although the vast majority of past mining activity occurred more than 3 kilometers (2 miles) south of this common segment. The district contains gold-bearing veins, and some veins contain silver. The district also contains a variety of minerals and semi-precious stones, including opal, chalcopyrite, malachite, azurite, galena, pyrite, limonite, hematite, fluorite, fluorspar, and gypsum (DIRS 173841-Shannon & Wilson 2005, pp. 38, 41, and 42).

The only patented mining claims that would fall within or intersect the Caliente rail alignment construction right-of-way would be along the Goldfield alternative segments (see Table 3-4). Table 3-8 lists the number of sections containing unpatented mining claims the rail line construction right-of-way could cross. The existence of abandoned or active mining tunnels and shafts near the rail alignment would also be a concern for safety reasons. There are several tunnels, shafts, and underground mines within the construction right-of-way along the Goldfield alternative segments. There is one tunnel along Goldfield alternative segment 1, four underground mines/shafts along Goldfield alternative segment 3, and one tunnel along Goldfield alternative segment 4. DOE obtained the data on locations of tunnels and caves, mining shafts, and underground mines from the Nevada Bureau of Mines and Geology (DIRS 181617-Hopkins 2007). However, none of the tunnels, shafts, and underground mines in this dataset that fall within the construction right-of-way is identified as having been field verified by the Nevada Bureau of Mines and Geology. Furthermore, this dataset might not include very old tunnels, shafts, and underground mines that were not recorded.

3.2.2.5.2.2 Energy Resources. The Basin and Range Province is considered a favorable area for geothermal resources because it has higher-than-average heat flow and is an area of crustal expansion, where faults can provide permeable reservoirs and conduits for deep circulation of water, and the crust is so thin it has a higher-than-average heat flux. Several hundred wells have been drilled in Nevada to discover high-temperature geothermal steam resources (DIRS 173841-Shannon & Wilson 2005, p. 32).

Table 3-8. Number of unpatented mining claims that may intersect with the Caliente rail alignment construction right-of-way.[a]

Rail line segment	Numbers of sections with unpatented mining claims	Unpatented mining claims across all sections [b]
South Reveille 2	2	72
South Reveille 3	2	72
Caliente common segment 3	10	166
Goldfield 1	14	474
Goldfield 3	14	359
Goldfield 4	19	538
Caliente common segment 4	5	169
Oasis Valley 1	2	14
Oasis Valley 3	2	14
Common segment 6	4	34

a. Source: DIRS 181617-Hopkins 2007.
b. Data are provided by Township, Range, and Section and might not fall within the rail line construction right-of-way. DOE would need to verify the actual numbers and locations of unpatented mining claims before applying for a right-of-way grant.

Geothermal resources are present as hot springs and thermal waters near Caliente Hot Springs, Bennett Spring, Pedro Spring, Sarcobatus Flat, Scottys Junction, Panaca (Owl Warm Springs), Cedar Spring, Stonewall Flat, and Beatty Warm Springs (DIRS 173841-Shannon & Wilson 2005, pp. 23 and 24). There are geothermal occurrences (springs and wells) in Sarcobatus Valley along U.S. Highway 95 south of Scottys Junction (DIRS 173841-Shannon & Wilson 2005, p. 50). However, there would be no geothermal resources within the construction right-of-way of any of the Caliente rail alignment alternative segments or common segments.

Fourteen sections of land constitute a single oil and gas lease (one permittee) 19 kilometers (12 miles) north of Beatty along the southwest flank of Pahute Mesa in southern Nye County (DIRS 179587-Wilson 2007, all). For reference, a section is a unit of land equal to 2.6 square kilometers (1 square mile), as defined under the public land survey system. Oasis Valley alternative segment 3 would cross 7 of the 14 sections and Oasis Valley alternative segment 1 would cross 2 sections of this oil and gas lease block.

3.2.2.5.3 Recreation

This section describes the recreational areas within or near the Caliente rail alignment region of influence. Figures 3-42 through 3-49 show recreational areas near the Caliente rail alignment.

3.2.2.5.3.1 Lincoln County. There are two state parks in the vicinity of the Caliente rail alignment in Lincoln County. The Kershaw-Ryan State Park is approximately 2.4 kilometers (1.5 miles) south of the City of Caliente, along State Route 317 (Rainbow Canyon Road). This park is approximately 3.2 kilometers (2 miles) southwest of the Caliente alternative segment and not within the region of influence. The Cathedral Gorge State Park is 2.6 kilometers (1.6 miles) west of U.S. Highway 93, approximately 5.3 kilometers (3.3 miles) northeast of Caliente common segment 1, and not within the region of influence.

Recreation on BLM-administered lands in Lincoln County has traditionally been dispersed. Primary recreation activities in Lincoln County include hunting, camping, exploration and site-seeing, off-highway vehicle competition events, and rock-art viewing.

A **Back Country Byway** is a vehicle route that traverses scenic corridors utilizing secondary or back country road systems (DIRS 181598-BLM [n.d.]).

Under the preferred alternative of the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 2.4-36), the BLM would designate two ***Back Country Byways*** (Silver State Trail Byway and Rainbow Canyon Byway) near the Caliente rail alignment. The Silver State Off-Highway Vehicle Trail is approximately 420 kilometers (260 miles) long and consists of a series of existing backcountry roads that are open for use by off-highway vehicle enthusiasts. Caliente rail alignment common segment 1 would cross the most trails, including the Silver State Off-Highway Vehicle Trail in two places (see Figure 3-43). The northern portion of the proposed Rainbow Canyon Back Country Byway would include portions of U.S. Highway 93 in Caliente. The Caliente and Eccles alternative segments would cross the Byway. The Rainbow Canyon Back Country Byway is made up of paved and unpaved ***class 3 or 4 roads***.

The Draft Ely District Resource Management Plan preferred alternative would also designate Chief Mountain as an off-highway vehicle use emphasis area (see Figure 3-43). The Chief Mountain area is frequently used for off-highway vehicles. The south access point is at Oak Springs Summit on the north side of U.S. Highway 93 approximately 8 kilometers (5 miles) west of Caliente. Portions of common segment 1 would cross this proposed off-highway vehicle use emphasis area.

A number of BLM-permitted off-highway vehicle races and special recreation events take place annually in areas around the Caliente rail alignment common segments and alternative segments in Lincoln County (DIRS 178416-Nevada Rail Partners 2007, all). The largest number of BLM-approved race routes are in and around Caliente and Panaca, and the Eccles and Caliente alternative segments would each cross previously used routes approximately 10 times. Caliente common segment 1 would cross previously used routes approximately 20 times, primarily east of Dry Lake Valley and in the Pahroc Range. Recent off-highway vehicle events in the area have included the Las Vegas to Reno Race and the Silver State 300. Most approved race routes are on existing roads and trails.

There are two Wilderness Areas along the Caliente rail alignment in Lincoln County – the Weepah Springs Wilderness Area and the Worthington Mountains Wilderness Area. Caliente common segment 1 would be 1.6 kilometers (1 mile) from the Weepah Springs Wilderness Area at its closest point (see Figure 3-44). Caliente common segment 2 would be 0.9 kilometer (0.6 mile) from the Worthington Mountains Wilderness Area at its closest point (see Figure 3-45).

The Weepah Springs and Worthington Mountains Wilderness Areas are predominantly natural areas, with only some evidence of localized human activity. Recreational uses of both areas include day hiking; backpacking; caving; photography; horseback riding; rockhounding; big game and upland bird hunting; wildflower viewing; bird watching, sightseeing; and ***heritage tourism*** (DIRS 176796-Winslow 2006, p. 3).

Particularly scenic locales in these Wilderness Areas include natural arches, caves, vistas from the ridgeline of the Worthington Mountains and the summit of Timber Mountain in the Weepah Springs Wilderness Area. Caliente rail alignment common segment 2 would be 3.2 kilometers (2 miles) from the Humboldt-Toiyabe National Forest at its closest point. The Ely Ranger District of the U.S. Forest Service manages this part of the Forest, which is bordered by Railroad Valley on the west and Garden Valley on the east. Hunting, photography, wildlife viewing, camping, and hiking are the dominant recreation uses of the area. Most of the recreational use is along Little Cherry Creek and Hooper Canyon. Approximately 33 kilometers (21 miles) of poor- or very-poor-condition trails are either not used or are only lightly used (DIRS 176796-Winslow 2006, all). Access to this part of the Humboldt-Toiyabe National Forest is by unimproved roads from State Highway 318 or State Highway 375, which the Caliente rail alignment would not cross.

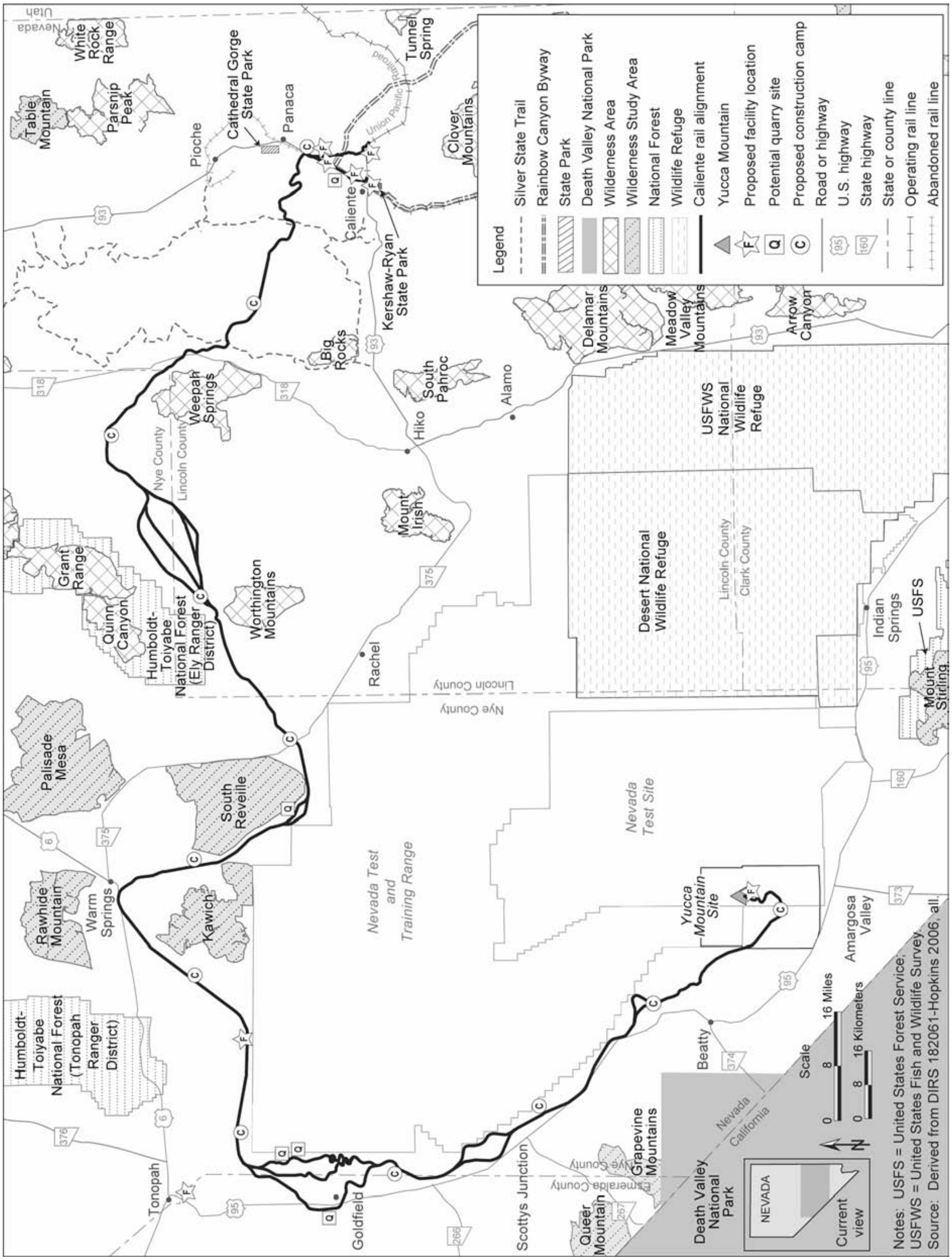


Figure 3-42. Recreation areas and roads along the Caliente rail alignment.

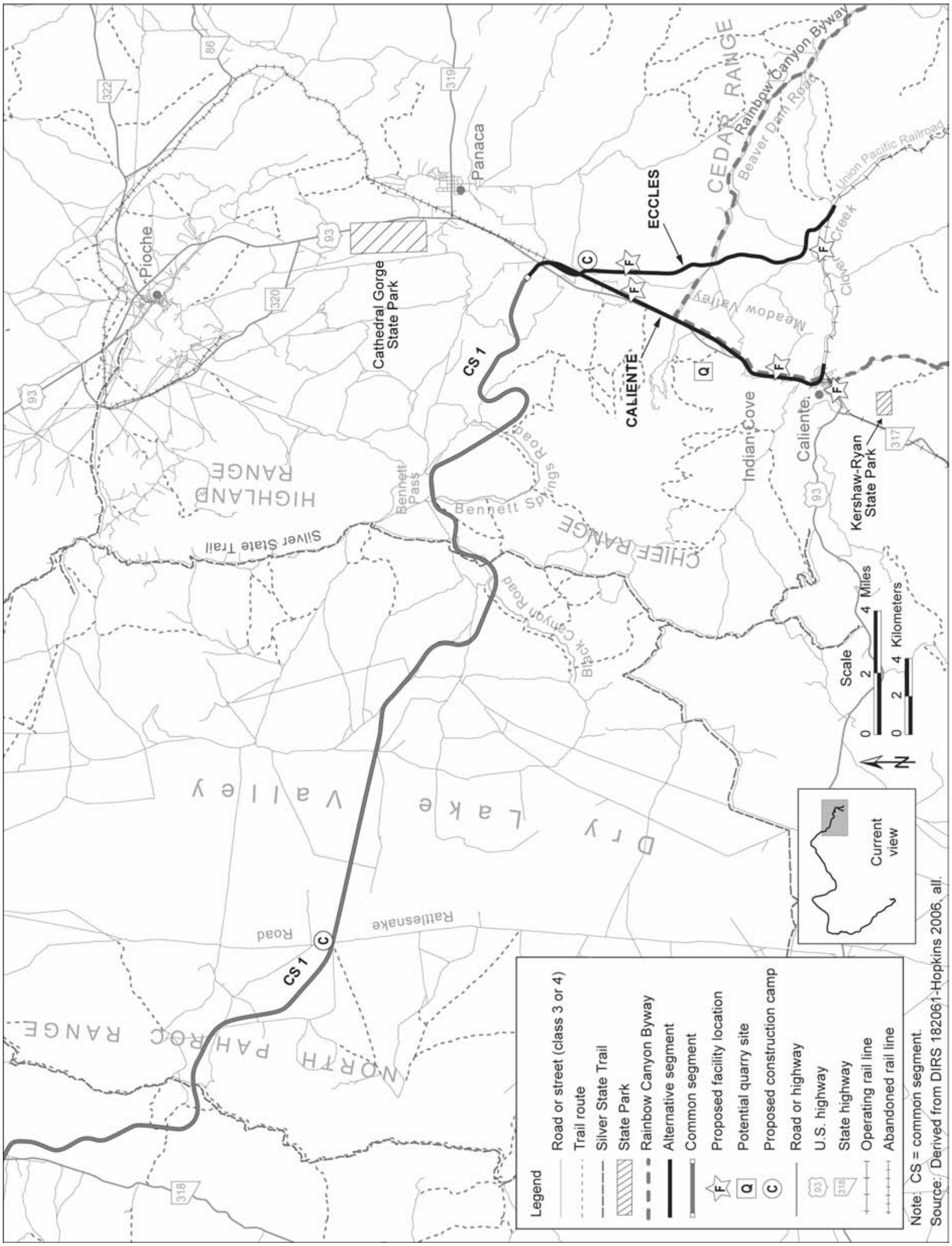


Figure 3-43. Recreation areas and roads within map area 1.

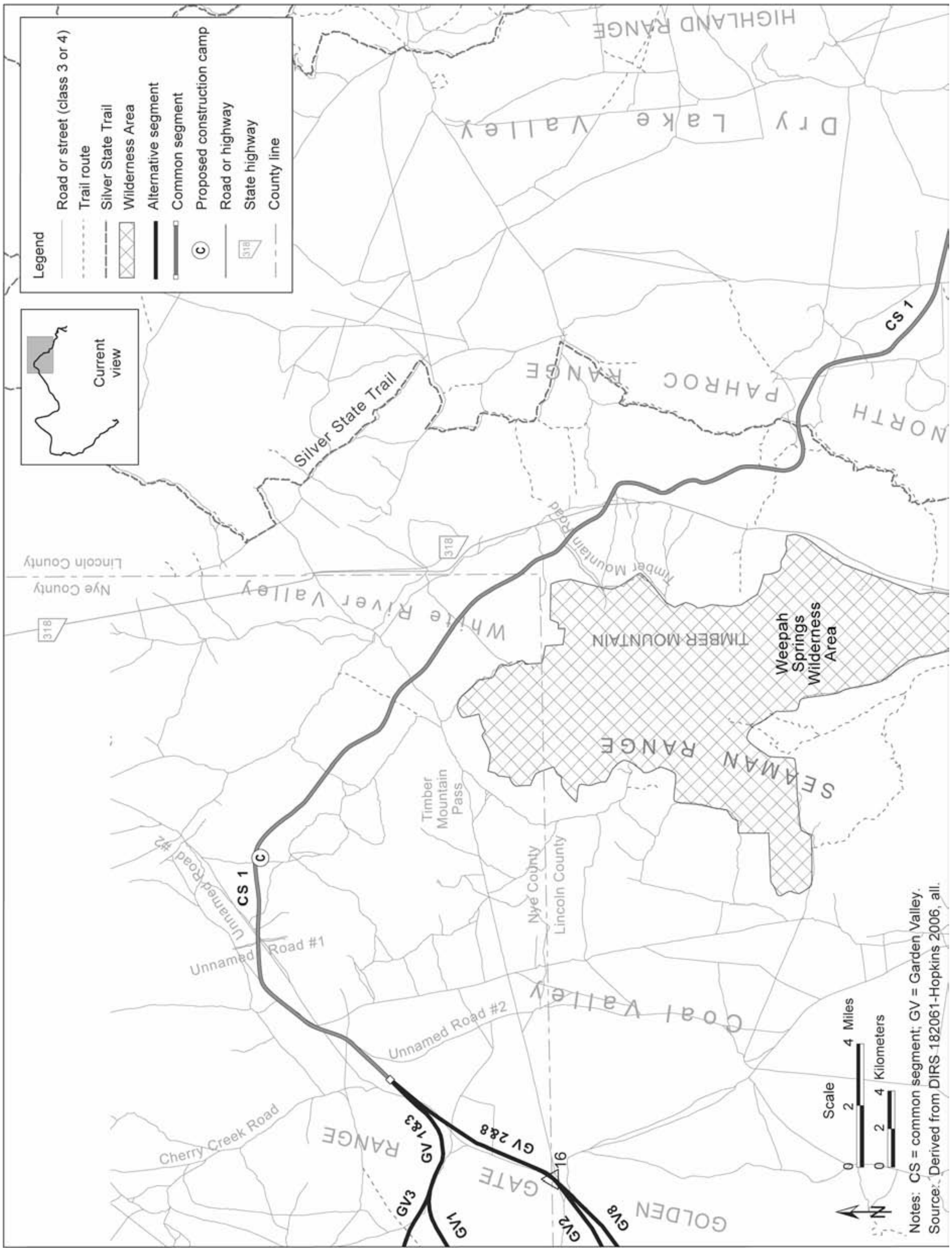


Figure 3-44. Recreation areas and roads within map area 2.

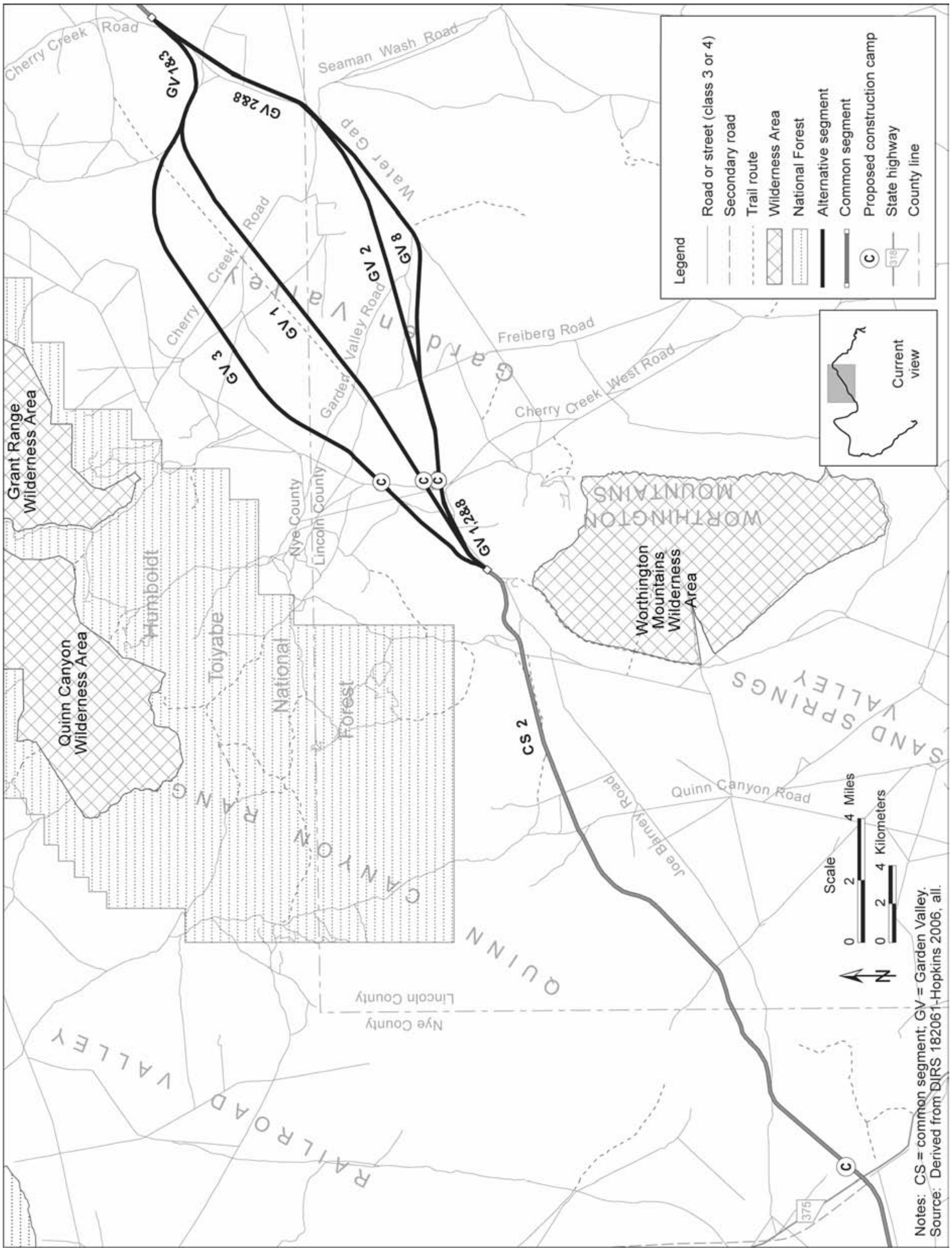
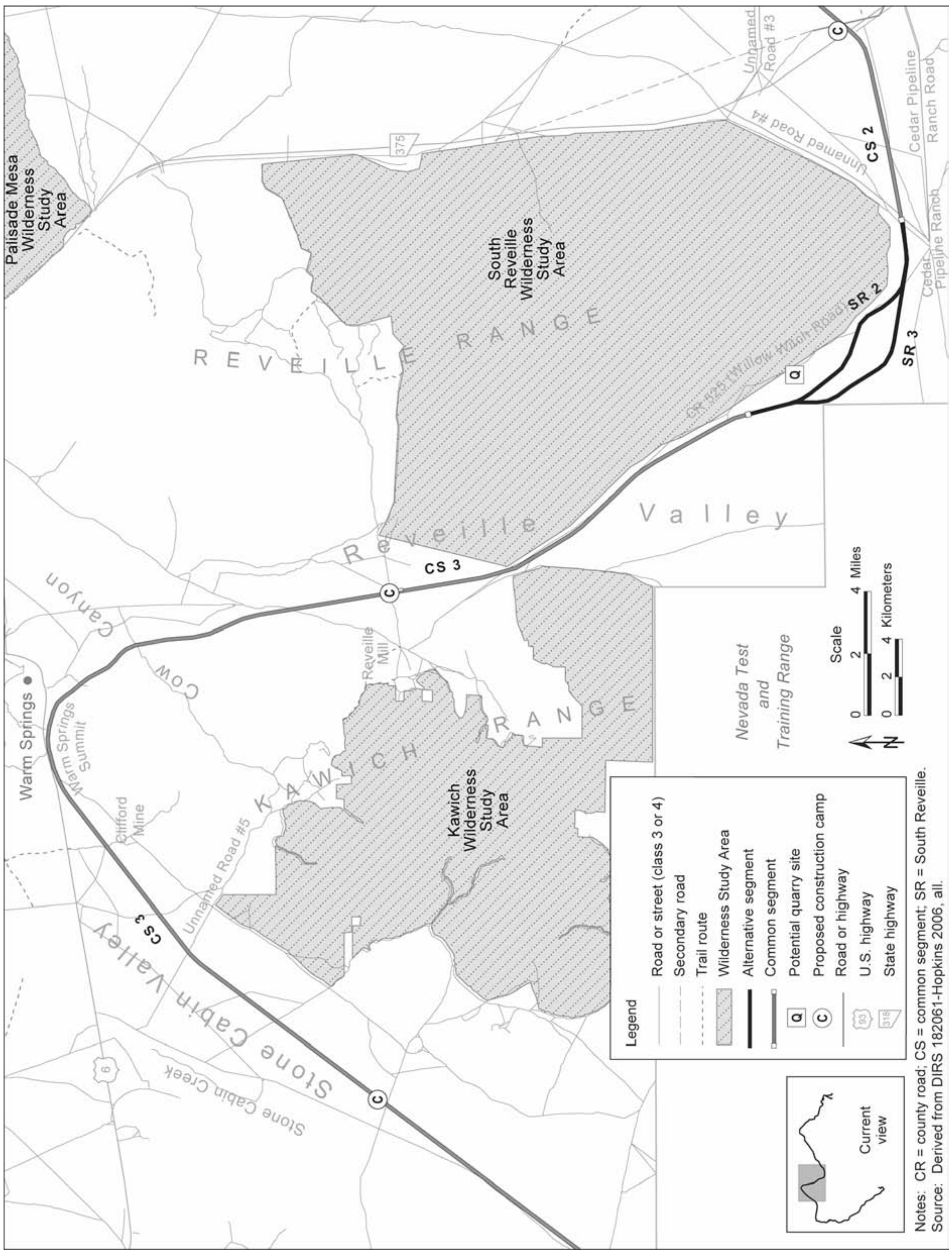


Figure 3-45. Recreation areas and roads within map area 3.



Notes: CR = county road; CS = common segment; SR = South Reveille.
Source: Derived from DIRS 182061-Hopkins 2006, all.

Figure 3-46. Recreation areas and roads within map area 4.

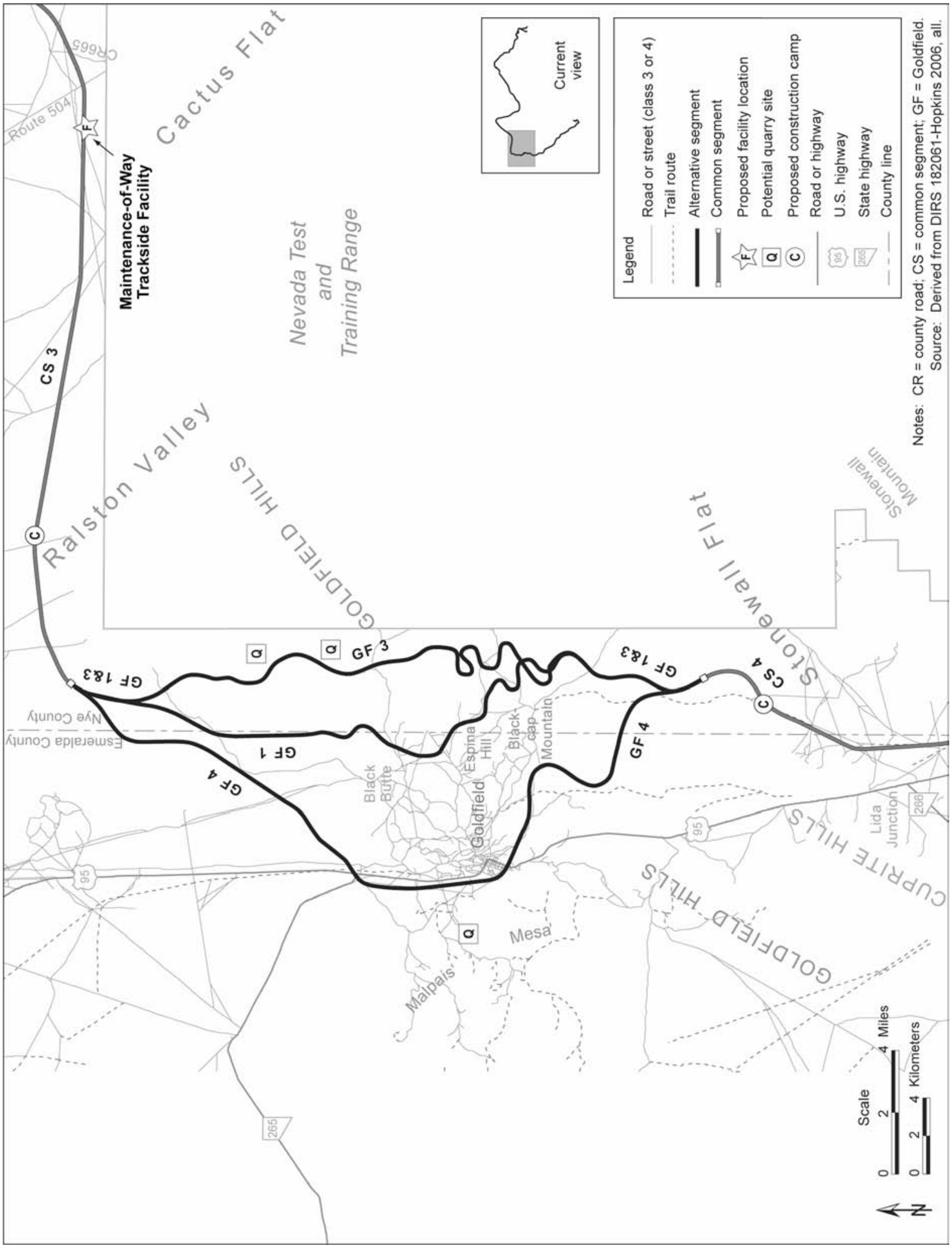


Figure 3-47. Recreation areas and roads within map area 5.

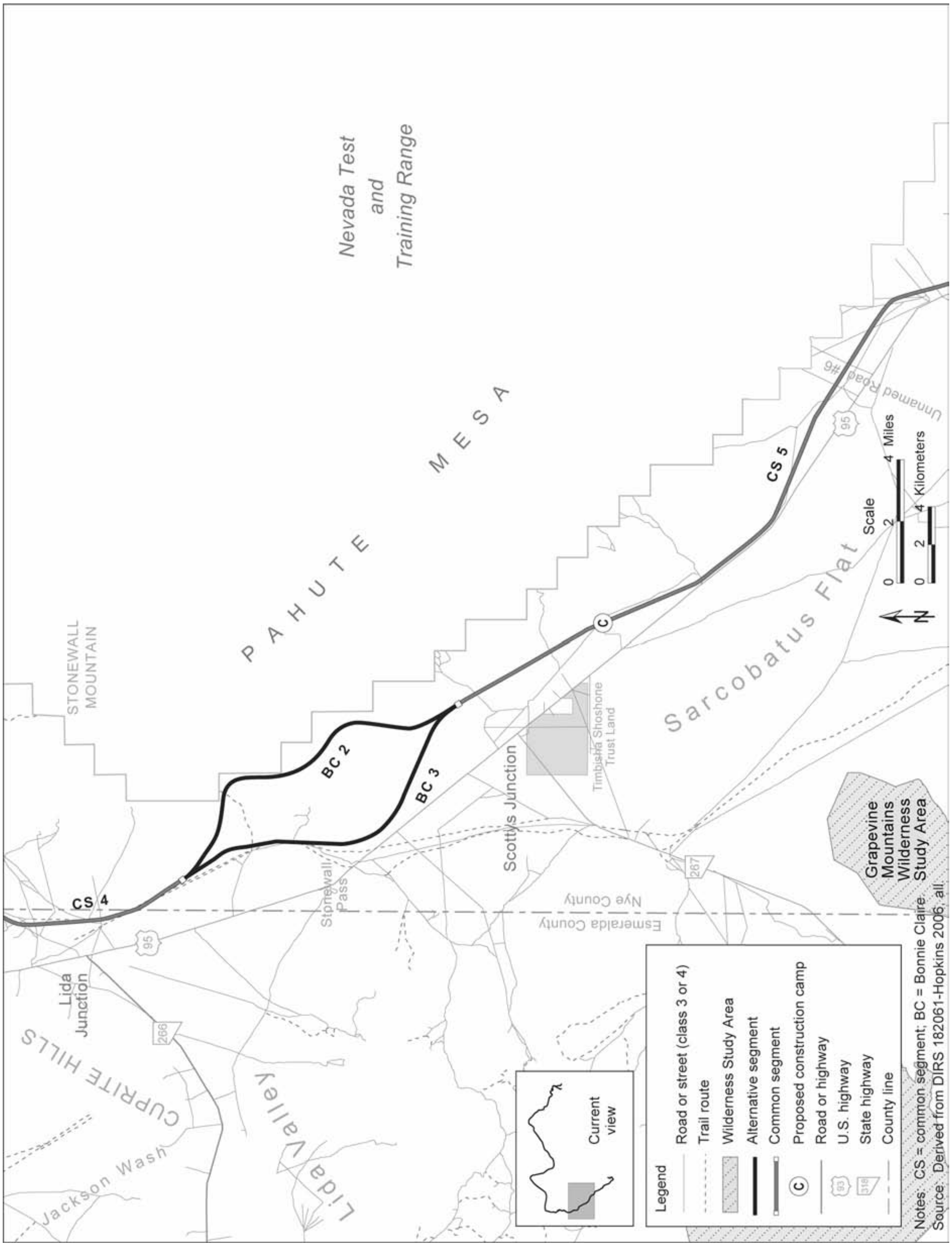


Figure 3-48. Recreation areas and roads within map area 6.

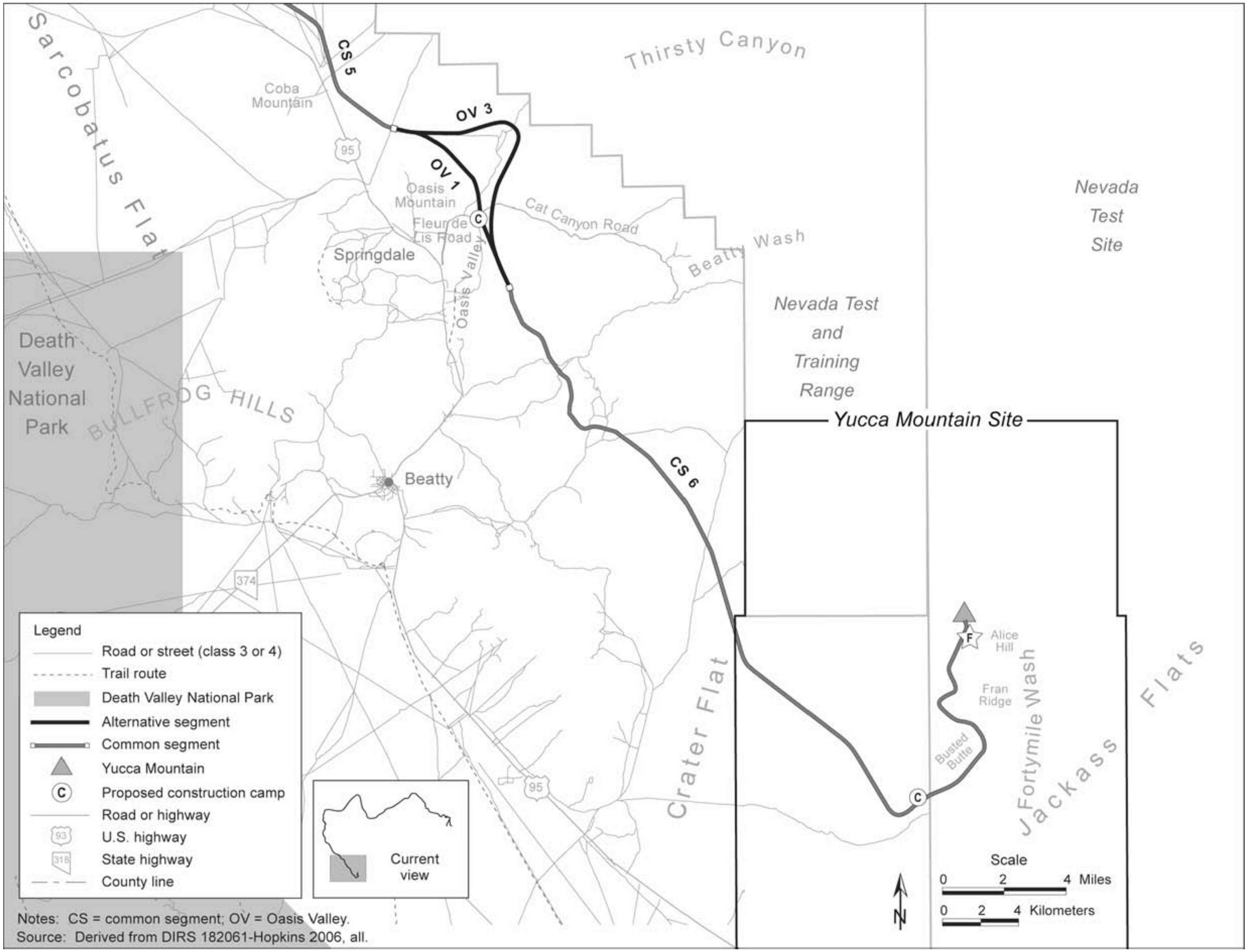


Figure 3-49. Recreation areas and roads within map area 7.

3.2.2.5.3.2 Nye County. Recreation on BLM-administered lands in Nye County is generally dispersed, and there would be no developed recreation sites within 1.6 kilometers (1 mile) of the Caliente rail alignment (see Figure 3-46). Dispersed recreation opportunities in Nye County include hunting, camping, exploration and sightseeing, and off-highway vehicle recreation and competition events.

There are two Wilderness Study Areas along the Caliente rail alignment in Nye County – the Kawich Wilderness Study Area and the South Reveille Wilderness Study Area. Caliente common segment 2 would be within 0.3 kilometer (0.2 mile) of the Kawich Wilderness Study Area at its closest point. The South Reveille Wilderness Study Area would be 30 meters (100 feet) from the centerline of Caliente common segment 2. The Kawich Wilderness Study Area consists of rugged, mountainous country with a high central plateau and several mountain peaks. The South Reveille Wilderness Study Area is a thick, multi-ridged swath of steep-sided mountain rising to crests and flat-topped summits between 2,400 and 2,700 meters (8,000 and 9,000 feet). Sheer cliffs form the mountain sides in many places and large canyons with steep walls run out to the edge of the valleys (DIRS 176796-Winslow 2006, p. 5).

Very few BLM-permitted off-highway vehicle races and special recreation events occur within the region of influence for the Caliente rail alignment common segments and alternative segments in Nye County (DIRS 178416-Nevada Rail Partners 2007, all). Both common segments 3 and 6 would cross race routes several times. All approved race routes the rail line would cross are on existing roads and trails.

3.2.2.5.3.3 Esmeralda County. Recreation in Esmeralda County is generally dispersed and includes competitive off-highway vehicle events, sometimes near the proposed rail alignment. The county is home to numerous largely abandoned towns and historical sites, many of which are in old mining districts, and areas for hunting and fishing (DIRS 176770-Duval et al. 1976, p. 28). No Areas of Critical Environmental Concern (see Section 3.2.2.4.1) fall within the rail alignment region of influence in Esmeralda County. The closest Wilderness Area or Wilderness Study Area to the rail alignment would be Queer Mountain Wilderness Study Area, which would be approximately 20 kilometers (12 miles) away from common segment 5, far outside the construction right-of-way.

A number of BLM-permitted off-highway vehicle races and special recreation events take place annually in areas around the Caliente rail alignment common segments and alternative segments in Esmeralda County (DIRS 178416-Nevada Rail Partners 2007, all). Recent permitted recreation events in the area have included the Las Vegas to Reno Race and the Nevada 1000 Race off-highway vehicle events. The largest number of BLM-approved race routes occur in and around Tonopah and Goldfield, and Goldfield alternative segment 4 would cross multiple routes. Most approved race routes are on existing roads and trails.

3.2.2.5.4 Land Access

The Caliente rail alignment would cross a number of class 3 or 4 roads and unpaved trail routes (see Table 3-9). The intersections of the Caliente rail alignment with these roads and trails could impact access to public lands (for recreational and land management activities) and to private property.

> A **class 3 road** is a light-duty, paved or improved road.
>
> A **class 4 road** is an unimproved, unsurfaced road (includes track roads in back country).
>
> **Trail routes** are trails and roads passable only with a 4-wheel drive vehicle (also called Jeep trails).
>
> Source: DIRS 181386-BLM 2001.

3.2.2.5.5 Utilities

3.2.2.5.5.1 Utility Rights-of-Way. Figures 3-50 through 3-57 show the major utilities and utility corridor networks in the region of influence. The figures do not identify smaller, local electric distribution lines, typically in the 14- to 25-kilovolt range, with linear right-of-way reservations along major roads, or local water, sewer, power, or telephone lines serving individual residences or businesses, or their corresponding rights-of-way.

Table 3-9. Trails and class 3 or 4 roads the Caliente rail alignment alternative segments and common segments would cross.

Segment	Lincoln County roads	Lincoln County trails	Nye County roads	Nye County trails	Esmeralda County roads	Esmeralda County trails
Eccles alternative segment[a]	8	0	0	0	0	0
Caliente alternative segment[a]	7	0	0	0	0	0
Caliente common segment 1[b]	19	7	12	1	0	0
Garden Valley alternative segment 1	6	0	2	1	0	0
Garden Valley alternative segment 2	9	0	3	0	0	0
Garden Valley alternative segment 3	6	0	4	1	0	0
Garden Valley alternative segment 8	10	1	3	0	0	0
Caliente common segment 2	7	1	5	0	0	0
South Reveille alternative segment 2	0	0	1	0	0	0
South Reveille alternative segment 3	0	0	1	0	0	0
Caliente common segment 3	0	0	30	0	0	0
Goldfield alternative segment 1	0	0	6	0	9	0
Goldfield alternative segment 3	0	0	5	0	0	0
Goldfield alternative segment 4	0	0	0	1	41	2
Caliente common segment 4	0	0	2	1	11	0
Bonnie Claire alternative segment 2	0	0	0	1	0	0
Bonnie Claire alternative segment 3	0	0	2	2	0	0
Common segment 5	0	0	14	0	0	0
Oasis Valley alternative segment 1	0	0	3	0	0	0
Oasis Valley alternative segment 3	0	0	3	0	0	0
Common segment 6	0	0	7	0	0	0

a. Both the Caliente and Eccles alternative segments would cross the Rainbow Canyon Back Country Byway.
b. Caliente common segment 1 would cross the Silver State Trail in two places.

3.2.2.5.5.2 Utility Corridors. As stated in Section 3.2.2.4.1, BLM resource management plans designate utility and transportation corridors to consolidate the location of new and existing rights-of-way whenever feasible. Table 3-10 lists the extent to which DOE would construct each Caliente rail alignment segment within BLM-designated corridors.

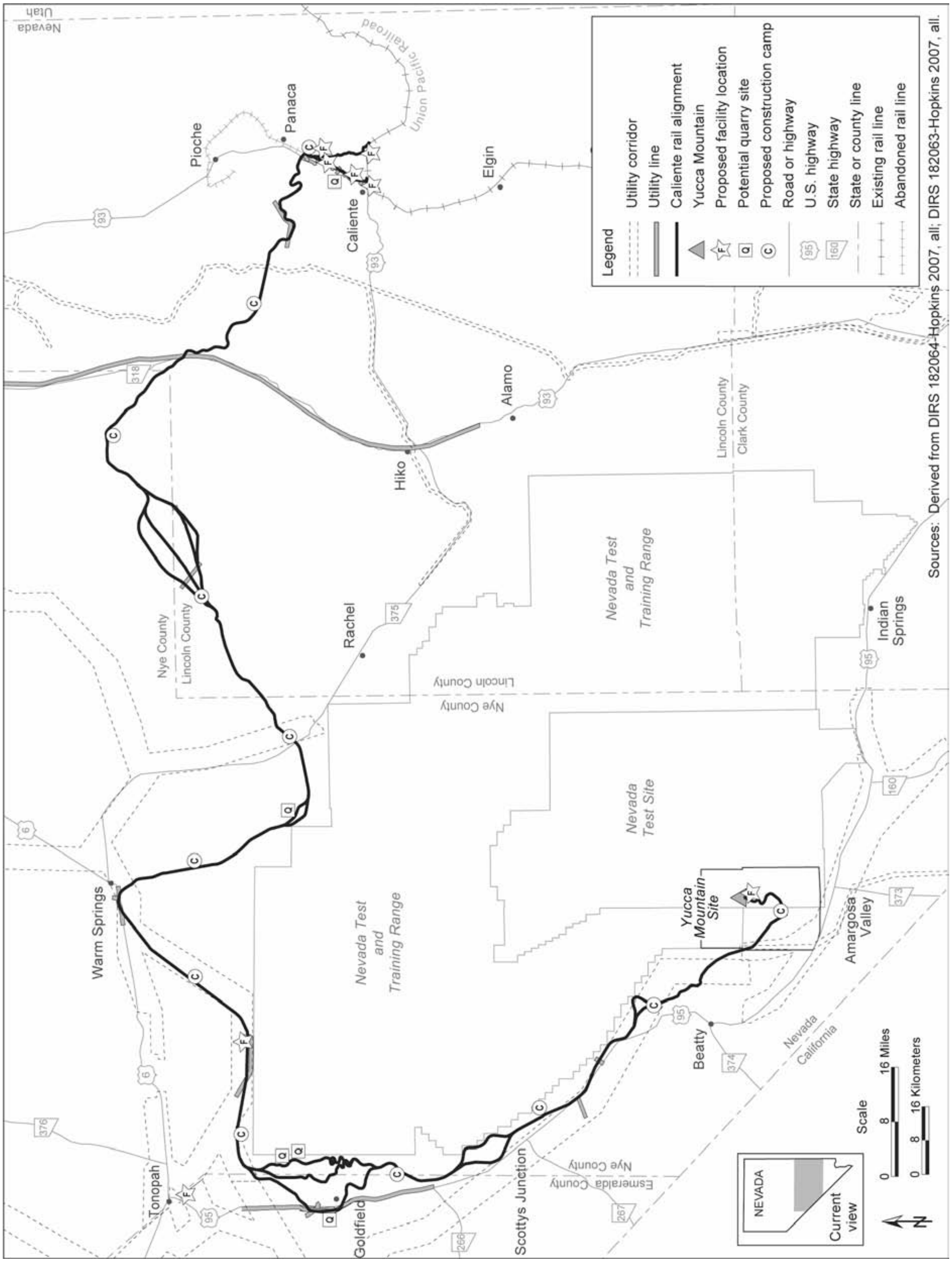


Figure 3-50. Utility corridors along the Caliente rail alignment.

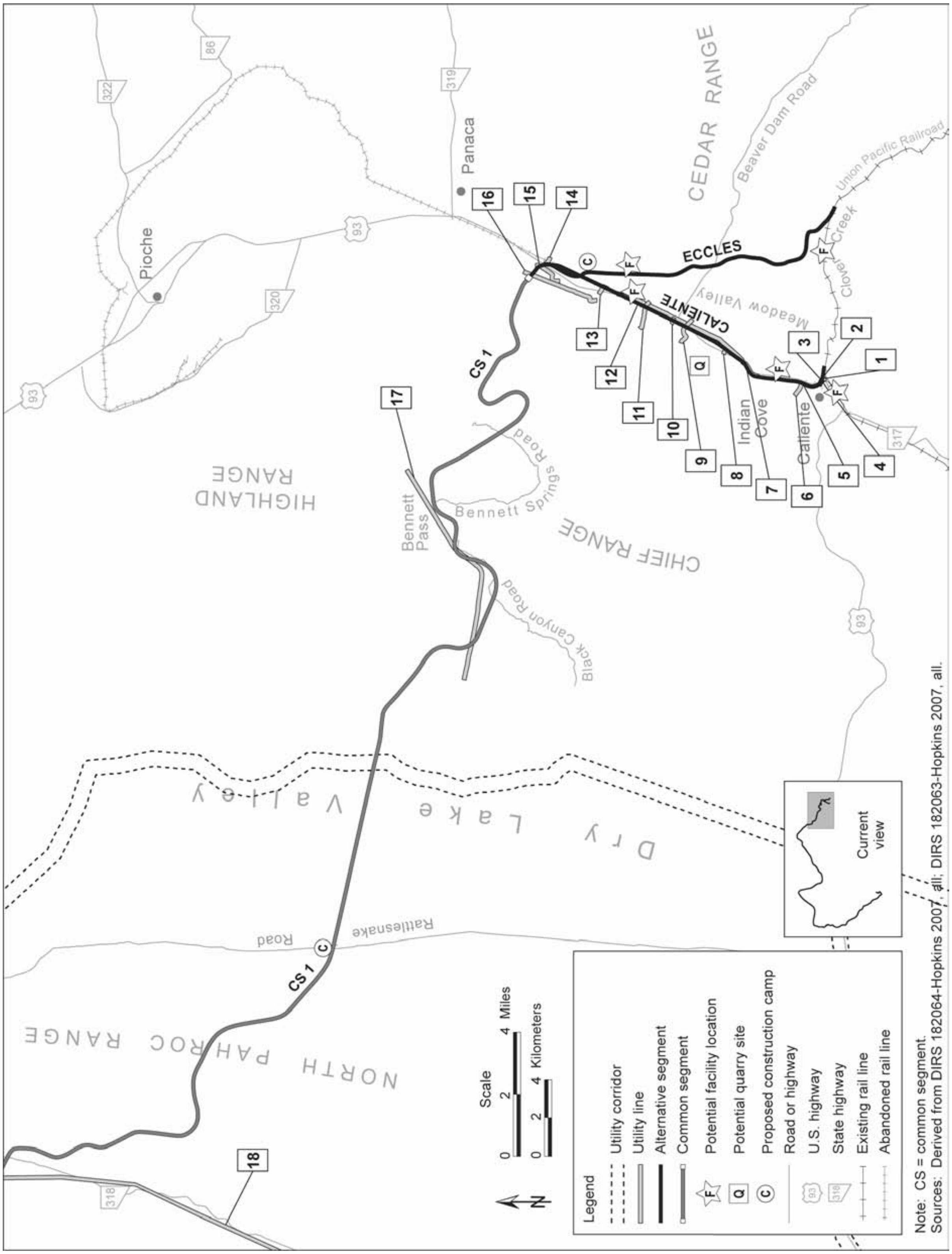


Figure 3-51. Utility corridors within map area 1.

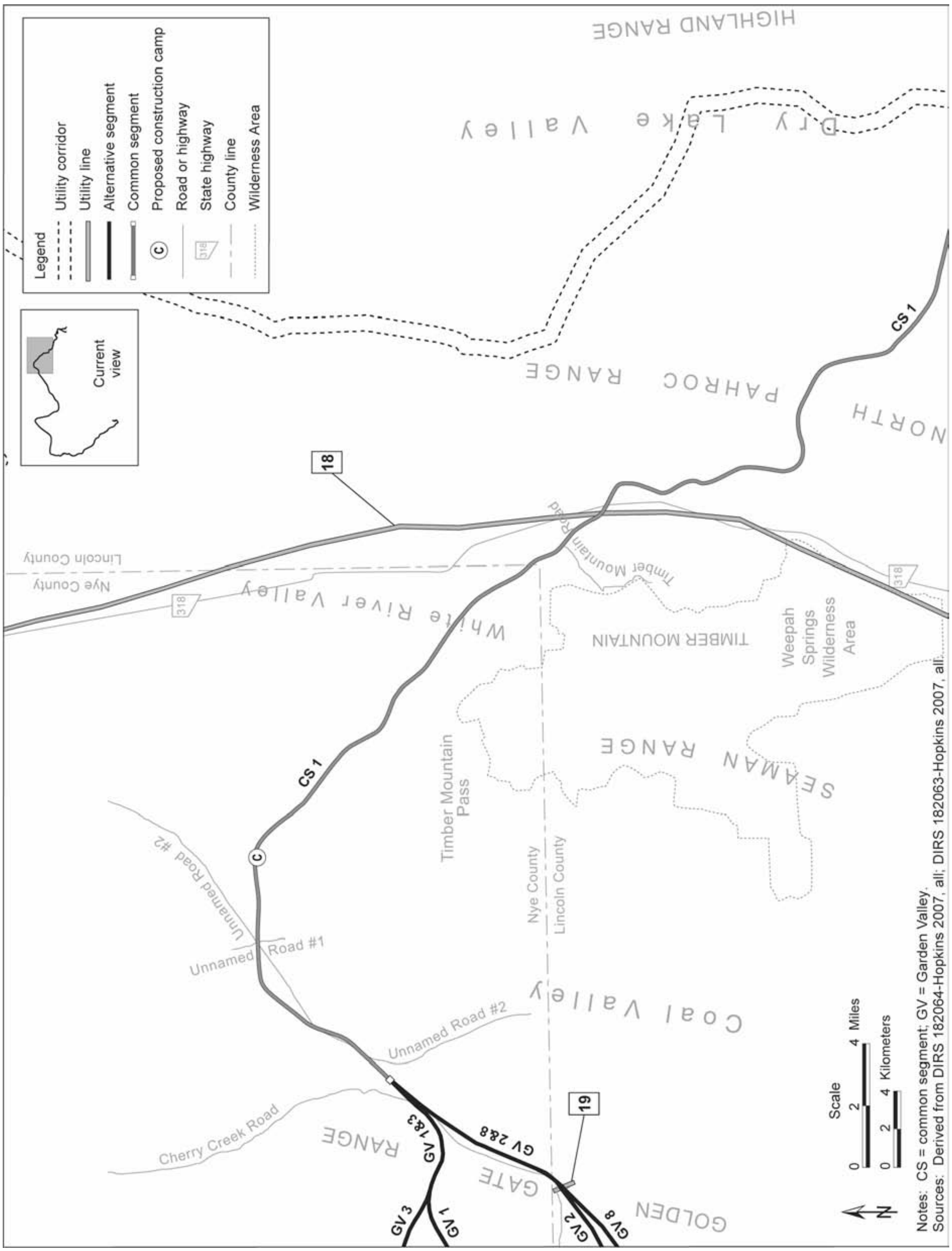


Figure 3-52. Utility corridors within map area 2.

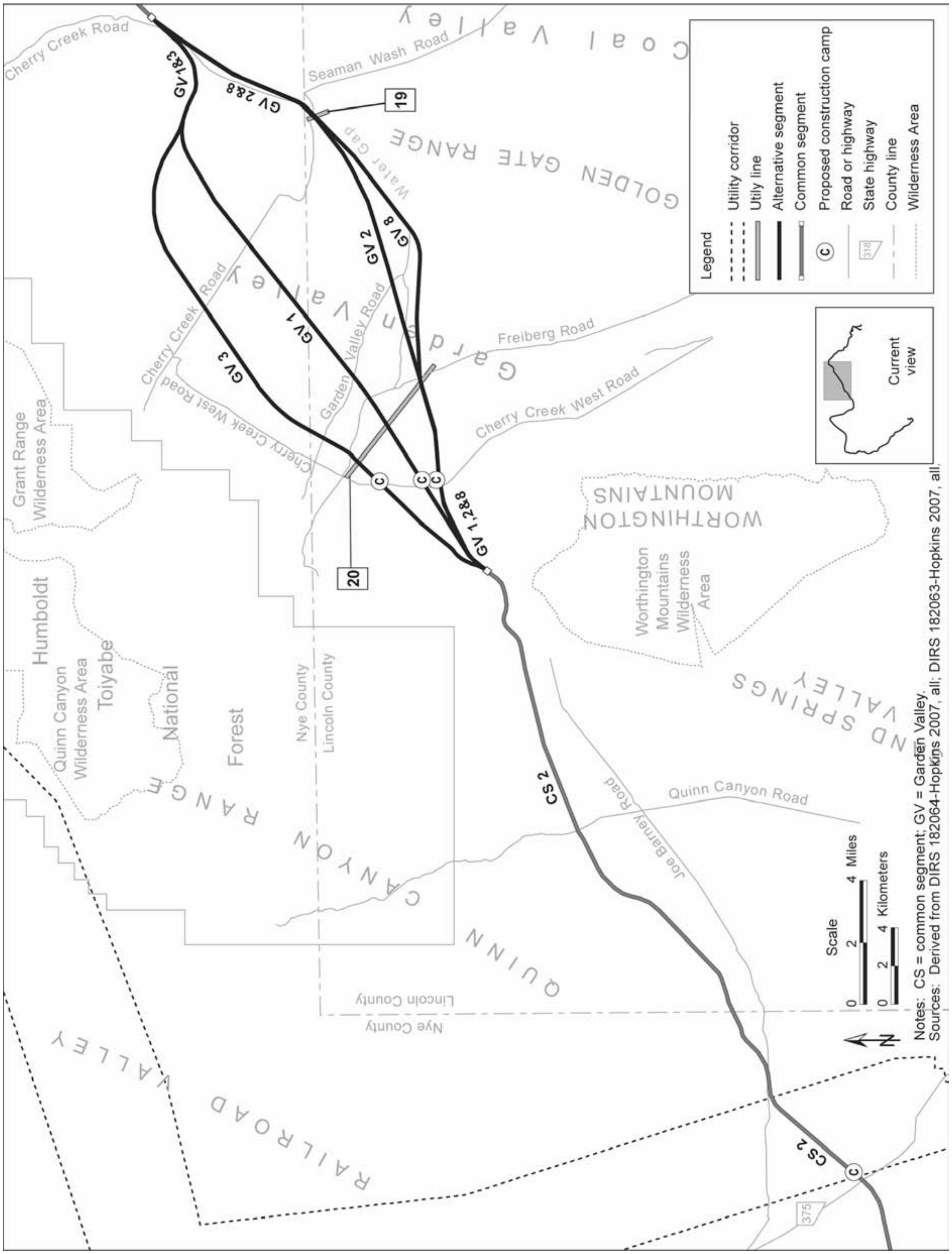


Figure 3-53. Utility corridors within map area 3.

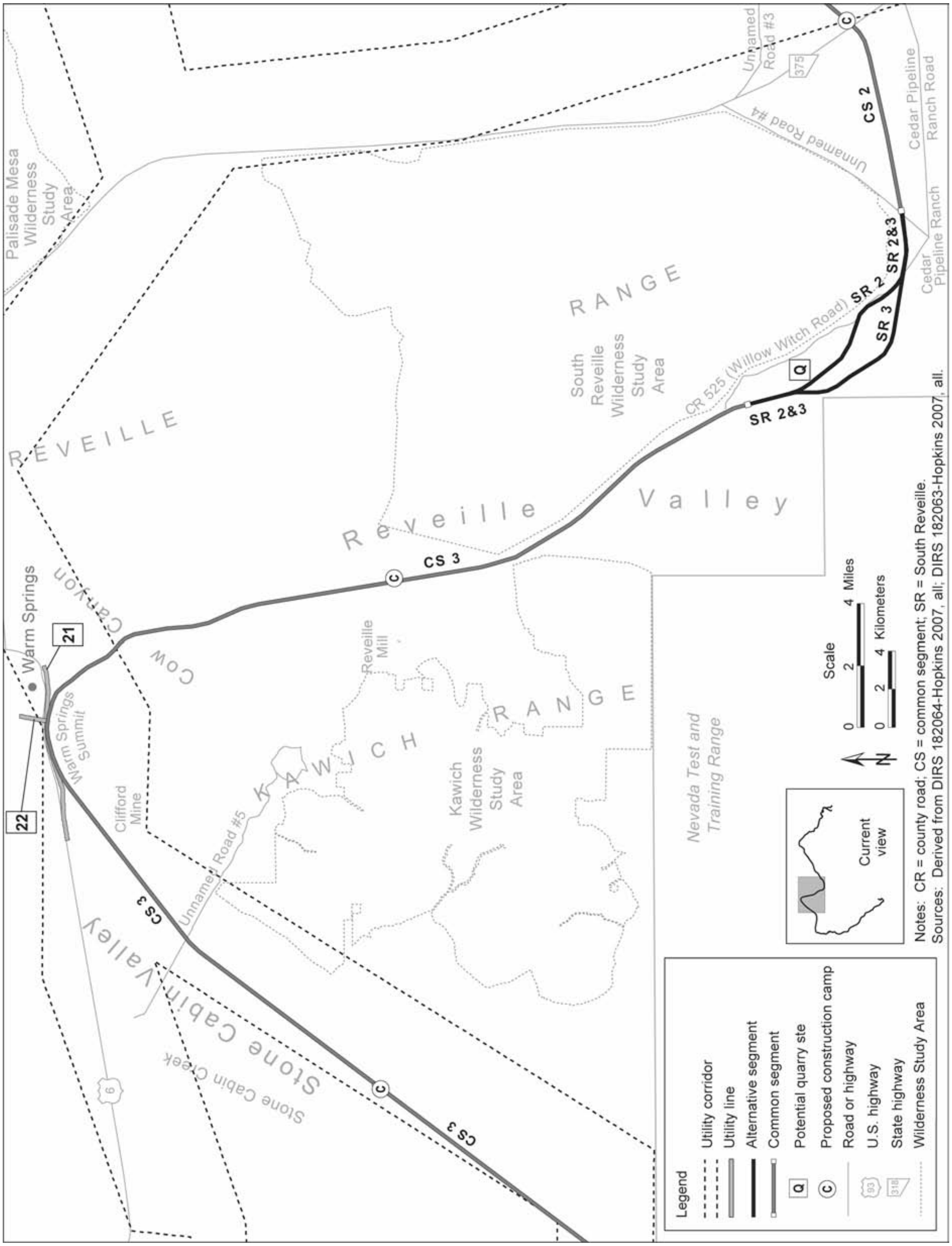


Figure 3-54. Utility corridors within map area 4.

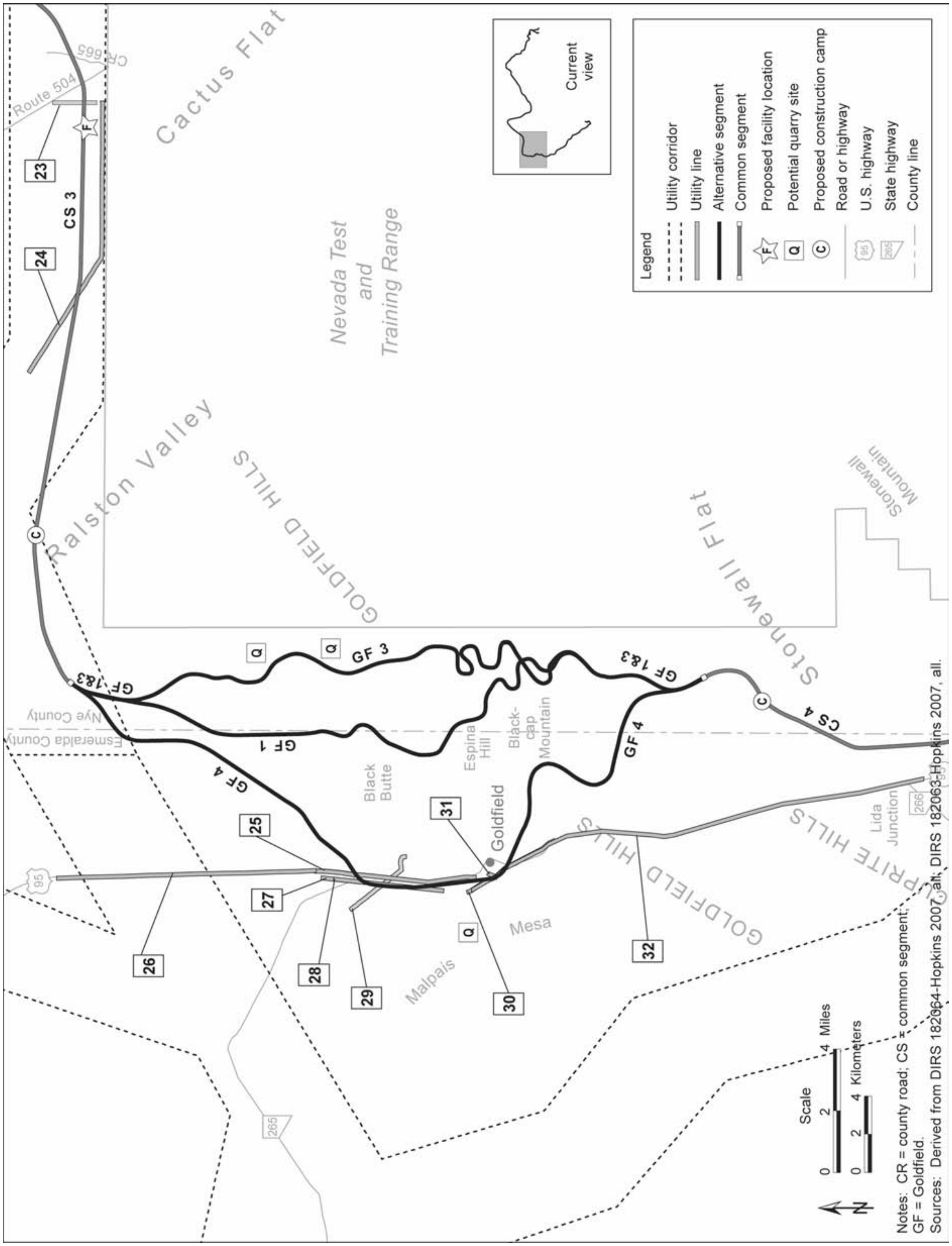


Figure 3-55. Utility corridors within map area 5.

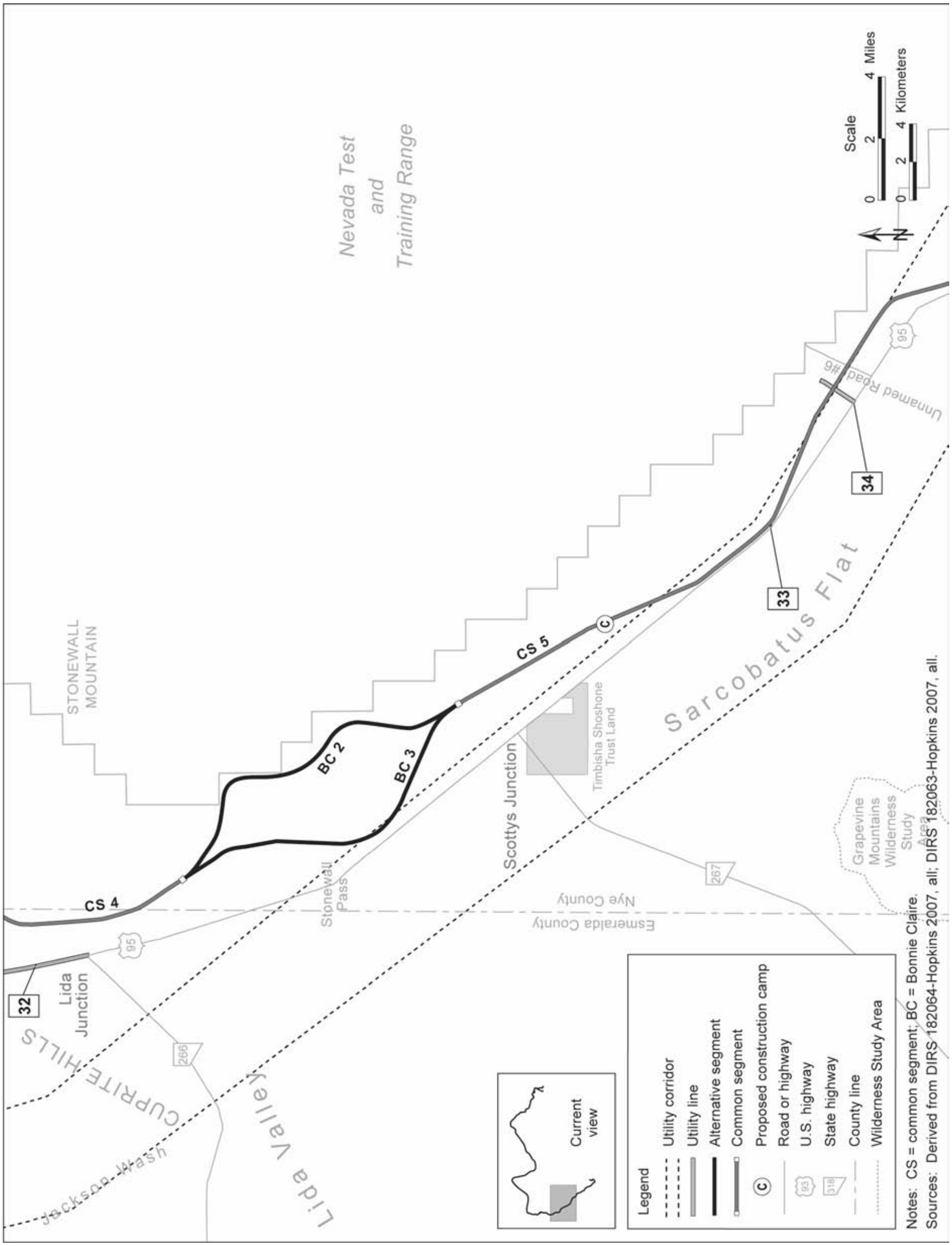
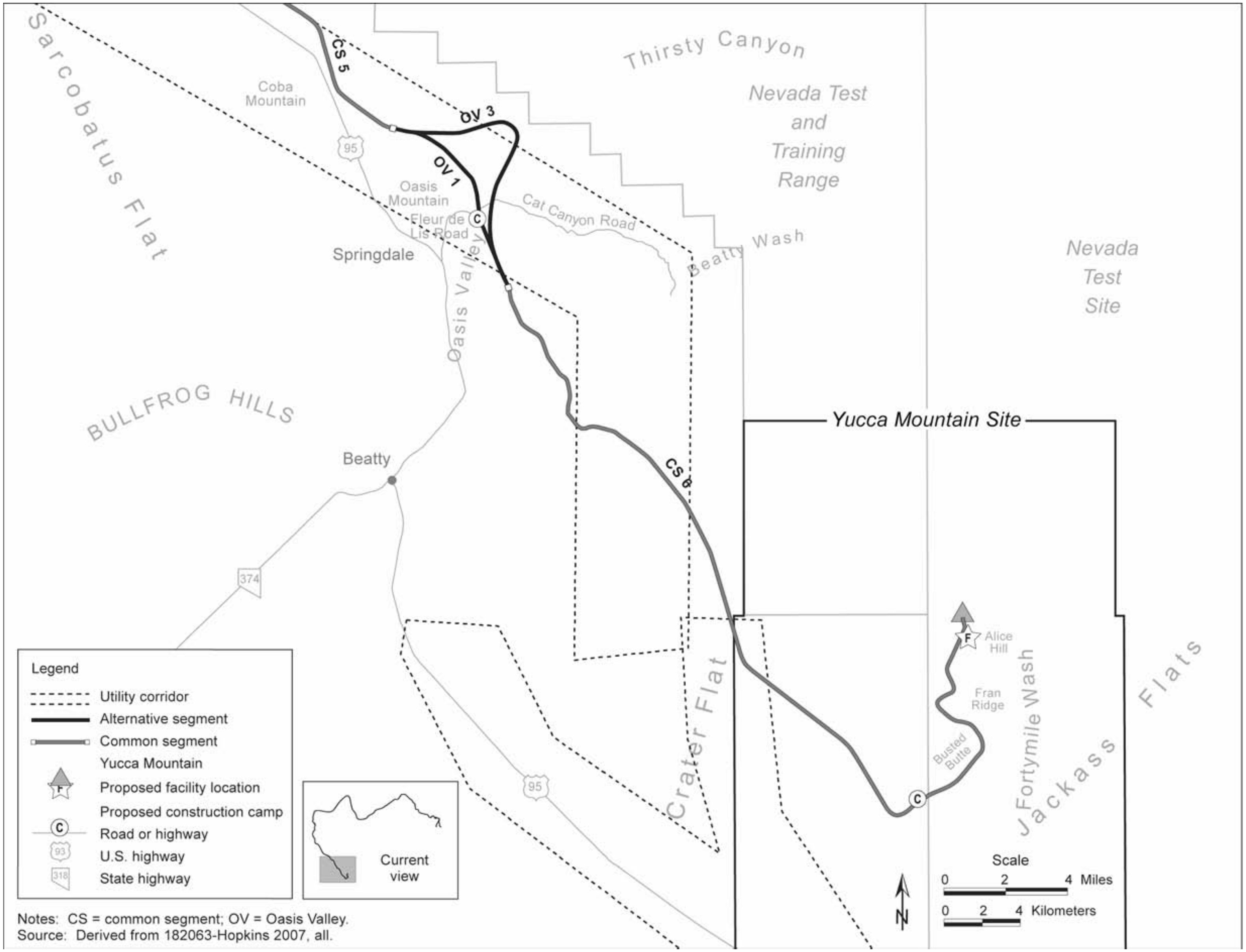


Figure 3-56. Utility corridors within map area 6.



Notes: CS = common segment; OV = Oasis Valley.
Source: Derived from 182063-Hopkins 2007, all.

Figure 3-57. Utility corridors within map area 7.

Table 3-10. Rail line segments within designated utility or transportation corridors.[a]

Segment	Resource management plan	Distance (kilometers)[b] within BLM-designated corridors	Total distance (kilometers) of segment	Percent within BLM-designated corridor
Caliente alternative segment	Draft Ely	0	18	0
Eccles alternative segment	Draft Ely	0	18	0
Caliente common segment 1	Draft Ely	0.8	114	0.7
Garden Valley alternative segment 1	Draft Ely	0	35	0
Garden Valley alternative segment 2	Draft Ely	0	36	0
Garden Valley alternative segment 3	Draft Ely	0	38	0
Garden Valley alternative segment 8	Draft Ely	0	37	0
Caliente common segment 2	Tonopah	6.2	18	3.4
Caliente common segment 2	Draft Ely	0	31	0
South Reveille alternative segment 2	Tonopah	0	19	0
South Reveille alternative segment 3	Tonopah	0	19	0
Caliente common segment 3	Tonopah	80	113	71
Goldfield alternative segment 1	Tonopah	3.2	47	6.8
Goldfield alternative segment 3	Tonopah	3.2	50	6.4
Goldfield alternative segment 4	Tonopah	5.1	53	9.6
Caliente common segment 4	Tonopah	0	12	0
Bonnie Claire alternative segment 2	Tonopah	0	20	0
Bonnie Claire alternative segment 3	Tonopah	1.6	20	8
Common segment 5	Tonopah	20	41	49
Oasis Valley alternative segment 1	Tonopah	8.3	10	83
Oasis Valley alternative segment 3	Tonopah	10	14	71
Common segment 6	Tonopah	7.8	24	33
Common segment 6	Las Vegas	4.0	27	15

a. Source: DIRS 181617-Hopkins 2007.
b. To convert kilometers to miles, multiply by 0.62137.

Table 3-11 identifies locations of where the rail line construction right-of-way and the possible locations for the ***Staging Yard*** could cross utility corridors. Figures 3-51 through 3-57 do not show all of the individual crossings because some of the locations are very close together. Utility lines listed in Table 3-11 are depicted on the figures by the location number designated in the table. For clarification, see Volume III-A of this Rail Alignment EIS, Map Atlas. Table 3-12 identifies utilities corridors at potential quarry sites.

The locations of potential utility crossings shown on figures and listed in tables are approximate and would be reviewed and verified after completion of the final rail design.

Table 3-11. Potential Caliente rail alignment utility crossings[a] (page 1 of 2).

Rail line segment/facility	Identified utilities and utility corridors[b,c,d]	Construction right-of-way crossings	Location number[e]
Caliente alternative segment	Transmission/power line	1	1
Caliente alternative segment	Transmission/power line	2	2
Caliente alternative segment	Transmission/power line	2	3
Caliente alternative segment	Transmission/power line	1	4
Caliente alternative segment	Transmission/power line	1	5
Caliente alternative segment	Transmission/power line	1	6
Caliente alternative segment	Transmission/power line	3	7
Caliente alternative segment	Transmission/power line	1	8
Caliente alternative segment	Transmission/power line	1	9
Caliente alternative segment	Transmission/power line	1	10
Caliente alternative segment	Transmission/power line	1	11
Caliente alternative segment	Transmission/power line	1	12
Caliente alternative segment	Transmission/power line	1	13
Caliente-Upland Staging Yard	Transmission/power line	1	7
Caliente-Upland Staging Yard	Transmission/power line	1	12
Caliente-Indian Cove Staging Yard	Transmission/power line	1	5
Caliente-Indian Cove Staging Yard	Transmission/power line	1	6
Caliente-Upland Staging Yard	Transmission/power line	1	7
Caliente-Upland Staging Yard	Transmission/power line	1	12
Caliente-Indian Cove Staging Yard	Transmission/power line	1	5
Caliente-Indian Cove Staging Yard	Transmission/power line	1	6
Eccles alternative segment	Transmission/power line	1	14
Caliente common segment 1	Transmission/power line	1	15
Caliente common segment 1	Transmission/power line	1	16
Caliente common segment 1	Transmission/power line	2	17
Caliente common segment 1	Telephone line	1	18
Garden Valley alternative segment 1	Unidentified line	1	19
Garden Valley alternative segment 2	Unidentified line	1	19
Garden Valley alternative segment 2	Unidentified line	1	20
Garden Valley alternative segment 3	Unidentified line	1	20
Garden Valley alternative segment 8	Unidentified line	1	19
Caliente common segment 2	None	None	None
South Reveille alternative segments	None	None	None
Caliente common segment 3	Transmission/power line	2	21

Table 3-11. Potential Caliente rail alignment utility crossings[a] (page 2 of 2).

Rail line segment/facility	Identified utilities and utility corridors[b,c,d]	Construction right-of-way crossings	Location number[e]
Caliente common segment 3	Transmission/power line	1	22
Caliente common segment 3	Transmission/power line	1	23
Caliente common segment 3	Transmission/power line	1	24
Goldfield alternative segment 1	None	None	None
Goldfield alternative segment 3	None	None	None
Goldfield alternative segment 4	Transmission/power line	1	25
Goldfield alternative segment 4	Telephone line	1	26
Goldfield alternative segment 4	Transmission/power line	1	27
Goldfield alternative segment 4	Transmission/power line	1	28
Goldfield alternative segment 4	Transmission/power line	1	29
Goldfield alternative segment 4	Transmission/power line	1	30
Goldfield alternative segment 4	Transmission/power line	1	31
Goldfield alternative segment 4	Telephone line	1	32
Caliente common segment 4	None	None	None
Bonnie Claire alternative segments	None	None	None
Common segment 5	Transmission/power line	1	33
Common segment 5	Transmission/power line	1	34
Oasis Valley alternative segments	None	None	None
Common segment 6	None	None	None

a. Sources: DIRS 181617-Hopkins 2007.
b. Electric distribution lines along major roads might not have been identified. Utilities serving individual residences or businesses are not identified.
c. To convert meters to feet, multiply by 3.2808.
d. Lines listed as "unidentified" are so listed in the Geographic Information System database.
e. Location numbers are shown on Figures 3-51 to 3-57.

Table 3-12. Potential quarry site utility crossings.[a]

Potential quarry site	Identified utilities and utility corridors	Number of crossings
CA-8B	Transmission/power line	1
CA-8B	Transmission/power line	1
CA-8B	Transmission/power line	1
ES-7	Water line	1
ES-7	Water line	1
ES-7	Transmission/power line	1

a. Source: DIRS 181617-Hopkins 2007.

3.2.3 AESTHETIC RESOURCES

This section describes the aesthetic (visual) setting in the region of influence along the Caliente rail alignment. Section 3.2.3.1 describes the region of influence for aesthetic resources; Section 3.2.3.2 describes the methods DOE used to classify visual values; and Section 3.2.3.3 describes the environmental setting and characteristics for aesthetic resources along the Caliente rail alignment.

3.2.3.1 Region of Influence

The region of influence for aesthetic resources is the viewshed around all Caliente rail alignment alternative segments, common segments, and proposed locations of rail line construction and operations support facilities.

BLM guidance subdivides landscapes into three ***distance zones*** based on relative visibility from travel routes or observation points. "Foreground-middleground" zone includes areas less than 5 to 8 kilometers (3 to 5 miles) away. "Background" zone includes areas visible beyond the foreground-middleground zone but usually less than 24 kilometers (15 miles) away. Areas not seen as foreground-middleground or background are in the "seldom-seen" zone (DIRS 101505-BLM 1986, Section IV). To ensure that seldom-seen views were included in this analysis, DOE used a conservative region of influence extending 40 kilometers (25 miles) on either side of the centerline of the Caliente rail alignment.

3.2.3.2 Methodology for Classifying Visual Values

Most of the lands along the Caliente rail alignment are BLM-administered public lands. Therefore, DOE used BLM methodologies for evaluating visual values. The BLM considers visual resources when addressing aesthetic issues during BLM planning. These resources include natural or manmade physical features that give a landscape its character and value as an environmental factor. The BLM uses a visual resource management system to classify the aesthetic value of its lands and to set management objectives (DIRS 173052-BLM 1984, all).

Scenic quality is a measure of the visual appeal of a tract of land. Areas are rated based on key factors including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (DIRS 101505-BLM 1986, Section II).

Sensitivity levels are a measure of public concern for scenic quality. Areas are ranked high, medium, or low based on types of users, amount of use, public interest, adjacent land uses, and whether they are special areas (DIRS 101505-BLM 1986, Section III).

The BLM classification of visual resource value, the visual resource inventory, involves assessing visual resources and assigning them to one of four visual resource management classes based on three factors: ***scenic quality***, visual sensitivity (***sensitivity levels***), and distance from travel or observation points (DIRS 101505-BLM 1986, all). The BLM uses a combination of the ratings of these three factors to assign a visual resource inventory class to a piece of land, ranging from Class I to Class IV, with Class I representing the highest visual values. Each visual resource class is subsequently associated with a management objective, defining the way the land may be developed or used. Each BLM district assigns visual resource management classes to its lands during the resource management planning process. Table 3-13 lists the BLM management objectives for visual resource classes.

The BLM uses visual resource contrast ratings to assess the visual impacts of proposed projects and activities on the existing landscape (DIRS 173053-BLM 1986, all).

Table 3-13. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

The Bureau looks at basic elements of design to determine levels of contrast created between a proposed project and the existing viewshed. Depending on the visual resource management objective for a particular location, varying levels of contrast are acceptable.

Contrast ratings are determined from locations called key observation points, which are usually along commonly traveled routes such as highways or frequently used county roads or in communities. To identify key observation points along the Caliente rail alignment, DOE considered the following factors: angle of observation, number of viewers, how long the project would be in view, relative project size, season of use, and light conditions. BLM guidance (DIRS 173053-BLM 1986, Section IIC) recommends that key observation points for linear projects, such as the proposed railroad, include the following:

- Most-critical viewpoints (for example, views from communities at road crossings)
- Typical views encountered in representative landscapes, if not covered by critical viewpoints
- Any special project or landscape features such as river crossings and substations

3.2.3.3 Visual Setting and Characteristics

3.2.3.3.1 General Visual Setting and Characteristics

The Class IV lands in the Caliente rail alignment region of influence consist of landscapes that are generally flat in form and horizontal in line, with gray and brown colors from soil and rock, and texture ranging from flat to slightly rough, depending on whether the broad flat valleys and alluvial fans include any topographic features such as hills, buttes, or eroded stream channels. Vegetation is usually small, low, and rounded in form (for example, grasses, shrubs, and small trees), horizontal in line, brown or gray-green in color, and light-to-medium in texture with irregular spacing. Structures are rare, but could include transmission towers, ranch buildings, or similar structures. Class III lands generally include more varied forms, lines, colors, and textures, including vertical lines in topography and vegetation, brighter greens in vegetation, visible blues from water, and dense texture from forested lands or rough texture in eroded rock. Class I and II lands are mostly in mountains that include forested areas and open rock exposures, with mixed forms including slopes and ridges; rounded lines; a wide range of rock and soil colors, and vegetation that changes color with the seasons; and variable texture that is often dense in forested areas.

Special areas are lands where measures must be taken to protect visual values. Special areas often include designated natural areas, Wilderness Study Areas, scenic rivers, and scenic roads. Special areas are not necessarily unique or picturesque, but the management objective for a special area is to preserve its natural characteristics (DIRS 101505-BLM 1986, Section III.5).

Sections 3.2.3.3.2.1 through 3.2.3.3.2.12 describe visual resources along and near the Caliente rail alignment alternative segments and common segments. The discussions highlight resources of high visual value, identify current visual resource management classifications, ***special areas***, and key observation points.

DOE excerpted visual resource management classifications for lands along the Caliente rail alignment primarily from BLM resource management plans from districts the alignment would cross (DIRS 173224-BLM 1997, all; DIRS 103079-BLM 1998, all; DIRS 174518-BLM 2005, all). The BLM Las Vegas and Ely Districts provided Geographic Information System data from their resource management plans as a source for mapping the visual resource management classes in their districts (DIRS 103079-BLM 1998, Map 2-9; DIRS 174518-BLM 2005, Map 2.4-5). Geographic Information System data used in this analysis from the BLM Ely District corresponds to the preferred alternative in the *Draft - Resource Management Plan/Environmental Impact Statement for the Ely District* (Draft Ely Resource Management Plan; DIRS 174518-BLM 2005, all). DOE used information from this draft resource management plan because BLM Ely District personnel indicated that it would be better to use the most recent visual inventory data (DIRS 174635-Quick 2005, all), even though visual resource management classes will not be confirmed until the Draft Ely Resource Management Plan is finalized.

The Department based visual resource classification boundaries for the BLM Battle Mountain District on the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, pp. 6, 7, and 27, and Map 8), and developed visual resource management classifications for non-BLM lands using BLM methodology (DIRS 173053-BLM 1986, all; DIRS 173052-BLM 1984, all), considering scenic quality ratings reported in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, pp. 3-158 and 3-159) where available. DOE confirmed visual resource management classifications in telephone communications and meetings with BLM personnel responsible for visual resource management for the Las Vegas and Battle Mountain Districts (DIRS 174631-Quick 2005, all; DIRS 174632-Quick 2005, all; DIRS 176988-Quick 2006, all).

Figure 3-58 is a map of visual resource management classifications for lands surrounding the Caliente rail alignment based on the sources identified above. As the figure shows, most of the lands surrounding the alternative segments and common segments are Class IV lands, which are common to the area. However, there are a few locations where the alternative segments and common segments would cross Class II or III lands or be very close to Class I, II, or III lands.

DOE selected 37 key observation points along the Caliente rail alignment to evaluate the visual impacts of constructing and operating the proposed railroad. Figure 3-58 also shows the locations of key observation points. Appendix D, Aesthetics, contains photos taken at each key observation point. Table 3-14 lists visual resource management classes in the viewshed of each key observation point.

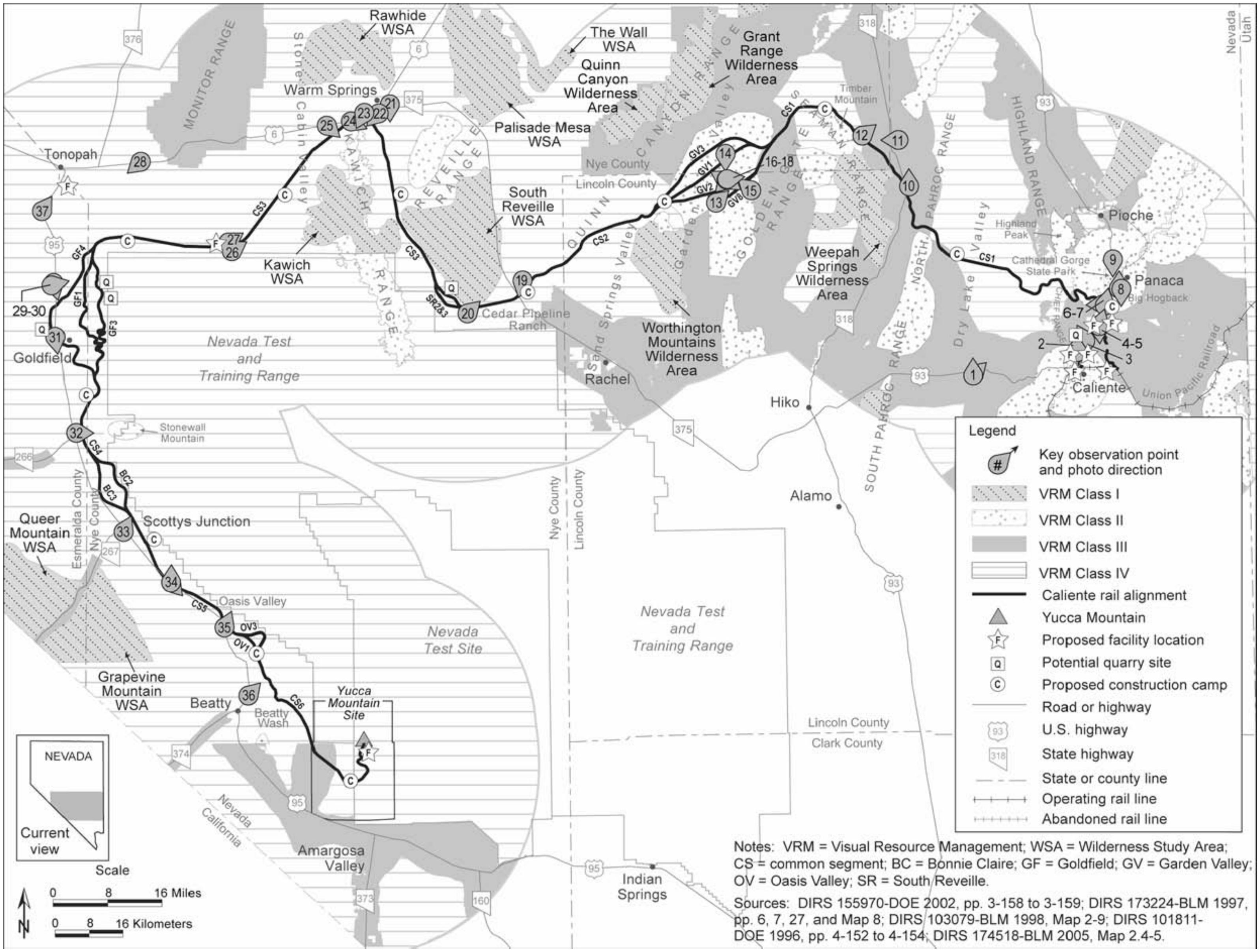


Figure 3-58. Visual resource management classifications and key observation points along the Caliente rail alignment.

Table 3-14. Key observation points and visual resource management classes in the Caliente rail alignment viewshed[a] (page 1 of 2).

Key observation point	Location	Visual resource management classes[b]
1	U.S. Highway 93 at Dry Lake Valley	Surrounding lands (III and IV), Highland and Chief Ranges (II and III)
2	Caliente-Indian Cove option for the Staging Yard	Surrounding lands (III)
3	Conveyer that would cross U.S. Highway 93 to feed Staging Yard, Caliente-Indian Cove option	Surrounding lands (II)
4	Conveyor that would cross U.S. Highway 93 to feed Staging Yard, Caliente-Upland option	Surrounding lands (III)
5	Caliente-Upland option for the Staging Yard	Surrounding lands (III)
6	Where rail line would cross U.S. Highway 93	Surrounding lands (III)
7	U.S. Highway 93 north of where rail line would cross	Surrounding lands (III), Big Hogback (II)
8	U.S. Highway 93 at State Route 319	Surrounding lands (III)
9	Miller Point - Cathedral Gorge	Surrounding lands (III), Cathedral Gorge State Park (II)
10	Where rail line would cross State Route 318	Surrounding lands (III), Weepah Springs Wilderness (I)
11	Off county road west of State Route 318 north of where rail line would cross	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)
12	Where rail line would cross Timber Mountain Pass Road	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)
13 and 15	County roads on south side of Garden Valley	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)
14	County road in middle of Garden Valley	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)
16 to 18	Top of *City* structure elements	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)
19	State Route 375 near where rail line would cross	Surrounding lands (IV)
20	Cedar Pipeline Ranch	Surrounding lands (IV), Kawich Range (II), Reveille Range (II), Quinn Canyon Range (III), South Reveille Wilderness Study Area (I)
21	State Route 375 near U.S. Highway 6	Surrounding lands (IV), Kawich Range (II), Kawich Wilderness Study Area (I)
22	U.S. Highway 6 near State Route 375	Surrounding lands (IV), Kawich Range(II), Kawich Wilderness Study Area (I)
23	U.S. Highway 6 on east side of Warm Springs Summit	Surrounding lands (IV), Kawich Range (II)

Table 3-14. Key observation points and visual resource management classes in the Caliente rail alignment viewshed[a] (page 2 of 2).

Key observation point	Location	Visual resource management classes[b]
24	Warm Springs Summit	Surrounding lands (IV), Kawich Range (II)
25	U.S. Highway 6 at a mine access road	Surrounding lands (IV), Kawich Range (II), Kawich Wilderness Study Area (I)
26	Nevada Test and Training Range Road near where rail line would cross	Surrounding lands (IV), Kawich Wilderness Study Area (I)
27	Nevada Test and Training Range Road	Surrounding lands (IV), Kawich Wilderness Study Area (I)
28	U.S. Highway 6 at Test and Training Range Road	Surrounding lands (IV)
29	U.S. Highway 95 north of Goldfield	Surrounding lands (IV)
30	U.S. Highway 95 at north end of Goldfield	Surrounding lands (IV)
31	Where rail line would cross U.S. Highway 95 south of Goldfield	Surrounding lands (IV)
32	U.S. Highway 95 at State Route 266	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)
33	U.S. Highway 95 at State Route 267	Surrounding lands (IV), State Route 267 (III)
34	U.S. Highway 95 (typical cut)	Surrounding lands (IV)
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)
36	U.S. Highway 95 and Beatty Wash access road	Surrounding lands (IV)
37	U.S. Highway 95 at proposed Maintenance-of-Way Headquarters Facility	Surrounding lands (IV)

a. Appendix D contains photographs taken from each key observation point.
b. Sources: DIRS 155970-DOE 2002, pp. 3-158 and 3-159; DIRS 173224-BLM 1997, pp. 6, 7, and 27, and Map 8; DIRS 103079-BLM 1998, Map 2-9; DIRS 101811-DOE 1996, pp. 4-152 to 4-154; DIRS 174518-BLM 2005, Map 2.4-5.

Following BLM guidance, DOE selected most key observation points along travel routes or at use or potential use areas, and included critical viewpoints and typical views. DOE also selected multiple points within Garden Valley, along county roads used primarily by a small number of residents, for two reasons: (1) During the scoping period for this Rail Alignment EIS, commenters expressed concern about visual impacts in Garden Valley because of *City*, a large outdoor complex of sculptural and architectural forms on private land, currently under construction; (2) Garden Valley is considered a special recreation management area for visual values under multiple alternatives of the Draft Ely Resource Management Plan (DIRS 174518-BLM 2005, all). Section 3.2.3.3.2 highlights areas of high visual value and other special areas, and identifies key observation points from which DOE analyzed impacts to these areas.

3.2.3.3.2 Specific Visual Settings and Characteristics along Alternative Segments and Common Segments

3.2.3.3.2.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline. The Caliente rail alignment would begin in or near the City of Caliente with either the Caliente or the Eccles alternative segment. The Caliente alternative segment would begin in a Class II area around the City of Caliente, while the Eccles alternative segment would begin in a Class III area farther east. Big Hogback, a Class II visual resource, would be visible from either alternative segment but would be more than 4 kilometers (2.5 miles) in the background of views across the alternative segments from the U.S.

Highway 93. The Caliente and Eccles alternative segments would approach within 6.1 kilometers (3.8 miles) of the southern boundary of Cathedral Gorge State Park, a Class II special area.

The Caliente alternative segment would cross or be very near Class III lands for approximately 4 to 5 kilometers (2.5 to 3.1 miles) and would cross approximately 1.1 kilometers (0.7 mile) of Class II lands north of the City of Caliente. The Eccles alternative segment would cross approximately 4 to 5 kilometers of Class III lands and would approach within approximately 400 meters (1,300 feet) of Class II lands for approximately 1 to 2 kilometers (0.6 to 1.2 miles).

Key observation points (indicated in parentheses) for the Caliente and Eccles alternative segments provide a view of where the rail line would cross under U.S. Highway 93 (6); views from the intersection of U.S. Highway 93 and State Route 319 toward Big Hogback and Cathedral Gorge (8); a view from Cathedral Gorge toward the alignment (9); and views of the Caliente-Upland and Caliente-Indian Cove options for the Staging Yard (5 and 2, respectively). In addition, a key observation point (3) provides a view of the place where a conveyor would cross U.S. Highway 93 to the Staging Yard Caliente-Indian Cove option if DOE developed potential quarry CA-8B (see Figure 2-25) as a source of ballast. Another key observation point (4) provides a view of the place where a conveyor would cross U.S. Highway 93 to the south of the Staging Yard Caliente-Upland option.

3.2.3.3.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross through the pass between the Highland Range and the Chief Range, through Dry Lake Valley, through the North Pahroc and Seaman Ranges, and on to the Golden Gate Range. Part of the Highland Range is Class II. Much of the Seaman Range falls into the Weepah Springs Wilderness, a Class I area; two areas are Class II, including Timber Mountain; while the north and south ends of the Seaman Range are Class III or IV.

As shown in Figure 3-58, Caliente common segment 1 would cross Class II lands in the area of the Highland and Chief Ranges, and Class IV land in Dry Lake Valley. Caliente common segment 1 would be approximately 2 kilometers (1.2 miles) north of the Class II lands of the Pahroc Range and would cross Class III lands between the Pahroc Range and Timber Mountain. The segment would approach within a few hundred meters of the northeastern point of Weepah Springs Wilderness, but would not cross any Class I land. It would also approach within a few hundred meters of the Class II slopes of Timber Mountain, at the north end of the Seaman Range, but remain in Class III and IV lands. Finally, Caliente common segment 1 would cross Class IV and then Class III lands from Timber Mountain to Garden Valley.

A key observation point on State Route 318 provides a view of the location where the Caliente rail alignment would cross the highway (10). A key observation point on a county road just off State Route 318 provides a view over the rail alignment on the slopes of Timber Mountain (11), while another key observation point provides a view of the rail alignment crossing the county road on those slopes (12). Two key observation points provide views across Dry Lake Valley and toward the Chief and Highland Ranges (1 and 7, respectively).

3.2.3.3.2.3 Garden Valley Alternative Segments. The Garden Valley alternative segments would cross the Golden Gate Range and Garden Valley, and pass between the Worthington Mountains and the Quinn Canyon Range. The Golden Gate Range is a Class III area. The portion of the Quinn Canyon Range that bounds Garden Valley on the northwest is managed by the U.S. Forest Service. The Quinn Canyon Range is generally considered Class III in this evaluation, with the exceptions of the Quinn Canyon and Grant Range Wilderness Areas (approximately 8 kilometers [5 miles] from Garden Valley alternative segment 3 at their closest) which are analyzed as Class I. The Worthington Mountains include the Class I Worthington Mountains Wilderness, and lower slopes that are Class III or Class IV. As shown in Figure 3-58, the valley floor and the hills and lower slopes of ranges around Garden Valley are considered Class II. The Draft Ely Resource Management Plan proposes Garden Valley as a Class II Special Recreation Management Area for visual values (DIRS 174518-BLM 2005, p. 2.5-111).

City is a complex of abstract sculptural and architectural forms made from earth, rock, and concrete extending over 2.4 kilometers (1.5 miles) on private land in Garden Valley. The largest feature to date is approximately 21 to 24 meters (70 to 80 feet) high and 0.4 kilometer (0.25 mile) long. *City* is designed in five phases and could be completed by 2010 supported by private funding.

Several key observation points (13 to 18) both inside and outside the sculpture provide views across one or more of the Garden Valley alternative segments. The DOE selection of key observation points within the sculpture area and along lightly traveled county roads is more conservative than standard BLM methodology for areas of low visual sensitivity, which calls for viewpoints at locations where a significant number of viewers are expected. There are no public roads within the sculpture area, and views from key observation points on county roads outside the sculpture area do not include the sculpture. DOE selected the additional key observation points to better inform decisionmakers about managing for the visual values in the Class II lands and Special Recreation Management Area, and to provide data to address concerns about visual impacts in Garden Valley raised in public comments offered during the scoping period for this Rail Alignment EIS.

3.2.3.3.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Caliente common segment 2 would run to the north of the Worthington Mountains, pass within 8.4 kilometers (5.2 miles) of the Class I Worthington Mountains Wilderness and travel through the Class IV land in the south end of the Quinn Canyon Range. The segment would continue through Class IV land but would come within 6.6 kilometers (4.1 miles) of the Class II slopes of the southern end of the Reveille Range, and 9.2 kilometers (5.7 miles) of the Class I South Reveille Wilderness Study Area. A key observation point provides views from State Route 375 across common segment 2 near the highway crossing and a proposed construction camp (19).

3.2.3.3.2.5 South Reveille Alternative Segments. The South Reveille alternative segments would begin near Cedar Pipeline Ranch, between the Reveille and Kawich Ranges, and extend northwest through Class IV lands. The Reveille Range is a Class II area and includes the Class I South Reveille Wilderness Study Area. The more northerly South Reveille alternative segment 2 would approach within about 5 kilometers (3.1 miles) of the Wilderness Study Area and come within 1.3 kilometers (0.8 mile) of the Class II land at the base of the range, while South Reveille alternative segment 3 would pass farther south from these areas. The Kawich Range is Class II in the area of these alternative segments, although the range would be more than 10 kilometers (6.2 miles) away at its closest point. Key observation point 20 is near Cedar Pipeline Ranch.

3.2.3.3.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Caliente common segment 3 would extend north up Reveille Valley and pass through the Kawich Range at Warm Springs summit. It would then proceed through Stone Cabin Valley and around the Nevada Test and Training Range to the Goldfield area. As previously mentioned, the Kawich Range is a Class II area. Caliente common segment 3 would be at least 5 kilometers (3 miles) away from the Class II portions of the Kawich Range as it crossed the Class IV portion of the valley, except near Warm Springs summit, where it would approach within 1 or 2 kilometers (0.6 to 1.2 miles) of the Class II area. The Kawich Range also contains the Class I Kawich Wilderness Study Area to the west of common segment 3. The segment would be within approximately 0.5 kilometer (0.31 mile) of the Wilderness Study Area boundary for approximately 2 kilometers in the Class IV land between the Reveille and Kawich Ranges. This portion of the common segment would also come within approximately 7.9 kilometers (4.9 miles) of the southern edge of the Rawhide Mountains Wilderness Study Area, which is north of Warm Springs. As common segment 3 passed Warm Springs summit and headed southwest and then west along the boundary of the

Nevada Test and Training Range, it would cross Class IV lands exclusively. Key observation points provide views from State Route 375 and U.S. Highway 6 across Caliente common segment 3 (21 through 23) on the east side of Warm Springs summit, views at Warm Springs summit and approaching it from the west (24 and 25), and views across common segment 3 from U.S. Highway 6 (28) and from the road leading into the Nevada Test and Training Range (26 and 27).

3.2.3.3.2.7 Goldfield Alternative Segments. The Goldfield alternative segments would pass through the Class IV hills northwest of Stonewall Mountain, which is a Class II area. Key observation points include a view across all three Goldfield alternative segments toward potential quarry NS-3A (29), a view across Goldfield alternative segment 4 from north Goldfield (30), a view of the place Goldfield alternative segment 4 would cross U.S. Highway 95 at the south end of Goldfield (31), and a view of the proposed Maintenance-of-Way Headquarters Facility from U.S. Highway 95 (37).

3.2.3.3.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Caliente common segment 4 would begin south of Goldfield and proceed past Stonewall Mountain and beyond the intersection of U.S. Highway 95 and State Route 266. Caliente common segment 4 would be in Class IV land and would never pass closer than 6.9 kilometers (4.3 miles) of the Class II Stonewall Mountain area. The BLM manages State Route 266 west of U.S. Highway 95 as a Class III area. Lida Junction, the intersection of U.S. Highway 95 and State Route 266, is a key observation point for the view toward Stonewall Mountain (32).

3.2.3.3.2.9 Bonnie Claire Alternative Segments. The Bonnie Claire alternative segments would cross Class IV lands to the southwest of the Nevada Test and Training Range and past Scottys Junction at the intersection of U.S. Highway 95 and State Route 267, which the BLM manages as a Class III area west of U.S. Highway 95. A key observation point at Scottys Junction provides a view northeast toward the alternative segments (33).

3.2.3.3.2.10 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross Class IV land between the Bonnie Claire area and the Oasis Valley area. There are no visual resources of concern along this common segment and, therefore, no key observation points.

3.2.3.3.2.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross Class IV areas through Oasis Valley. Key observation point (35) is north of Springdale, looking east over the Oasis Valley, showing a typical landscape. Key observation point (34) provides a view of a typical ***cut***.

3.2.3.3.2.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would pass from the Oasis Valley area, near Beatty and across Beatty Wash, through the Nevada Test Site to the Yucca Mountain Site. State Route 374, entering Beatty, is a Class III area. Common segment 6 would cross approximately 10 kilometers (6.2 miles) of Class III lands before it entered the Nevada Test Site, but the segment would be more than 15 kilometers (9.3 miles) from U.S. Highway 95 in this area. Land on the Nevada Test Site is not under BLM jurisdiction. Land on the Nevada Test Site that is visible from U.S. Highway 95 and that the rail line would cross is considered Class IV in this evaluation. Key observation point (36) is north of Beatty, with views from U.S. Highway 95 over the Class IV lands surrounding the access road to Beatty Wash. The viewshed within the wash is considered a contributing element to cultural resources within the wash that are important to American Indians (DIRS 174205-Kane et al. 2005, p. 17). Beatty Wash and the rail line through it would not be visible from the highway. Therefore, DOE did not select key observation points in this area.

3.2.4 AIR QUALITY AND CLIMATE

This section describes the present air quality and climate characteristics along the Caliente rail alignment and summarizes information from ***ambient air*** monitoring and meteorological data collection in the region. Section 3.2.4.1 describes the region of influence for air quality and climate, Section 3.2.4.2 describes general air quality characteristics in the Caliente rail alignment region of influence, and Section 3.2.4.3 describes the climate characteristics in the Caliente rail alignment region of influence.

3.2.4.1 Region of Influence

The region of influence for air quality and climate along the Caliente rail alignment is the air basins in Lincoln, Nye, and Esmeralda Counties. Historic data on pollutant emissions inventories and compliance status for the State of Nevada are calculated at the county level, and these data provide a basis for determining existing air quality in the region of influence for use in analyzing potential impacts to air quality (see Section 4.2.4).

However, air-emissions fixed-point sources such as quarries and linear sources such as operating railroads can subject certain locations (for example, population centers) to higher localized levels of pollutants than a regional analysis would suggest. Therefore, DOE also selected more focused study locations within the region of influence in which to model air quality impacts on specific receptors. These locations are the two largest population centers near the Caliente rail alignment (the City of Caliente in Lincoln County and Goldfield in Esmeralda County), and potential quarry sites northwest of the City of Caliente (CA-8B) and in South Reveille Valley (NN-9B).

3.2.4.2 Existing Air Quality

Air quality is determined by measuring concentrations of certain pollutants in the atmosphere. The U.S. Environmental Protection Agency designates an area as being ***in attainment*** for a particular pollutant if ambient concentrations of that pollutant are below the National ***Ambient Air Quality Standards***. The pollutants regulated under the State of Nevada and National Ambient Air Quality Standards are ***ozone***, ***carbon monoxide***, ***nitrogen dioxide***, ***sulfur dioxide***, ***particulate matter*** with an aerodynamic diameter less than or equal to 10 micrometers (***PM_{10}***) and particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers (***$PM_{2.5}$***), and lead. Collectively, these pollutants are referred to as ***criteria air pollutants***. Table 3-15 lists the National Ambient Air Quality Standards for both the primary public health standard and the secondary public welfare standards in comparison to State of Nevada Ambient Air Quality Standards.

Areas in violation of one or more of these standards are classified as ***nonattainment areas***. If there is not enough air quality data to determine the status of a remote or sparsely populated area, then the U.S. Environmental Protection Agency lists the area as unclassifiable. However, for regulatory purposes, unclassifiable areas are considered to be in attainment. All portions of the Caliente rail alignment would be within areas classified as in attainment for all National Ambient Air Quality Standards.

The most comprehensive source of representative data on ambient concentrations of gas-phase air pollutants for the region of influence is a special study at Yucca Mountain covering a 4-year period from October 1991 to September 1995 (DIRS 102877-CRWMS M&O 1999, all). The limited amount of air quality data reflects choices made by national and state agencies to focus monitoring resources either on population centers or pristine areas such as national parks. Additional data on particulate matter are available based on monitoring at three sites in the vicinity of Yucca Mountain from 1989 to 1997 (DIRS 102877-CRWMS M&O 1999, all; DIRS 102876-CRWMS M&O 1997, all; DIRS 147777-SAIC 1992, all; DIRS 147780-SAIC 1992, all), from three sites from 1998 to 2001 (DIRS 173738-DOE

Table 3-15. State of Nevada and National Ambient Air Quality Standards[a] (page 1 of 2).

Pollutant[b]	Average time[c]	Nevada standards concentration[b]	National primary standards[b]	National secondary standards[b]	Notes regarding the air quality standard
Ozone	1 hour	0.12 ppm (235 μg/m^3)	None	Same as primary	The expected number of days per calendar year with a maximum hourly average concentration above the standard is less than or equal to 1.
	8 hour	None	0.08 ppm (195 μg/m^3)	Same as primary	The 3-year average of annual fourth-highest daily maximum.
Ozone, Lake Tahoe Basin	1 hour	0.10 ppm (195 μg/m^3)	None	None	The expected number of days per calendar year with a maximum hourly average concentration above the standard is less than or equal to 1.
Carbon monoxide	8 hours	9 ppm (10,500 μg/m^3) for elevations less than 1,500 meters[d] above mean sea level	9 ppm (10,500 μg/m^3) at any elevation	None	Not to be exceeded more than once per year.
		6 ppm (7,000 μg/m^3) for elevations greater than 1,500 meters above mean sea level			
Carbon monoxide (at any elevation)	1 hour	35 ppm (40,500 μg/m^3)	35 ppm (40,500 μg/m^3)		
Nitrogen dioxide	Annual arithmetic mean	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as primary	Not to be exceeded.
Sulfur dioxide	Annual arithmetic mean	0.03 ppm (80 μg/m^3)	0.03 ppm (80 μg/m^3)	None	Not to be exceeded.
	24 hours	0.14 ppm (365 μg/m^3)	0.14 ppm (365 μg/m^3)		Not to be exceeded more than once per year.
	3 hours	0.5 ppm (1,300 μg/m^3)	None	0.5 ppm (1,300 μg/m^3)	
Particulate matter as PM	Annual arithmetic mean	50 μg/m^3	Revoked[e]	Revoked[e]	The 3-year average of the weighted annual mean concentration at each monitor within an area.
	24 hours	150 μg/m^3	150 μg/m^3		Not to be exceeded more than once per year.[f]

Table 3-15. State of Nevada and National Ambient Air Quality Standards[a] (page 2 of 2).

Pollutant[b]	Average time[c]	Nevada standards concentration[b]	National primary standards[b]	National secondary standards[b]	Notes regarding the air quality standard
Particulate matter as $PM_{2.5}$	Annual arithmetic mean	None	15 μg/m^3	Same as primary	The 3-year average of the weighted annual mean concentration from single or multiple community-oriented monitors.
	24 hours	35 μg/m^3	35 μg/m^3		The 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area.[g]
Lead [h]	Quarterly arithmetic mean	1.5 μg/m^3	1.5 μg/m^3	Same as primary	Not to be exceeded.
Hydrogen sulfide[h]	1 hour	0.08 ppm (112 μg/m^3)	None	None	Not to be exceeded.

a. Sources: Nevada Administrative Code Section 445B.22097 and 40 CFR 50.4 through 50.11.
b. PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers; ppm = parts per million; μg/m^3 = micrograms per cubic meter.
c. Time over which pollutant is measured.
d. To convert meters to feet, multiply by 3.2808.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 FR 60853, October 17, 2006).
f. The 24-hour state standard is attained when the expected number of days per calendar year with a 24-hour average concentration above the standard is equal to or less than 1. The expected number of days per calendar year is based on an average of the number of exceedances per year for the last 3 years.
g. The 24-hour state standard is attained when the second highest of a 3-year rolling average of the 24-hour concentration at each monitor is less than the standard.
h. The proposed railroad would not emit lead or hydrogen sulfide; they are included here for completeness.

2002, p. 42), and from two sites from 2002 through 2005 (DIRS 168842-DOE 2003, p. 42; DIRS 173740-DOE 2004, p. 36; DIRS 176801-Wills 2005, p. 38; DIRS 179948-DOE 2006, p. 40). While these data sets pertain to locations more than 160 kilometers (100 miles) from the easternmost part of the Caliente rail alignment, DOE believes they are representative of the ambient air quality along most of the Caliente rail alignment, because neither area has large emission sources or metropolitan areas that would otherwise affect air quality. However, local natural sources of particulate matter, such as barren land or dry lake beds, could generate higher localized concentrations of particulate matter.

In the vicinity of the eastern portion of the Caliente rail alignment, the closest location for which there are recorded air quality data is Mesquite, Nevada, at which ozone and particulate matter measurements are taken. However, because Mesquite is outside the air quality and climate region of influence (Mesquite is in Clark County) and is more than 100 kilometers (65 miles) from its closest point to the Caliente rail alignment, and because there has been substantial construction activity and population growth in Mesquite in recent years, Mesquite's air quality is not representative of the area of the Caliente rail alignment.

In the vicinity of the western portion of the Caliente rail alignment, the closest location (other than the Yucca Mountain Site) for which there are recent air quality data is Pahrump, Nevada. However, Pahrump, which is in the extreme southern tip of Nye County, is 65 kilometers (40 miles) southeast of the rail alignment, and only monitors particulate matter. In recent years there have been exceedances of the National Ambient Air Quality Standards for particulate matter in Pahrump because there has been substantial construction activity and population growth in the Pahrump Valley. In September 2003, Pahrump entered into a Memorandum of Understanding (DIRS 178128-Nevada Division of Environmental Protection 2003, p. 5) with the U.S. Environmental Protection Agency, the State of Nevada, and Nye County to develop an air quality improvement plan, with quantified emission-reduction measures so that the emission reduction strategies will be adequate to ensure the area stays in attainment of the particulate matter standards and with the objective that the area would be in attainment by 2009. Pahrump has a background monitoring site intended to represent natural background concentrations of the northern Mojave Desert; however, some disturbed land in the vicinity of the monitor makes the site only representative of the local background in the Pahrump Valley. Because of Pahrump's distance from the Caliente rail alignment and heavy construction activity and population growth, its air quality is not representative of the area of the Caliente rail alignment.

The DOE Environmental Safety and Health Department began air quality monitoring in the Yucca Mountain vicinity in 1989. Figure 3-59 shows station locations. The air quality network originally consisted of Sites YMP1 and YMP5; DOE added sites YMP6 and YMP9 in 1992.

DOE designed the air quality and meteorological monitoring program to comply with the U.S. Environmental Protection Agency's *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (DIRS 101822-EPA 1987, all) and *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)* (DIRS 108989-EPA 1987, all), and with U.S. Nuclear Regulatory Commission meteorological monitoring guidance (ANSI/ANS-2.5-1984, *Standard for Determining Meteorological Information at Nuclear Power Sites* and Regulatory Guide 1.23, Rev. 0, *Onsite Meteorological Programs*).

DOE monitored the criteria gaseous pollutants of carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide at YMP1 from October 1991 through September 1995. DOE also monitored the concentration of PM_{10} at YMP1; the ambient air quality monitoring program included sampling of PM_{10} every sixth day, based on the U.S. Environmental Protection Agency's representative schedule of sampling.

YMP5, the second site measuring PM_{10}, represented background conditions away from site activities at Yucca Mountain. Measurements at YMP5 began in April 1989 and continued until 2002.

In October 1992, DOE added two sites to measure PM_{10}:

- YMP6, along the western border of the Nevada Test Site where the Test Site meets the U.S. Air Force land in upper Yucca Wash, measured particulate matter that might be transported from Midway Valley toward the northwest through Yucca Wash (discontinued September 1999).
- YMP9, at Gate 510 on the southern border of the Nevada Test Site, north of Amargosa Valley.

Tables 3-16 and 3-17 summarize the results of the particulate-matter air quality monitoring programs. More information on the results of the sampling program is available in *Environmental Baseline File for Meteorology and Air Quality* (DIRS 102877-CRWMS M&O 1999, all); *Meteorological Monitoring Program Particulate Matter Ambient Air Quality Monitoring Report January through December 1996* (DIRS 102876-CRWMS M&O 1997, all); *Particular Matter Ambient Air Quality Data Report for 1989 and 1990* (DIRS 147777-SAIC 1992, all); and *Particular Matter Ambient Air Quality Data Report for 1991* (DIRS 147780-SAIC 1992, all).

Between 1989 and 1997, the highest 24-hour PM_{10} measurement was 67 micrograms per cubic meter. This measurement, made at Site YMP5 in 1995, is approximately 45 percent of the regulatory standard of 150 micrograms per cubic meter (40 CFR 50.4 through 50.11).

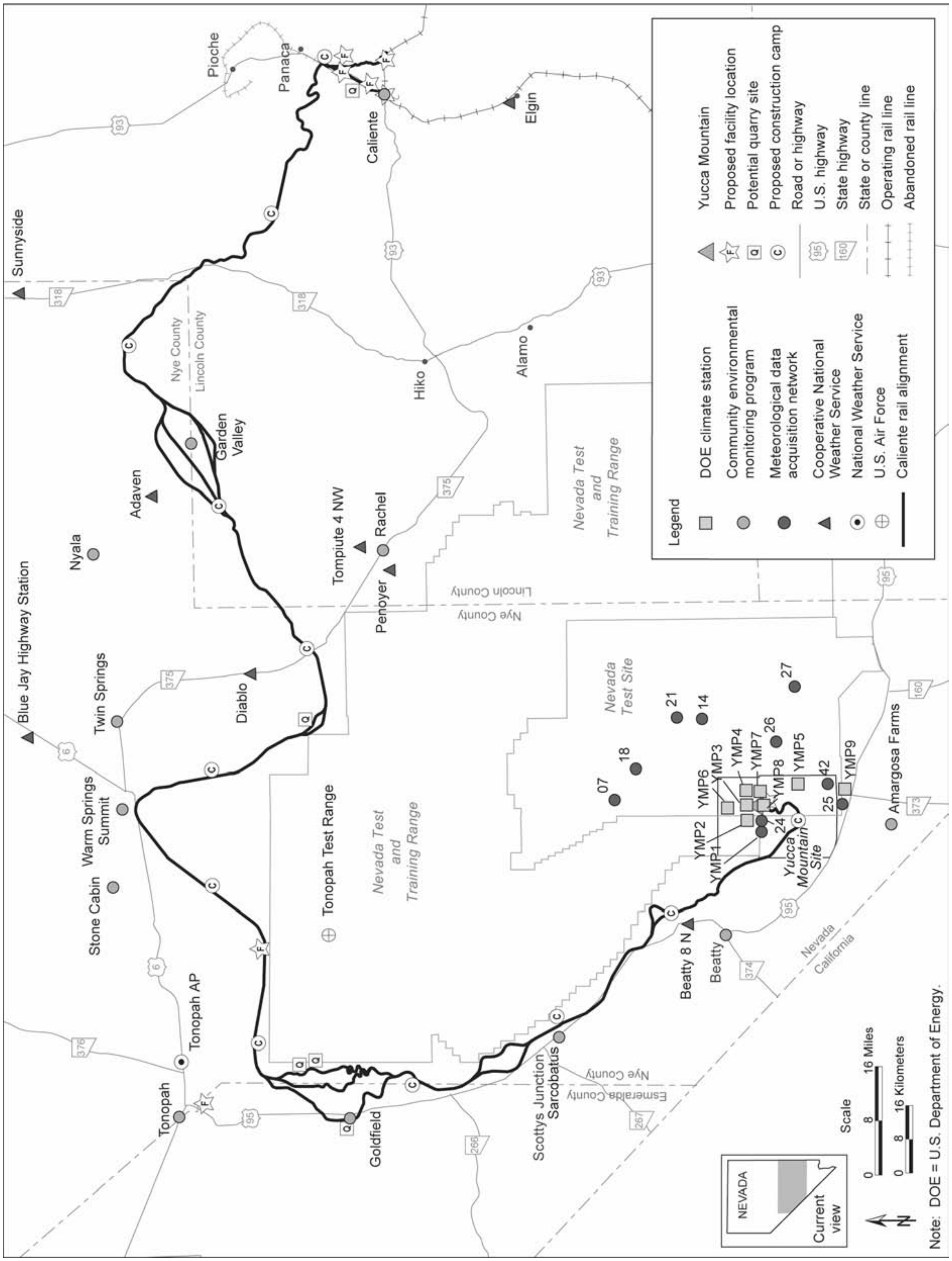


Figure 3-59. Air quality and climate stations along the Caliente rail alignment.

Table 3-16. Summary of PM_{10} concentrations at sites in the vicinity of Yucca Mountain (1989 to 1997).[a,b,c]

Sampler[d]	Averaging time	1989	1990	1991	1992	1993	1994	1995	1996	1997	High
Site YMP1	24-hour highest	41	62	33	30	30	39	21	60	31	62
	Second highest	27	49	25	24	22	26	20	23	21	49
	Annual average	12	12	10	12	10	10	10	10	9	12
Site YMP5	24-hour highest	40	51	45	49	21	42	67	57	26	67
	Second highest	38	43	33	27	20	23	21	35	19	43
	Annual average	13	10	10	12	9	9	10	10	9	13
Site YMP6	24-hour highest	NA	NA	NA	NA	21	25	14	32	59	59
	Second highest	NA	NA	NA	NA	21	20	13	21	18	21
	Annual average	NA	NA	NA	NA	9	7	7	9	8	9
Site YMP9	24-hour highest	NA	NA	NA	31	21	39	15	57	29	57
	Second highest	NA	NA	NA	31	21	19	14	28	19	31
	Annual average	NA	NA	NA	NA	9	8	7	10	8	10

a. Sources: DIRS 102877-CRWMS M&O 1999, p. 13; DIRS 102876-CRWMS M&O 1997, p. 13; DIRS 147777-SAIC 1992, p. 13; DIRS 147780-SAIC 1992, p. 13.
b. Concentrations are shown in micrograms per standard cubic meter ($\mu g/m^3$).
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; NA = samples were not taken during the corresponding monitoring period.
d. YMP = Yucca Mountain Project.

The second-highest value at any monitoring site, which is the basis for a violation of the ambient air quality standard, was 49 micrograms per cubic meter at Site YMP1 in 1990, which is 33 percent of the PM_{10} standard.

The annual averages were between 6 and 13 micrograms per cubic meter (Site YMP9 [1998] and Site YMP5 [1989], respectively), which is less than 30 percent of the historical annual standard (50 micrograms per cubic meter).

Table 3-17 lists the annual highest and second-highest 24-hour concentrations, and the annual average PM_{10} concentration for the period 1998 to 2005 for YMP1, YMP5, and YMP9, and shows the measured levels of ambient particulate matter were well below the Nevada particulate-matter standards. Table 3-18 lists Site YMP1 results for monitoring of gaseous criteria pollutants (carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide) for each year of the 4-year monitoring period (1991 to 1995); for comparison, the National Ambient Air Quality Standards are also shown.

Ambient concentrations of carbon monoxide and sulfur dioxide were below the threshold of reliable detection of the instrument. Nitrogen dioxide occasionally registered values of a few hundredths of parts per million by volume, typically associated with nearby vehicle activity. The number of hours per operating quarter with measurements above the threshold was between 1 and 161, which occurred from October through December 1993. The results listed in Table 3-18 are expressed in the units of the applicable standard (for example, annual average of nitrogen dioxide), and the listed values are based on the threshold of reliable detection for that instrument.

Table 3-17. Summary of PM_{10} concentrations at sites in the vicinity of Yucca Mountain (1998 to 2005).[a,b,c]

Sampler	Averaging time	1998	1999	2000	2001	2002	2003	2004	2005	High
Site YMP1	24-hour highest	30	18	38	23	52	33	24	32	52
	Second highest	17	34	34	19	37	17	19	29	37
	Annual average	8	8	11	8	10	8	8	9	11
Site YMP5	24-hour highest	26	24	45	27	NA	NA	NA	NA	45
	Second highest	18	21	39	25	NA	NA	NA	NA	39
	Annual average	7	8	12	10	NA	NA	NA	NA	12
Site YMP9	24-hour highest	22	18	36	22	43	39	27	26	43
	Second highest	20	17	33	19	39	38	21	26	39
	Annual average	6	8	11	9	10	11	9	9	11

a. Sources: DIRS 173738-DOE 2002, p. 42; DIRS 168842-DOE 2003, p. 44; DIRS 173740-DOE 2004, p. 36; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40.
b. Concentrations are shown in micrograms per standard cubic meter ($\mu g/m^3$).
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; NA = samples were not taken during the corresponding monitoring period.

Table 3-18. Site YMP1 maximum observed ambient gaseous air quality concentration in comparison to the Nevada Standards for Air Quality and the National Ambient Air Quality Standards (in parts per million by volume).[a]

Pollutant	Nevada and NAAQS[b]	Year 1 (10/91 to 9/92)	Year 2 (10/92 to 9/93)	Year 3 (10/93 to 9/94)	Year 4 (10/94 to 9/95)
Carbon monoxide	35 (1 hour)	0.2	0.2	0.2	0.2
	9[c] (8 hour)	0.2	0.2	0.2	0.2
Nitrogen dioxide	0.053 (annual)	0.0020	0.0020	0.0021	0.0021
Ozone[d] (for Nevada ambient air quality only)	0.12 (1 hour) 0.08 (8 hour)	0.096 (1 hour)	0.093 (1 hour)	0.081 (1 hour)	0.083 (1 hour)
Sulfur dioxide	0.5 (3 hour)	0.002	0.002	0.002	0.002
	0.14 (24 hour)	0.002	0.002	0.002	0.002
	0.03 (annual)	0.002	0.002	0.002	0.002

a. Source: DIRS 102877-CRWMS M&O 1999, p. 14; 40 CFR 50.4 through 50.11.
b. NAAQS = National Ambient Air Quality Standards.
c. Nevada Standards for Air Quality: less than 5,000 feet above mean sea level.
d. The 1-hour ozone standard of 0.12 parts per million, in place during the listed years, was phased out in 2005 and replaced with an 8-hour ozone standard of 0.08 parts per million.

DOE believes these measurements of particulate matter, carbon monoxide, nitrogen dioxide, and sulfur dioxide are representative of the air quality along the Caliente rail alignment because the region of influence has no large emission sources or metropolitan areas that would otherwise affect its air quality. However, in areas close to barren land or dry lake beds, there could be higher particulate-matter concentrations.

Ozone was the only gaseous criteria pollutant to routinely register ambient levels above the instrument threshold. Ozone levels never exceeded the regulatory limit for the 1-hour average standard (0.12 parts per million by volume). The highest 1-hour average was 0.096 parts per million. Note that the 1-hour average standard was withdrawn in 2005, and has now been replaced with an 8-hour average standard (0.08 parts per million). Ozone is formed in the atmosphere under the presence of sunlight, ***nitrogen oxides***, and ***volatile organic compounds***. Ozone typically has the highest concentrations during warm weather because strong sunlight and high temperatures are more conducive to higher ambient concentrations. Approximately 90 percent of the warm-season hours had concentrations between 0.020 and 0.060 parts per million; only 44 hours had concentrations in excess of 0.080 parts per million.

Available data for Death Valley National Park (for 1995 to 2004), 50 kilometers (31 miles) west of the westernmost portion of the Caliente rail alignment, reported a highest 1-hour average ozone concentration of 0.095 parts per million (DIRS 176115-EPA 2005, all), which is similar to the ozone values measured at Yucca Mountain. Ozone concentrations along more eastern parts of the Caliente rail alignment are anticipated to be even lower because of their greater distance from emission sources.

No ambient monitoring data were available for lead. However, DOE expects concentrations of lead to be far below the regulatory standard because there are no industrial sources in the region of influence (or near enough to transport this ***contaminant*** into the region of influence), and lead-based gasoline, previously the principal source of lead in the air, has been phased out.

No ambient monitoring data were available for $PM_{2.5}$; however, because $PM_{2.5}$ is a subset of PM_{10}, $PM_{2.5}$ can be estimated from measurements of ambient PM_{10}. In the region of influence, nearly all PM_{10} would be generated from the resuspension of surface-level soil and mineral materials. A U.S. Department of Agriculture study on wind erosion in the western United States found that over all soils, the fraction of PM_{10} as $PM_{2.5}$ was about 15 percent, ranging from 10 to 30 percent (DIRS 173838-Hagen 2001, p. 1). To be conservative, DOE applied the upper end of this range (30 percent) to the ambient PM_{10} data collected at Yucca Mountain (Sites YMP1, YMP5, and YMP9) over the past 8 years (1998 through 2005), and the resulting data indicated the highest expected 24-hour concentration of $PM_{2.5}$ would be 16 micrograms per cubic meter, and the highest expected annual average concentration would be 4 micrograms per cubic meter. These figures are 46 and 26 percent of the standards for $PM_{2.5}$. Table 3-19 summarizes these results and indicates that $PM_{2.5}$ would be well below the National Ambient Air Quality Standards at all locations along the Caliente rail alignment.

3.2.4.3 Climate

The Caliente rail alignment would cross ***desert*** and ***semi-desert*** areas that generally have abundant hours of cloud-free days, low annual precipitation, and large daily ranges in temperature.

To characterize the existing climate, DOE collected meteorological data from 41 meteorological monitoring stations within the Caliente rail alignment region of influence (see Figure 3-59 and Table 3-19).

The following four groups operated these stations:

- National Oceanic and Atmospheric Administration
- Community Environmental Monitoring Program
- DOE Environment, Safety and Health Programs Department Network
- U.S. Air Force

The Meteorological Data Acquisition Network is a network of meteorological stations operated by the National Oceanic and Atmospheric Administration, Air Resources Laboratory/Special Operations and Research Division.

Table 3-19. Maximum observed ambient air quality concentrations at sites in the vicinity of Yucca Mountain (1998 to 2005) compared to the National Ambient Air Quality Standards for particulate matter.[a,b,c]

Sampler	Nevada and NAAQS[d]	1998	1999	2000	2001	2002	2003	2004	2005	High
PM_{10}	24 hour: 150	30	24	45	27	52	39	27	32	52
	Annual: 50[e]	8	8	12	10	10	11	9	9	12
Estimated[f] $PM_{2.5}$	24 hour: 35	9	7	14	8	16	12	8	10	16
	Annual: 15	2	2	4	3	3	3	3	3	4

a. Sources: DIRS 173738-DOE 2002, p. 42; DIRS 168842-DOE 2003, p. 44; DIRS 173740-DOE 2004, p. 36; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; and 40 CFR 50.4 through 50.11.
b. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers.
c. Concentrations are shown in micrograms per standard cubic meter.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006. (71 Federal *FR* 60853, October 17, 2006).
f. Estimated based on upper-end range of PM_{10} data assuming 30 percent of PM_{10} is $PM_{2.5}$ (DIRS 173838-Hagen 2001, p. 1).

The Community Environmental Monitoring Program is a joint effort between the DOE Nevada Operations Office, the University of Nevada Desert Research Institute, and the Community College System of Nevada, and is a network of monitoring stations in communities surrounding the Nevada Test Site that check the ***environment*** for ***radioactivity*** and check a variety of meteorological parameters. The U.S. Air Force has historically operated a meteorological station from time to time on the Nevada Test and Training Range at the Tonopah Test Range and archives this data with the Air Force Combat Climatology Center.

DOE acquired data not directly available through these programs through the Western Regional Climate Center (DIRS 165987-WRCC 2002, all), which maintains historical climate databases for most of the climate and operational National and Military Weather Service stations throughout the western United States, including a network of stations that collect daily climate observations.

Table 3-20 lists the station operators and their respective elevations in the Caliente rail alignment air quality and climate region of influence. All stations collected temperature and precipitation data, and Table 3-20 also identifies those stations that collected wind speed and direction data. The range of elevations over which weather data were collected is approximately the same as the elevation range of the Caliente rail alignment – from 746 meters (2,450 feet) at the Amargosa Farms Station to 2,293 meters (7,520 feet) at the Warm Springs Summit Station.

The Caliente rail alignment would cross a variety of topographic features, ranging from mountain passes to sage-covered deserts. Alignment elevations range from 1,341 meters (4,400 feet) near the City of Caliente in Lincoln County to 2,293 meters (7,520 feet) at the Warm Springs Mountain Summit in Nye County and back down to 1,080 meters (3,540 feet) near the end of the Caliente rail alignment at Yucca Mountain. These elevation changes drive a wide variation in temperature and precipitation.

From east to west, the Caliente rail alignment would lie within and be exposed to the climatic conditions of the Nevada counties of Lincoln, Nye, and Esmeralda, as described in Sections 3.2.4.3.1 through 3.2.4.3.3.

3.2.4.3.1 Lincoln County

In Lincoln County, the Caliente rail alignment would cross two mountain ranges and cross the Dry Lake Valley, representing an elevation range of approximately 1,200 to 2,000 meters (3,900 to 6,600 feet),

Table 3-20. Meteorological stations in the Caliente rail alignment air quality and climate region of influence[a,b] (page 1 of 2).

Station name	Elevation (in meters)[c]	Operator	Wind data
Pioche	1,883	CEMP	Yes
Caliente	1,341	CEMP	Yes
Elgin	1,042	WRCC	NA
Sunnyside	1,615	WRCC	NA
Garden Valley	1,614	CEMP	Yes
Adaven	1,905	WRCC	NA
Tempiute 4 Northwest	1,490	WRCC	NA
Rachael	1,448	CEMP	Yes
Nyala	1,484	CEMP	Yes
Penoyer	1,463	WRCC	NA
Diablo	1,556	WRCC	NA
Blue Jay Highway Station	1,622	WRCC	NA
Twin Springs	1,615	CEMP	Yes
Warm Springs Summit	2,293	CEMP	Yes
Tonopah Test Range	1,691	Air Force	Yes
Stone Cabin	1,787	CEMP	Yes
Tonopah	1,836	CEMP	Yes
Tonopah Airport	1,655	WRCC	NA
Goldfield	1,734	CEMP	Yes
Sarcobatus Flat	1,226	CEMP	Yes
Beatty 8 North	1,082	WRCC	NA
Beatty	1,007	CEMP	Yes
Amargosa Farms	746	CEMP	Yes
07	1,663	MEDA	NA
14	1,432	MEDA	NA
18	1,533	MEDA	NA
21	1,512	MEDA	NA
24	1,505	MEDA	NA
25	835	MEDA	NA
26	1,133	MEDA	NA
27	1,370	MEDA	NA
42	880	MEDA	NA
NTS 60 (YMP1)	1,136	DOE	NA

Table 3-20. Meteorological stations in the Caliente rail alignment air quality and climate region of influence[a,b] (page 2 of 2).

Station Name	Elevation (in meters)[c]	Operator	Wind data
Fortymile Wash (YMP5)	952	DOE	NA
Gate 510 (YMP9)	838	DOE	NA
Knothead Gap (YMP8)	1,130	DOE	NA
Sever Wash (YMP7)	1,080	DOE	NA
Yucca Mountain (YMP2)	1,478	DOE	NA
Coyote Wash (YMP3)	1,278	DOE	NA
Alice Hill (YMP4)	1,234	DOE	NA
WT-6 (YMP6)	1,315	DOE	NA

a. Source: DIRS 165987-WRCC 2002.
b. CEMP = Community Environmental Monitoring Program; DOE = DOE Environment, Safety and Health Programs Department Network; MEDA = Meteorological Data Acquisition Network; NA = not available; NTS = Nevada Test Site; WRCC = Western Regional Climate Center; YMP = Yucca Mountain Project.
c. To convert meters to feet, multiply by 3.2808.

and would pass through another portion of Lincoln County from approximately Garden Valley to near the Quinn Canyon Range. Annual average temperatures along the rail alignment through Lincoln County range from approximately 13° Celsius (55° Fahrenheit) at lower elevations to approximately 7° Celsius (45° Fahrenheit) at higher elevations. Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer months. Daily temperature variations are smaller during winter months, and less pronounced at higher elevations. At the lower elevations, summertime mean maximum temperatures are approximately 35° Celsius (95° Fahrenheit), and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are around minus 8° Celsius (18° Fahrenheit) in December and January (DIRS 165987-WRCC 2002, all).

In the eastern portion of Lincoln County, maximum precipitation occurs during the winter months (January through March), and a secondary peak occurs during July through September, associated with occasional thunderstorms. At higher elevations, annual average precipitation is greater than 250 millimeters (10 inches); at lower elevations, average precipitation is 250 millimeters or less. Daily precipitation levels can be high, and historical maximums have exceeded 76 millimeters (3 inches) per day in the vicinity of the Caliente rail alignment. These maximums have historically occurred during the winter months, and could cause localized flooding, particularly if the ground has been saturated by recent rainfall. The occasional summer thunderstorms can produce heavy rains that can cause flash floods.

The western portion of Lincoln County is drier, averaging closer to 130 millimeters (5 inches) of precipitation per year, primarily occurring January through April.

From November through April, precipitation in Nye County along the Caliente rail alignment might fall as snow. Mean average snowfall in the lower valleys is about 250 millimeters (10 inches). At higher elevations, the average snowfall is between 500 and 1,000 millimeters (20 and 40 inches) per year.

Local topography strongly influences winds in Lincoln County along the Caliente rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Wind speeds are highest in the spring and occasionally generate dust storms. The extreme highest wind speeds are along ridgetops and mountain summits. Annual average wind speeds in the valleys range from 1.3 meters per second (2.9 miles per hour) at the Caliente station to about 2.2 meters per second

(4.9 miles per hour) at the Garden Valley station. Calm conditions (wind speeds of less than 0.6 meter per second [1.3 miles per hour]) are most frequent at the Caliente station, and characterize slightly more than one-third of all hours; the Garden Valley station has calm conditions about 15 percent of the time.

3.2.4.3.2 Nye County

Through southern Nye County, the Caliente rail alignment would lie to the east of the southern Sierra Nevada Range, a large mountain ***barrier*** that prevents much of the moist Pacific Ocean air from reaching the area. The result is lower-elevation areas that are largely desert or semidesert. The Caliente rail alignment would cross a variety of topographic features within the region, from mountain passes to sage-covered deserts. Elevations range from 2,293 meters (7,520 feet) at the Warm Springs Mountain Summit to 1,080 meters (3,540 feet) near the end of the Caliente rail alignment at Yucca Mountain, and present a wide variation in temperature and precipitation. In general, the climatic features can be described as abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large daily ranges in temperature.

In Nye County, the mean annual temperature along the Caliente rail alignment ranges from approximately 16° Celsius (61° Fahrenheit) at lower elevations to approximately 10° Celsius (50° Fahrenheit) at the highest elevations. Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer months. Daily temperature variations are smaller during winter months, and less pronounced at higher elevations. At the lowest elevations along the Caliente rail alignment, summertime maximum temperatures frequently exceed 38° Celsius (100° Fahrenheit), and are accompanied by low relative humidity (commonly less than 10 percent).

Annual precipitation averages less than 250 millimeters (10 inches) per year at all locations across southern Nye County, and most precipitation occurs during the winter. Along the Caliente rail alignment, precipitation is lowest from the Sarcobatus Flat station to the Beatty station, averaging just 75 to 100 millimeters (3 to 4 inches) per year because of the ***rain shadow*** effects from the Sierra Nevada and Amargosa Range. At higher elevations, a secondary peak in rainfall (associated with increased thunderstorm activity) occurs during the late summer months; at lower elevations, this precipitation often evaporates before reaching the ground. The thunderstorms occasionally produce heavy rains that can cause flash floods. Daily precipitation levels can be high, and historical maximums have reached 60 millimeters (2.4 inches) at the Sarcobatus Flat station, with a number of locations exceeding 40 millimeters (1.6 inches).

From November through April, precipitation in Nye County along the Caliente rail alignment might fall as snow. Mean average snowfall in the lower valleys is about 50 to 130 millimeters (2 to 5 inches). At higher elevations, the average snowfall is between 130 and 380 millimeters (5 and 15 inches) per year.

Local topography in Nye County strongly influences winds along the Caliente rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Wind speeds are highest in the spring, and occasionally generate dust storms at playas. The extreme highest wind speeds are along ridgetops and mountain summits. The maximum wind speed recorded at Warm Springs Summit was 34 meters per second (76 miles per hour), and winds of more than 40 meters per second (90 miles per hour) have been recorded along ridgetops at the Nevada Test Site station. Annual average wind speeds are much lower – from 5.4 meters per second (12 miles per hour) at the Warm Springs Summit station to 1.7 meters per second (3.8 miles per hour) at the Stone Cabin station. Along the Caliente rail alignment through southern Nye County, calm conditions (wind speeds of less than 0.6 meter per second [1.3 miles per hour]) are most frequent at the Stone Cabin station, and characterize wind conditions in the area about 12 percent of the time. In southern Nye County, annual average wind speeds are much lower, with annual average speeds of 2.4 meters per second (5.4 miles per hour) at Sarcobatus Flat and 2.2 meters per second (4.9 miles per hour) at Beatty. Through southern Nye County, calm conditions are most frequent at Sarcobatus Flat station, and characterize wind conditions in the area about 7 percent of the time.

3.2.4.3.3 Esmeralda County

The Caliente rail alignment would cross through a small portion of Esmeralda County near the Goldfield station and would be east of the high peaks of the Sierra Nevada and White Mountain ranges, at an elevation of around 1,700 meters (5,500 feet). This area experiences abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large daily ranges in temperature.

Within Esmeralda County, the mean annual temperature along the Caliente rail alignment is approximately 10° Celsius (50° Fahrenheit). Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer months. Summertime mean maximum temperatures are approximately 32° Celsius (90° Fahrenheit), and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are approximately minus 7° Celsius (20° Fahrenheit) in December and January.

Annual precipitation in this part of Esmeralda County averages less than 180 millimeters (7 inches) per year, and is heaviest during the winter. During the summer, occasional thunderstorms can produce heavy rains and cause flash floods. Daily precipitation levels occasionally exceed 50 millimeters (2 inches), but on average only 1 day per year has more than 25 millimeters (1 inch) of rain. Precipitation from October through April might fall as snow. Snowfall averages are around 380 millimeters (15 inches).

Local topography in Esmeralda County strongly influences winds along the Caliente rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Highest wind speeds occur in the spring, and occasionally generate dust storms. Annual average wind speeds at the Goldfield station are around 2.7 meters per second (6 miles per hour); slightly more than 5 percent of the time the area experiences calm conditions.

3.2.5 SURFACE-WATER RESOURCES

This section describes surface-water resources along the Caliente rail alignment. Surface-water resources include streams, washes, playas, ponds, wetlands, floodplains, and springs. Section 3.2.5.1 describes the region of influence for surface-water resources along the Caliente rail alignment; Section 3.2.5.2 is a general overview of surface-water features along the rail alignment; and Section 3.2.5.3 describes specific surface-water features for the rail alignment alternative segments and common segments. Sections 3.2.5.2.3 and 3.2.5.2.4 describe wetlands and floodplains, respectively, from a regulatory perspective; Section 3.2.7, Biological Resources, describes wetlands from a habitat perspective. Appendix F (Floodplain and Wetlands Assessment) addresses compliance with Executive Orders 11988, *Floodplain Management*, and 11990, *Protection of Wetlands*, in more detail.

3.2.5.1 Region of Influence

The Caliente rail alignment region of influence for surface-water resources is limited in most cases to the nominal width of the construction right-of-way. Because of the types of land-disturbing activities that would take place during rail line construction, the construction right-of-way would be susceptible to erosion and changes in surface-water flow patterns. Spills (of, for example, fuel, paint, or lubricants) during the railroad construction and operations phases could also affect this area.

In some cases, the region of influence for surface water extends beyond the construction right-of-way. In places where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage could carry eroded soil, sediment, or spills downstream, the region of influence extends beyond the construction right-of-way. Within the region of influence, there could be impacts to floodwaters such that they would back up on the upstream side of the rail line, while there could be impacts to water quality pollutants traveled downstream during a storm event without precipitating out (soils from erosion) or becoming too dilute (petroleum-based lubricants or fuels) to detect. For purposes of analysis, DOE screened the area within 1.6 kilometers (1 mile) of the centerline of the rail alignment for surface-water resources that could be indirectly affected.

Surface-Water Terms

An **ephemeral stream** or ephemeral drainage has a channel bed above the normal water table and only flows in direct response to precipitation or snowmelt within its drainage basin.

An **intermittent stream** or intermittent drainage has a channel bed that fluctuates above or below the normal water table along its length, and might or might not have flow within it during any particular time or at any particular location. The presence of flow within the channel is determined by its channel elevation in relation to the water table, precipitation events, or snowmelt within its drainage basin.

A **wash** or drainage in the western United States generally refers to the dry streambed of an intermittent or ephemeral stream. In this Rail Alignment EIS, wash is used interchangeably with intermittent and ephemeral streams.

A **perennial stream** or perennial drainage receives groundwater into its channel and its stream bed is normally below the water table. During years with normal precipitation, a perennial stream will have constant flow.

A **playa** is normally a dry lake bed that can contain water in response to seasonally high runoff.

Evapotranspiration is a combination of processes through which water is transferred to the atmosphere from evaporation from open water and bare soil, and transpiration from vegetation.

3.2.5.2 General Environmental Setting and Characteristics

Important characteristics of hydrologic systems in the region of influence include ***ephemeral streams*** and playas. Ephemeral surface-water features can be dry over multiple seasons or even years during droughts, but can have multiple periods of flow or standing water during wet periods, as during the winter of 2004-2005. Central and southern Nevada are characterized by low precipitation and high annual ***evapotranspiration*** rates typical of desert climates, as described in Section 3.2.4, Air Quality and Climate. Because of the arid climate and the terrain (that is, north-south trending, parallel mountain ranges with broad, intervening valleys) in this area, surface water generally evaporates before it can flow out of the drainage basin. Typically, surface drainage in this area remains within its topographically defined water basin; that is, surface water generally flows to low areas such as lakes, flats, or playas.

Surface-water systems are typically defined in terms of watersheds (or basins). For water planning and management purposes, the State of Nevada is divided into discrete hydrologic units delineated by 14 major hydrographic regions that are subdivided into 256 hydrographic areas (DIRS 103406-Nevada Division of Water Planning 1992, all). In this Rail Alignment EIS, watersheds (or basins) are referred to as hydrographic regions. A region is defined as a geographic area drained by a single major stream or an area consisting of a drainage system comprised of streams and often natural or manmade lakes.

Overall, most surface-water features described in this section are ephemeral drainage features that intermittently contain flowing water. Meadow Valley Wash and portions of Clover Creek at the beginning of the Caliente rail alignment are the exceptions, where surface-water flow is perennial or more consistently present. This section describes surface-water features in relation to the hydrographic regions in which they are located. Figure 3-60 shows the hydrographic regions within Nevada and the boundaries for the three hydrographic regions the Caliente rail alignment would cross. These regions include the Colorado River Basin, the Central Region, and the Death Valley Basin.

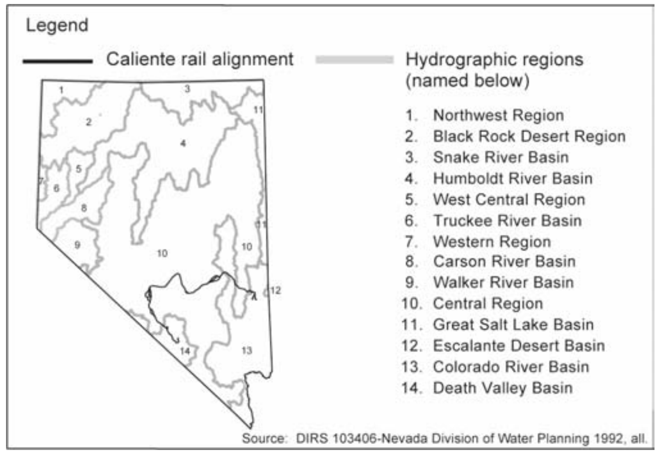


Figure 3-60. Nevada hydrographic regions crossed by the Caliente rail alignment.

3.2.5.2.1 Surface Drainage Features (Streams and Playas)

As described in Section 3.2.1, Physical Setting, the Caliente rail alignment would pass through numerous valleys and over or around numerous mountain ranges. The need for relatively gentle curves and gradients sets physical limitations on the design of the rail line that would require the alignment to follow valley floors that go around mountain ranges, or parallel the mountain ranges in transition zones to change elevation gradually (DIRS 180916-Nevada Rail Partners 2007, Appendix B). Within the valley floors, the rail alignment could parallel predominant drainage channels and cross through or near flats and playas. Some streams within low areas are braided channels where stream flow is divided among multiple channels, which the rail alignment could cross in several locations. Near or within mountain ranges, the alignment typically would be perpendicular to the predominant drainage direction. Therefore, the Caliente rail alignment would encounter a wide variety of surface drainage features.

Drainage features have been classified using Strahler's stream order system (DIRS 176728-Goudie et al., ed. 1981, pp. 50 and 51), which is a method of classifying stream segments based on the number of upstream tributaries. Stream order ranks the size and potential power of streams. Orders range from small streams with no branches (1st Order) up to streams the size of the Mississippi River, which is a 10th Order stream. As two 1st Orders come together, they form a 2nd Order stream. Two 2nd Order streams converging form a 3rd Order stream. Streams of lower order joining a higher order stream do not change the order of the higher order stream.

DOE used stream order to define ***notable drainage channels*** and as a method to select the number of ephemeral washes shown on figures in Section 3-62. To improve the readability of these figures and provide a means to prioritize the drainage features, the figures depict only rivers, streams, and washes the rail alignment would cross that are 2nd Order streams or higher. Figures in Section 3-62 do not show all the washes and drainages the rail alignment would cross, but provide enough information to support the analysis of potential impacts to surface-water resources. Section 4.2.5 identifies the estimated number of drainage channels the rail alignment would cross by alternative segment and common segment.

> **Notable drainage channels,** as referenced in the text and shown on figures in Section 3.2.5.3, were determined by choosing those channels with a stream order of 2 or greater based on Strahler's ordering system, with the National Hydrography Dataset as a base map.

3.2.5.2.1.1 Surface-Water Quality. Because of the ephemeral nature of surface water in the southern part of Nevada, water-quality data for the region of influence are limited. The State of Nevada does not formally monitor surface water in the Caliente rail alignment region of influence.

Water-quality data for the State of Nevada are available through the Nevada District of the U.S. Geological Survey and the Nevada Division of Environmental Protection. Surface water samples are collected from several major river basins in the state and then analyzed for physical and chemical parameters. The routine water-quality monitoring network includes the following river/basin systems: Walker River, Humboldt River, Colorado River, Lake Tahoe Tributaries, Snake River, Truckee River, Carson River, and Steamboat Creek. The Colorado River Basin is the only hydrographic region in the Nevada Division of Environmental Protection's monitoring system within the region of influence for the Caliente rail alignment (DIRS 176306-NDEP 2005, all).

In accordance with federal regulations, each state is required to submit a report on overall water-quality conditions to the U.S. Environmental Protection Agency every 2 years. According to the Nevada Division of Environmental Protection report for 2005 (DIRS 176306-NDEP 2005, all), agriculture and grazing have the greatest impacts on Nevada's waters, mainly because of ***nonpoint source pollution*** (such as irrigation, grazing, and flow-regulation practices). Flow reductions have a great impact on streams, limiting dilution of salts, minerals, and pollutants. Temperature, ***pH***, dissolved oxygen, nutrients, and suspended solids are the main pollutants of concern in the state. Agricultural sources generate large sediment and nutrient loads. Surface-water quality in Nevada varies greatly from location to location and from month to month with change of flow. In general, concentrations of dissolved solids are higher in the southern part of the state than in the northern part, depending largely on water discharge (DIRS 176316-Bostic et al. 2004, all). Because of dilution by precipitation or snowmelt, dissolved solids concentrations are usually highest during periods of low stream flow and lowest during periods of high stream flow.

No site-specific water chemistry data are available for streams or washes the Caliente rail alignment would cross. No streams the alignment would cross are known to be impaired. DOE previously collected and analyzed surface-water samples for chemical characteristics in the Yucca Mountain region. These analytical data are provided in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-40).

3.2.5.2.1.2 Stream Flow. The U.S. Geological Survey has stream-gaging stations (many of which have been discontinued) throughout Nevada. Stream-flow data from these monitoring stations are available through the Geological Survey Nevada District. Table 3-21 lists the range of peak discharges for typical or major streams along the Caliente rail alignment. DOE cross-referenced peak discharge measurements at and near the Nevada Test Site with a Geological Survey fact sheet that discusses significant flooding events in the Amargosa River drainage basin in 1995 and 1998 (DIRS 159895-Tanko and Glancy 2001, Table 2).

Table 3-21. U.S. Geological Survey annual peak flow measurements for selected sites in streams of hydrographic areas along the Caliente rail alignment (page 1 of 3).[a]

Hydrologic unit gaging station (station number)	Drainage area (square kilometers)[b]	Annual peak flow range (cubic meters per second)[c]	Typical peak flow month(s)	Years of record (number of counts)
Areas in the Nevada Test Site				
Meadow Valley Wash (Eccles alternative segment, Caliente alternative segment, Caliente common segment 1)				
Meadow Valley Wash near Caliente (09418500)	4,300	0.12 to 68	February and March	1951-2004 (53)
Caselton Wash near Panaca (09418150)	180	0.11 to 48	July through August	1963-1981 (19)
Meadow Valley Wash at Eagle Canyon near Ursine (09417500)	760	0.62 to 20	January and February	1963-2003 (14)
Dry Lake Valley (Caliente common segment 1)				
Dry Lake Valley tributary near Caliente (10245270)	28	0 to 4.4	July	1967-1981 (15)
White River (Caliente common segment 1)				
White River near Lund (09415550)	1,800	0 to 1.3	March	1991-2003 (8)
Crystal Spring near Hiko (09415590)	No data	0.37 to 0.57	June through October	1986-2001 (11)
White River tributary near Sunnyside (09415560)	52	0 to 17	August and September	1966-1982 (15)
Sand Spring-Tikaboo Valleys (Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8; Caliente common segment 2)				
Penoyer Valley tributary near Tempiute (10247860)	3.8	0 to 3.7	July through September	1964-1981 (18)
Hot Creek-Railroad Valleys (Caliente common segment 2; South Reveille alternative segments 2 and 3; Caliente common segment 3)				
Big Creek near Warm Springs (10247200)	31	0.14 to 0.62	May	1991-1994 (4)
Hot Creek tributary near Warm Springs (10247010)	5.4	0.03 to 2.8	August	1964-1981 (17)
Ralston-Stone Cabin Valleys (Caliente common segment 3; Goldfield alternative segments 1, 3, and 4)				
Ralston Valley tributary near Tonopah (10249140)	0.52	0 to 1.4	July and August	1961-1981 (21)
Cactus-Sarcobatus Flats (Goldfield alternative segments 1, 3, and 4; Caliente common segment 4; and common segment 5)				
Stonewall Flat tributary near Goldfield (10248970)	1.4	0 to 4.3	June through August	1964-1985 (20)
Upper Amargosa (Oasis Valley alternative segments 1 and 3; common segment 6)				
Pah Canyon Wash above Fortymile Wash confluence (102512495)	16	2.6	February	1998 (1)

Table 3-21. U.S. Geological Survey annual peak flow measurements for selected sites in streams of subbasins along the Caliente rail alignment (page 2 of 3).[a]

Hydrologic unit gaging station (station number)	Drainage area (square kilometers)[b]	Annual peak flow range (cubic meters per second)[c]	Typical peak flow month(s)	Years of record (number of counts)
Areas in the Nevada Test Site				
Upper Amargosa (Oasis Valley alternative segments 1 and 3; common segment 6) (continued)				
Unnamed tributary to Fortymile Wash north of Delirium Canyon (102512496)	2.9	5.1	February	1998 (1)
Delirium Canyon Wash above Fortymile Wash confluence (102512497)	6.2	3.4	February	1998 (1)
Unnamed Tributary to Fortymile Wash south of Delirium Canyon (102512499)	2.1	2.0	February	1998 (1)
Fortymile Wash at narrows (10251250)	670	0 to 85	March	1982-1998 (8)
Yucca Wash near mouth (10251252)	44	0 to 27	February and March	1982-1998 (10)
Pagany Wash near the Prow (102512531)	1.3	0.57 to 1.7	February and March	1995-1998 (2)
Pagany Wash #1 near Well UZ (4102512533)	2.1	0.48 to 1.7	February and March	1993-1998 (2)
Drillhole Wash above UZ (1102512535)	1.8	0 to 0.85	March	1994-1998 (3)
Wren Wash at Yucca Mountain (1025125356)	0.52	0 to 0.85	March	1994-1998 (3)
Split Wash below Quac Canyon Wash (102512537)	0.78	0 to 0.37	February	1994-1998 (3)
Split Wash at Antler Ridge (1025125372)	6.2	0 to 0.06	February	1994-1998 (3)
Drillhole Wash at mouth (10251254)	42	0 to 22	July	1982-1998 (10)
Fortymile Wash near Well J (1310251255)	790	0 to 85	March through July	1984-1998 (7)
Dune Wash near Busted Butte (10251256)	18	0 to 0.40	August	1982-1995 (9)
Topopah Wash at Little Skull Mountain (10251260)	270	0 to 42	August	1984-1998 (8)
Beatty Wash near Beatty (10251215)	250	0 to 25	July through March	1989-1998 (5)
Amargosa River at Beatty (10251217)	1,200	0.03 to 28	March through August	1994-2004 (10)

Table 3-21. U.S. Geological Survey annual peak flow measurements for selected sites in streams of subbasins along the Caliente rail alignment (page 3 of 3).[a]

Hydrologic unit gaging station (station number)	Drainage area (square kilometers)[b]	Annual peak flow range (cubic meters per second)[c]	Typical peak flow month(s)	Years of record (number of counts)
Areas near the Nevada Test Site				
Upper Amargosa (Oasis Valley alternative segments 1 and 3; common segment 6) (continued)				
Fortymile Wash near Amargosa Valley (10251258)	820	0 to 94	February through July	1969-2004 (23)
Topopah Wash at Highway 95 near Amargosa Valley (10251261)	390	0.57	February	1998 (1)

a. Sources: DIRS 176325-USGS 2006, p. 29; DIRS 159895-Tanko and Glancy 2001, Table 2.
b. To convert square kilometers to square miles, multiply by 0.3861.
c. To convert cubic meters per second to cubic feet per second, multiply by 35.3.

Most of the drainage channels the Caliente rail alignment alternative segments and common segments would cross typically flow only during significant (heavy) rainfall events, which generally occur only a few times a year. In many years, most of the streams listed in Table 3-21 have little or no flow. From late spring to early fall, precipitation patterns are dominated by convective, short-duration, high-intensity thunderstorms. From late fall to early spring, precipitation patterns are dominated by long-duration, low-intensity, general storm events with both rain and snow possible throughout the area. These two types of precipitation events result in runoff that differs between smaller watersheds (up to 520 square kilometers [200 square miles]) and larger watersheds (greater than 520 square kilometers). For smaller watersheds, the summer thunderstorm events dominate the peak runoff rates, which occur in the tributary channels and washes. However, as watershed size increases, the general storm events eventually dominate the peak rates of runoff. In addition, for all watersheds, the volume runoff is generally greater for the general (winter) storm events than for the thunderstorm (summer) events (DIRS 182755-Parsons Brinckerhoff 2005, p. 12).

In general, stream discharge in Nevada is low in late summer, and then increases through the autumn and winter until the snow melts in the spring. Maximum discharge for the year normally can be expected in May and June, although rain or snow has caused floods from November through March (DIRS 176325-USGS 2006, all). As shown in Table 3-21, the more significant peak-flow scenarios relevant to the Caliente rail alignment occur within the Meadow Valley Wash and Upper Amargosa hydrologic units. The highest peak flows for these hydrographic regions generally occur during late winter due to snowmelt and late summer due to intense precipitation.

The washes that drain the Yucca Mountain Site discharge into the Amargosa River. This ephemeral drainage typically sees very low runoff rates due to minimal precipitation in its basin and is usually dry (DIRS 159895-Tanko and Glancy 2001, p. 1). Precipitation is least along the Caliente rail alignment in this area, from Sarcobatus Flat to Beatty, averaging just 75 to 100 millimeters (3 to 3.9 inches) per year. Most of the annual precipitation typically occurs in late spring to early fall. Fortymile Wash and Topopah Wash are significant tributaries draining the Nevada Test Site area into the Amargosa River with maximum peak flows of 94 cubic meters (3,300 cubic feet) per second and 42 cubic meters (1,500 cubic feet) per second, respectively, during late winter to late summer (see Table 3-21). Section 3.2.5.2.4 describes two significant flooding events (March 1995 and February 1998) in the Amargosa River drainage basin on and near the Nevada Test Site.

3.2.5.2.2 Waters of the United States

Some of the surface-water features along the Caliente rail alignment, such as ephemeral drainages, streams, ponds, and lakes, are considered waters of the United States, especially if there is an interstate connection to commerce. Section 404 of the Clean Water Act (33 U.S.C. 1344) and implementing regulations (33 CFR Part 323) require the U.S. Army Corps of Engineers to regulate discharges of dredge or fill material into waters of the United States. Discharges of dredge or fill material essentially includes all land-disturbing activities accomplished via the use of mechanized equipment.
The placement of structures, such as bridge embankments, bridge piers and abutments, and culverts, would be activities potentially discharging fill materials into waters of the United States. Chapter 6 of this Rail Alignment EIS discusses compliance with Section 404 of the Clean Water Act in more detail.

DOE surveyed all drainages within 400 meters (0.25 mile) of the Caliente rail alignment that are within interstate hydrologic basins to determine if those drainages could be classified as waters of the United States (DIRS 180914-PBS&J 2006, p. 1). This survey also identified and delineated wetlands along the Caliente rail alignment. The alignment-specific discussions in Section 3.2.5.3 detail the results of the survey. Subsequent to DOE surveys performed along the rail alignment, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released new guidance to be used when making determinations of waters of the United States subject to jurisdiction under the Clean Water Act.
This guidance provides criteria for making these determinations for adjacent wetlands and non-navigable tributaries of waters of the United States, particularly in relation to ephemeral waters. As a result of this guidance, it is likely that many of the drainages along the rail alignment would not be considered waters of the United States (see Section 4.2.5.2.1 for further discussion).

The U.S. Army Corps of Engineers is responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. If DOE pursued the Caliente rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the alignment before beginning construction.

> The term **waters of the United States** is defined in 33 CFR 328.3a. The U.S. Army Corps of Engineers and U.S. Environmental Protection Agency regulate the placement of dredged or fill material into these waters. The definition incorporates channels with ephemeral and intermittent flow that exhibit specific physical features, including channel shape and surrounding vegetation that would provide indications of an ***ordinary high water mark***.
>
> **Ordinary high water mark** means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3e).

3.2.5.2.3 Wetlands

Generally, wetlands are lands where saturation with water is the dominant factor that determines how soil develops and the types of plant and animal communities living in the soil and on its surface (DIRS 178724-Cowardin et al. 1979, p. 3). Wetlands can support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland (***hydric***) ***soils***.

According to the U. S. Environmental Protection Agency and the U. S. Army Corps of Engineers, the regulatory definition of a Section 404 jurisdictional wetland is (33 CFR 328.3b) "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The U.S. Department of Agriculture Natural Resources Conservation Service and U. S. Fish and Wildlife Service define wetlands somewhat differently, but all four agencies include three basic elements for identifying wetlands: ***hydrology***, soils, and vegetation. Wetland communities are recognized as providing many valuable functions that improve the human environment. Wetlands that have surface-water connections to or are adjacent to (bordering, contiguous, neighboring) other waters of the United States are regulated under Section 404 of the Clean Water Act. Wetlands that are isolated – that is, they have no permanent or temporary surface-water connections to interstate water bodies or are not considered adjacent – are not typically regulated under Section 404 unless the use of these isolated wetlands could affect interstate commerce.

Surveys in support of this Rail Alignment EIS have identified wetlands along the Caliente rail alignment (DIRS 180914-PBS&J 2006, all). Tables in Section 3.2.5.3 list wetlands identified during these surveys. Appendix F discusses wetlands along the Caliente rail alignment in more detail, and Section 3.2.7, Biological Resources, discusses wetlands from a habitat perspective.

3.2.5.2.4 Floodplains

The presence of floodplains in the Caliente rail alignment region of influence largely depends on the meteorology and hydrology of the area. Much of the rail alignment would be in areas that are subject to intense rainfall over a short duration (1 to 3 hours), which typically occurs in late spring to early fall. Precipitation in late fall to early spring is dominated by low-intensity rainfall or snow over a long duration (2 to 4 days). In both cases, precipitation has the potential to produce flooding (DIRS 182755-Parsons Brinckerhoff 2005, pp. 12 to 14). Evapotranspiration rates throughout the region of influence are high; therefore, most of the rainfall from summer storms is lost relatively quickly unless a storm is intense enough to produce runoff, or unless there are more storms before the water evaporates (DIRS 182755-Parsons Brinckerhoff 2005, p. 18). Evapotranspiration rates are lower during the winter, and water from precipitation or melting snow has a better chance of resulting in streamflow, thereby increasing the chances of flooding. Much of the runoff quickly infiltrates into rock fractures or into the dry soils, some is carried down alluvial fans in arroyos, and some drains onto dry lakebeds where it might stand for weeks as a lake (DIRS 182755-Parsons Brinckerhoff 2005, p. 18).

Although flow in most washes is rare, the area is subject to flash flooding from intense summer thunderstorms and sustained winter precipitation. When it occurs, intense flooding can include mud and debris flows in addition to water runoff. Thunderstorms in the area can be local and intense, creating runoff in one wash while an adjacent wash receives little or no rain. In rare cases, however, storm and runoff conditions can be extensive enough to result in flow being present throughout the drainage systems. For example, conditions recorded during March 1995 and February 1998 at the Amargosa River and its tributaries indicated that the channels all flowed simultaneously along its primary stream channels to Death Valley. The 1995 event was the first documented case of this flow condition. During the 1995 event, the peak flow near the location where the existing Yucca Mountain access road crosses Fortymile Wash was approximately 100 cubic meters (3,500 cubic feet) per second (DIRS 182755-Parsons Brinckerhoff 2005, p. 18).

In accordance with the requirements of 10 CFR Part 1022, DOE reviewed available authoritative information to determine whether the Caliente rail alignment would be located in wetlands or floodplains. The results of that effort (DIRS 182755-Parsons Brinckerhoff 2005, p. 10) indicated that the only flood map or flood studies available for the areas of the Caliente rail alignment were those completed by the Federal Emergency Management Agency in the form of Flood Insurance Rate Maps. Furthermore, and consistent with the remoteness of the project area, DOE found that Federal Emergency Management Agency maps cover only about 45 percent of the rail alignment (see Appendix F, Table F-1). DOE completed flood studies for several washes on the eastern slope of Yucca Mountain at the repository site in support of the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-37 to 3-39).

In accordance with 10 CFR Part 1022, DOE prepared a floodplain and wetland assessment (see Appendix F) for the Caliente rail alignment. Appendix F provides a detailed discussion of the floodplains the Caliente rail alignment would cross, including figures of the relevant floodplains identified on Federal Emergency Management Agency maps and those identified near the repository site.

3.2.5.2.5 Springs

Springs are the only natural source of perennial surface water throughout the Caliente rail alignment region of influence. Typically, these springs flow year round. The springs often infiltrate naturally into the ground or undergo evapotranspiration, or are captured near the source for local use (such as irrigation). DOE used the U.S. Geological Survey Geographic Names Information System, the National Hydrologic Dataset, and several DOE field studies completed in support of this Rail Alignment EIS to identify springs along the Caliente rail alignment (DIRS 180914-PBS&J 2006, all; DIRS 182755-Parsons Brinckerhoff 2005, all).

3.2.5.3 Surface-Water Features along Alternative Segments and Common Segments

DOE compiled this information using the National Wetland Inventory database, a U.S. Geological Survey dataset of hydrologic features known as the National Hydrological Dataset (DIRS 177714-MO0607NHDFLM06.000), a dataset from the U.S. Geological Survey Geographic Names Information System (DIRS 176979-MO0605GISGNISN.000), and DOE wetland surveys conducted in support of this Rail Alignment EIS (DIRS 180914-PBS&J 2006, all). Specific hydrologic features are divided into two categories: those within 150 meters (500 feet) of the rail alignment centerline and those between 150 meters and 1.6 kilometers (1 mile) from the rail alignment centerline. Both of these categories fall within the region of influence for surface-water resources. The first category is also within the nominal width of the rail line construction right-of-way.

Sections 3.2.5.3.1 through 3.2.5.3.12 describe surface-water resources for each Caliente rail alignment alternative segment and common segment moving along the rail line from east to west (from Caliente, Nevada, to Yucca Mountain). Tables in these sections provide summaries of surface-water features identified in the Caliente rail alignment region of influence. Figures in these sections show the proposed rail line location as it crosses Nevada's physiographic features. A key for these map areas is provided in Chapter 2, Figure 2-4.

3.2.5.3.1 Interface with Union Pacific Mainline Railroad

DOE is considering two alternative segments to connect the rail line to the existing Union Pacific Railroad Mainline: the Caliente alternative segment and the Eccles alternative segment (Figure 3-61). DOE would construct an Interchange Yard at the beginning of either of these two alternative segments. There are two options for siting the Staging Yard along the Caliente alternative segment (Caliente-Upland and Caliente-Indian Cove) and one potential site for the Staging Yard along the Eccles alternative segment (Eccles-North). Potential quarry CA-8B would be to the west of the Caliente alternative segment approximately 4.8 kilometers (3 miles) north of Caliente (see Figure 3-61).

3.2.5.3.1.1 Caliente Alternative Segment. The Caliente alternative segment would originate in the City of Caliente, near the junction of Clover Creek and Meadow Valley Wash. For nearly its entire length, the Caliente alternative segment would be constructed along an abandoned rail ***roadbed***.

From Caliente, the alternative segment would run north across Meadow Valley for approximately 16 kilometers (10 miles) running parallel to and crossing Meadow Valley Wash (Table 3-22 and Figure 3-61).

Both Meadow Valley Wash and Clover Creek are part of the interstate tributary system of the Colorado River, a navigable waterway. The Caliente alternative segment would cross several stream channels and washes. DOE field surveys identified nine of these drainage channels that classify as waters of the United States under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, Figure 3A and Table 3), including Clover Creek, Meadow Valley Wash, Bennett Springs Wash, and unnamed washes flowing toward Meadow Valley Wash from side canyons. Construction camp 1 would be in Meadow Valley approximately 2.5 kilometers (1.6 miles) south of the beginning of Caliente common segment 1 (DIRS 180922-Nevada Rail Partners 2007, Figure 4-A). Potential quarry CA-8B would be approximately 2 kilometers (1.2 miles) west of the Caliente alternative segment. The siding that would be constructed to support the proposed quarry would cross three unnamed washes identified as waters of the United States. The Upland option for the Staging Yard would cross one water of the United States within the Staging Yard area.

According to the U.S. Geological Survey, Meadow Valley Wash near Caliente (at gaging station 09418500) has a drainage area of 4,300 square kilometers (1,660 square miles) (see Table 3-21). The Geological Survey collected 53 years of streamflow data (1951 through 2004); the annual peak flow range for streamflow was 0.11 cubic meter (3.9 cubic feet) per second to 68 cubic meters (2,400 cubic feet) per second (see Table 3-21). The maximum discharge of 68 cubic meters per second was recorded on March 5, 1978. There are several irrigation diversions upstream of the gaging station. There are no gaging stations within the region of influence for the Caliente alternative segment (DIRS 176325-USGS 2006, all). No water-quality data are available for drainage channels along the Caliente alternative segment.

There is a relatively large extent of wetlands in the southern portion of the Caliente alternative segment. This segment would be constructed on or adjacent to an existing rail roadbed that runs adjacent to or across DOE-delineated wetland areas for approximately 9.2 kilometers (5.7 miles) along Meadow Valley Wash (see Figures 3-62 and 3-63). DOE delineated all wetlands within 61 meters (200 feet) of the alignment (DIRS 180914-PBS&J 2006, p. 1). The Department did not examine a larger area because it would limit rail line construction activities in this area as much as possible and maintain disturbances within wetlands to an area within 30 meters of the rail alignment centerline. In those areas where the rail line would cross wetlands, the rail line would be constructed along an existing, rail roadbed on upland fill raised above the wetlands in width from about 7 to 16 meters (23 to 52 feet) (DIRS 180914-PBS&J 2006, Figure 4A). The Indian Cove option for the Staging Yard would be in a wetland (DIRS 180914-PBS&J 2006, Figure 4A). Based on field observations, the wetlands extend beyond the rail alignment DOE surveyed. The entire meadow is assumed to be a wetland area. There are no wetlands associated with the Upland option for the Staging Yard. The Interchange Yard would not be in wetlands. Appendix F of this Rail Alignment EIS provides additional information about wetlands.

The Federal Emergency Management Agency has mapped floodplains only for the very southern portion of the Caliente alternative segment. This mapping shows that the alternative segment would cross 100-year floodplains at its starting point in Clover Creek and within Meadow Valley Wash north of the City of Caliente (see Figure 3-64). Based on the topography of these areas, it is reasonable to assume that the portions of Meadow Valley Wash farther upstream to the north would have similar flood levels to the mapped areas. The southern end of the Indian Cove option for the Staging Yard would lie in the mapped 100-year floodplain. Appendix F further describes the floodplains associated with the Caliente alternative segment.

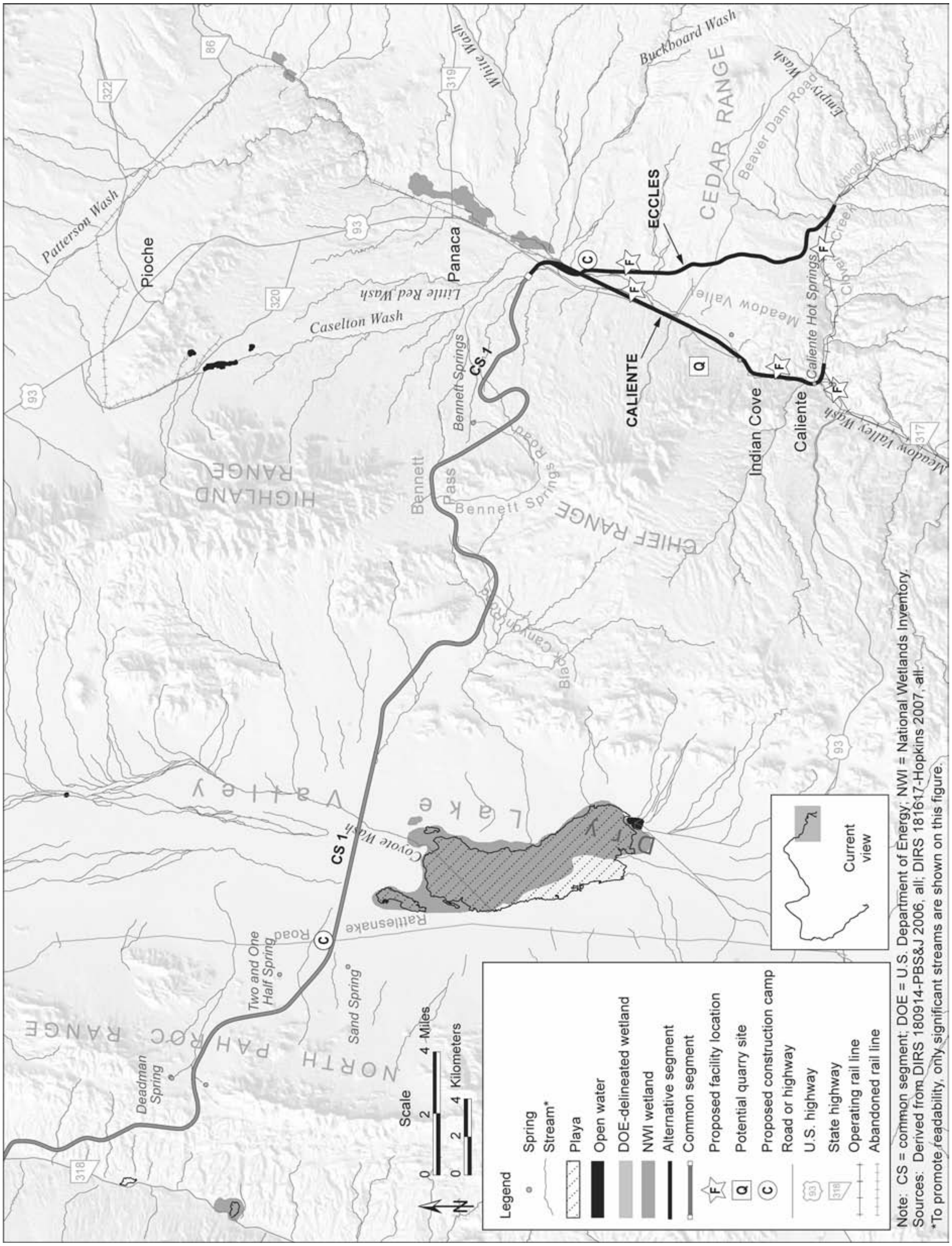


Figure 3.-61. Surface drainage within map area 1.

Table 3-22. Hydrologic features potentially relevant to the Caliente alternative segment.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from the Delmar Mountain Range, the Clover Mountains, the Chief Range, and the Cedar Range down to Meadow Valley through Meadow Valley Wash, Clover Creek, and Miller Spring Wash.	The alignment would run along the Meadow Valley Wash for nearly 16 kilometers and cross Meadow Valley Wash three times. The alignment would cross 12 tributaries leading into Meadow Valley Wash, including Bennett Springs Wash, Cobalt Canyon Wash, Miller Spring Wash, Clover Creek, and White Wash. The alignment would run adjacent to or across wetland areas for approximately 9.2 kilometers of DOE-delineated wetlands within Meadow Valley Wash. Indian Cove option for the Staging Yard would be in a wetland. Caliente Hot Springs 0.02 kilometer east. Unnamed spring 0.1 kilometer northwest.	The alignment would be within 1.6 kilometers of Casselton Wash, Little Red Wash, and 18 unnamed tributaries. Ponds/reservoirs along valley floor. Unnamed spring 0.71 kilometer southeast. Unnamed spring 0.83 kilometer southeast. Unnamed spring 0.75 kilometer southwest.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 63.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

There are two springs within the Caliente alternative segment construction right-of-way: Caliente Hot Springs is 16 meters (52 feet) east and there is an unnamed spring 0.1 kilometer (0.06 mile) northwest of the alternative segment. There are three other unnamed springs at distances of 0.71 kilometer (0.44 mile) southeast, 0.83 kilometer (0.52 mile) southeast, and 0.75 kilometer (0.47 mile) southwest of the alternative segment. See Table 3-22 for a list of springs.

3.2.5.3.1.2 Eccles Alternative Segment. The Eccles alternative segment would start at the Eccles Siding of the Union Pacific Railroad at Dutch Flat, which is within the Clover Creek drainage, approximately 8 kilometers (5 miles) east of the City of Caliente. Dutch Flat is basically a wide area in an otherwise relatively narrow, east-west oriented canyon where Clover Creek, an ephemeral stream at that location, parallels an existing rail line. The Eccles alternative segment would cross the bed of Clover Creek to connect to the Union Pacific Railroad Mainline in this location. Proceeding north from the Eccles/Dutch Flat area, the Eccles alternative segment would cross Meadow Valley Wash upstream of Caliente and downstream of Panaca, just before joining with Caliente common segment 1 (Table 3-23 and Figure 3-61). The Interchange Yard location proposed for the Eccles alternative segment would be adjacent to and extend into Clover Creek. There are no potential quarry sites along this alternative segment (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

Clover Creek is part of the interstate tributary system of the Colorado River, a navigable waterway. All of the washes along this segment are characterized by ephemeral flow. There are no gaging stations within the region of influence for the Eccles alternative segment (DIRS 176325-USGS 2006, all). There are no water-quality data available for drainage channels along this alternative segment.

Of the washes or drainage channels the Eccles alternative segment would cross, DOE field surveys identified 11 stream segments that are designated as waters of the United States under Section 404 of the

Table 3-23. Hydrologic features potentially relevant to the Eccles alternative segment.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from the Delmar Mountain Range, the Clover Mountains, the Chief Range, and the Cedar Range down to Meadow Valley through Meadow Valley Wash, Clover Creek, and Miller Spring Wash.	The segment would cross Meadow Valley Wash, Clover Creek, and unnamed tributaries leading into Meadow Valley Wash, and Clover Creek. Notable crossings would include Bennett Springs Wash, Miller Spring Wash, Empty Wash, and White Wash. Alignment would cross a total of 15 washes. The segment would cross DOE-delineated wetlands along Meadow Valley Wash just south of the end of the segment. The Interchange Yard would extend into Clover Creek.	The segment would lie within 1.6 kilometers of Casselton Wash, Little Red Wash and many unnamed tributaries. DOE-delineated wetlands within 1.2 kilometers of the origin of the Eccles alternative segment. DOE-delineated wetlands within 0.4 kilometer.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 63.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Clean Water Act (DIRS 180914-PBS&J 2006, Figures 3A and 3B, and Table 3), including Clover Creek, Meadow Valley Wash, Miller Spring Wash, Empty Wash, White Wash, and Bennett Springs Wash. The proposed Interchange Yard for the Eccles alternative segment would cross Clover Creek, which is classified as a water of the United States (DIRS 180914-PBS&J 2006, Figure 3A). The Eccles-North Staging Yard would cross one wash identified as a water of the United States. There are no water-quality data available for drainage channels along this alternative segment.

DOE delineated five wetland areas within 1.2 kilometers (0.8 mile) of the origin of the Eccles alternative segment, one of which is associated with a spring. Although these wetlands would be outside the rail line construction right-of-way, two of them would be within the construction footprint for the Interchange Yard (see Figure 3-65). DOE delineated another wetland area within 0.4 kilometer (0.25 mile) of this alternative segment approximately 1.8 kilometers (1.1 miles) south of where the Eccles alternative segment crosses the Caliente alternative segment as shown on Figure 3-62. The alternative segment would also cross wetlands associated with the Meadow Valley Wash just to the south of the end of the segment. Appendix F provides additional information about these wetlands.

The Federal Emergency Management Agency has no published flood maps for the area of the Eccles alternative segment. Existing flood maps of Clover Creek near Caliente indicate the floodplain associated with Clover Creek terminates before it reaches the Eccles alternative segment. However, flooding that occurred in 2005 in and around Clover Creek, Meadow Valley Wash, and Muddy River washed out and undermined portions of an existing rail line in this area. Rail line construction would require encroachment into Clover Creek. The Interchange Yard along the Eccles alternative segment would cross Clover Creek and be in the floodplain. Appendix F provides more information on floodplains.

3.2.5.3.2 Caliente Common Segment 1 (Dry Lake Valley Area)

From Meadow Valley, Caliente common segment 1 would pass through Bennett Pass, Black Canyon, and Dry Lake Valley (Table 3-24 and Figures 3-61 and 3-66). The common segment would then cross State Highway 318 and the White River Valley before passing around the northern end of the Seaman Range and terminating in Coal Valley. Construction camp 2 would be adjacent to Caliente common segment 1 approximately 37 kilometers (23 miles) northwest of the beginning of the common segment. Construction camp 3 would be directly adjacent to the common segment approximately 15 kilometers (9.3 miles) northeast of the junction of common segment 1 with the Garden Valley alternative segments. There are no potential quarry sites along this common segment (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

Common segment 1 would run 1.4 kilometers (0.87 mile) to the north of an unnamed playa in Dry Lake Valley that is 47 square kilometers (18 square miles) in size. During periods of heavy rainfall, runoff from the Highland, Chief, North Pahroc, and Seaman Ranges can produce ephemeral lakes in this playa. There is no flow data available indicating the seasonal duration of the ephemeral lakes. There is ephemeral flow from streams draining upland areas such as Coyote Wash. Flow data for a Dry Lake Valley tributary indicates an annual peak flow range of 0 to 4.4 cubic meters (160 cubic feet) per second (see Table 3-21).

Caliente common segment 1 would continue northwest from Dry Lake Valley, where it would cross State Highway 318 and the White River. The White River Valley hydrographic area has a drainage area of 1,800 square kilometers (700 square miles) (see Table 3-22) The closest U.S. Geological Survey gaging station to common segment 1 is on the White River near Lund, Nevada, approximately 51 kilometers (32 miles) north (upstream) of common segment 1. At the station near Lund, the river's drainage basin is 1,800 square kilometers (700 square miles); annual mean streamflow was 0.79 cubic meter (28 cubic feet) per second recorded in 1993, and 1.3 cubic meters (44 cubic feet) per second in 2001 (DIRS 176325-USGS 2006).

From White River Valley, common segment 1 would pass around the northern end of the Seaman Range and then down into Coal Valley. Coal Valley contains a large playa approximately 30 kilometers (19 miles) long and 8 kilometers (5 miles) wide, with its northern tip reaching the termination of common segment 1. The National Wetlands Inventory dataset identifies Coal Valley Playa as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 3).

Caliente common segment 1 would cross 17 stream channels or washes designated as waters of the United States tributaries of the Colorado River (a navigable river) along its route, as classified by DOE field studies completed in support of this Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figure 3C). DOE also surveyed the White River and its associated drainages and determined that even though the White River drained into the Colorado River in the past, there is no surface-water connection between the two drainage systems. Drainages associated with the White River have been altered over time by changes in topography and geological conditions.

DOE determined that the bottom of the White River Valley is flat and has no discernable channel bed and bank (indicators used to identify waters of the United States) in the area where the rail alignment would cross. At that location, and at other locations to the south, sediment deposited from channels flowing into the valley have blocked downstream flow. Additional field observations within the White River Valley south of the rail alignment (historically downstream) confirmed the lack of a discernable channel bed and bank. Because there are no physical indicators of a stream channel in this portion of the White River Valley, it has been determined that the White River and associated tributaries do not have connectivity to the Colorado River system. Because they have no connectivity to the Colorado River system and do not appear to have a connection with interstate or foreign commerce, they are not considered waters of the United States in this analysis (DIRS 180914-PBS&J 2006, p. 7).

No water-quality data are available for drainage channels along Caliente common segment 1.

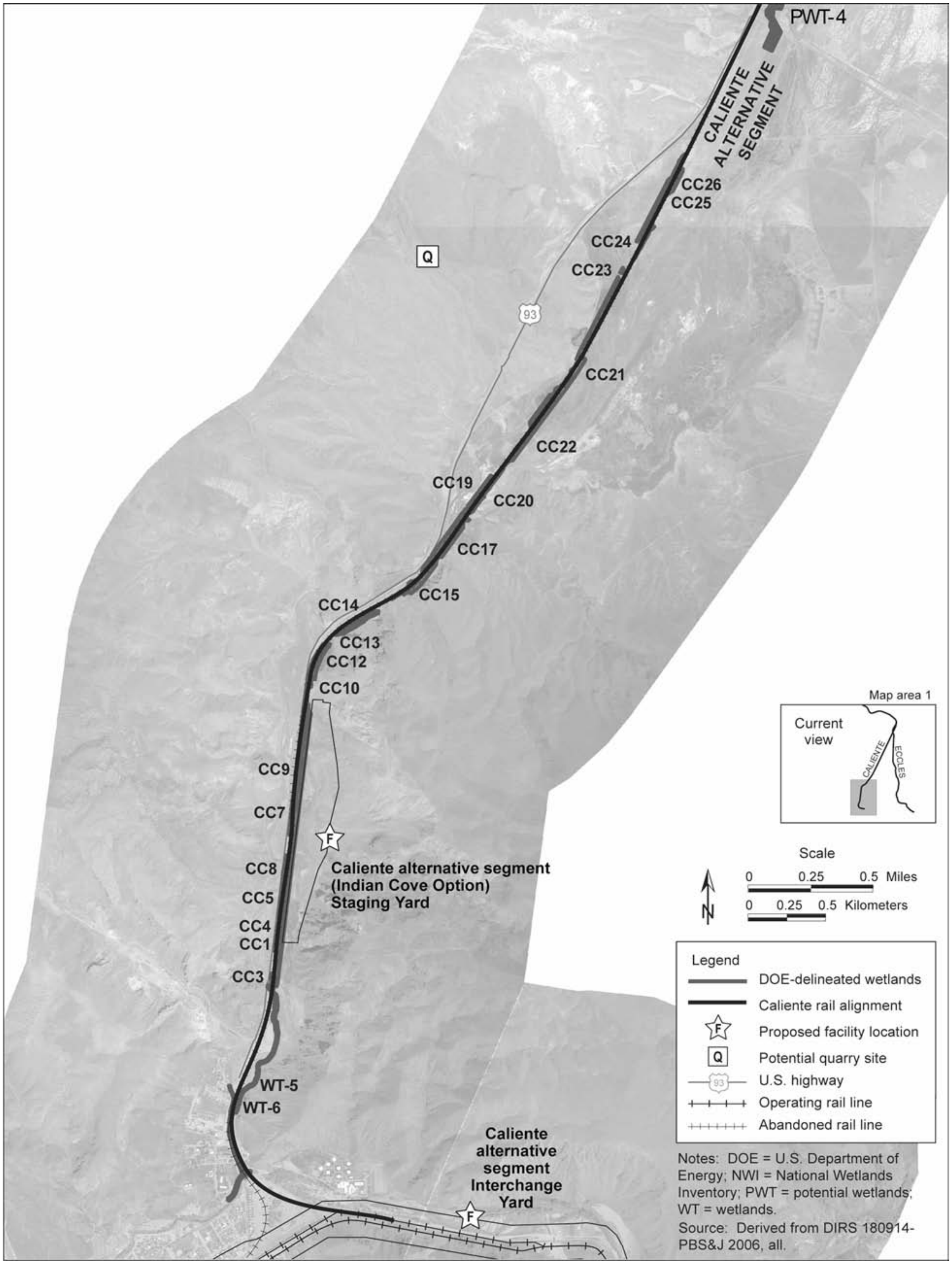


Figure 3-62. Wetlands along the southern portion of Caliente alternative segment.

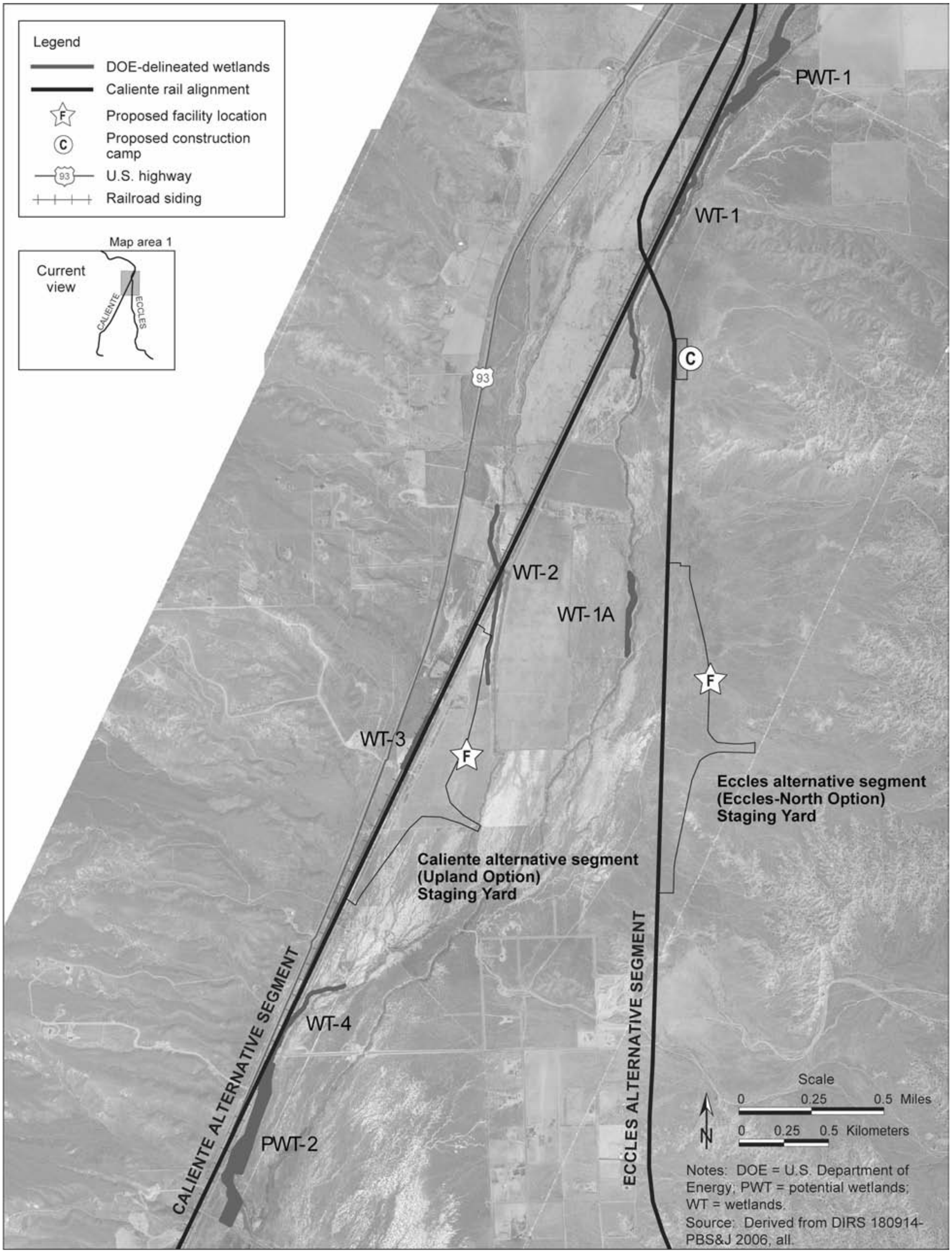


Figure 3-63. Wetlands along northern portion of Caliente alternative segment.

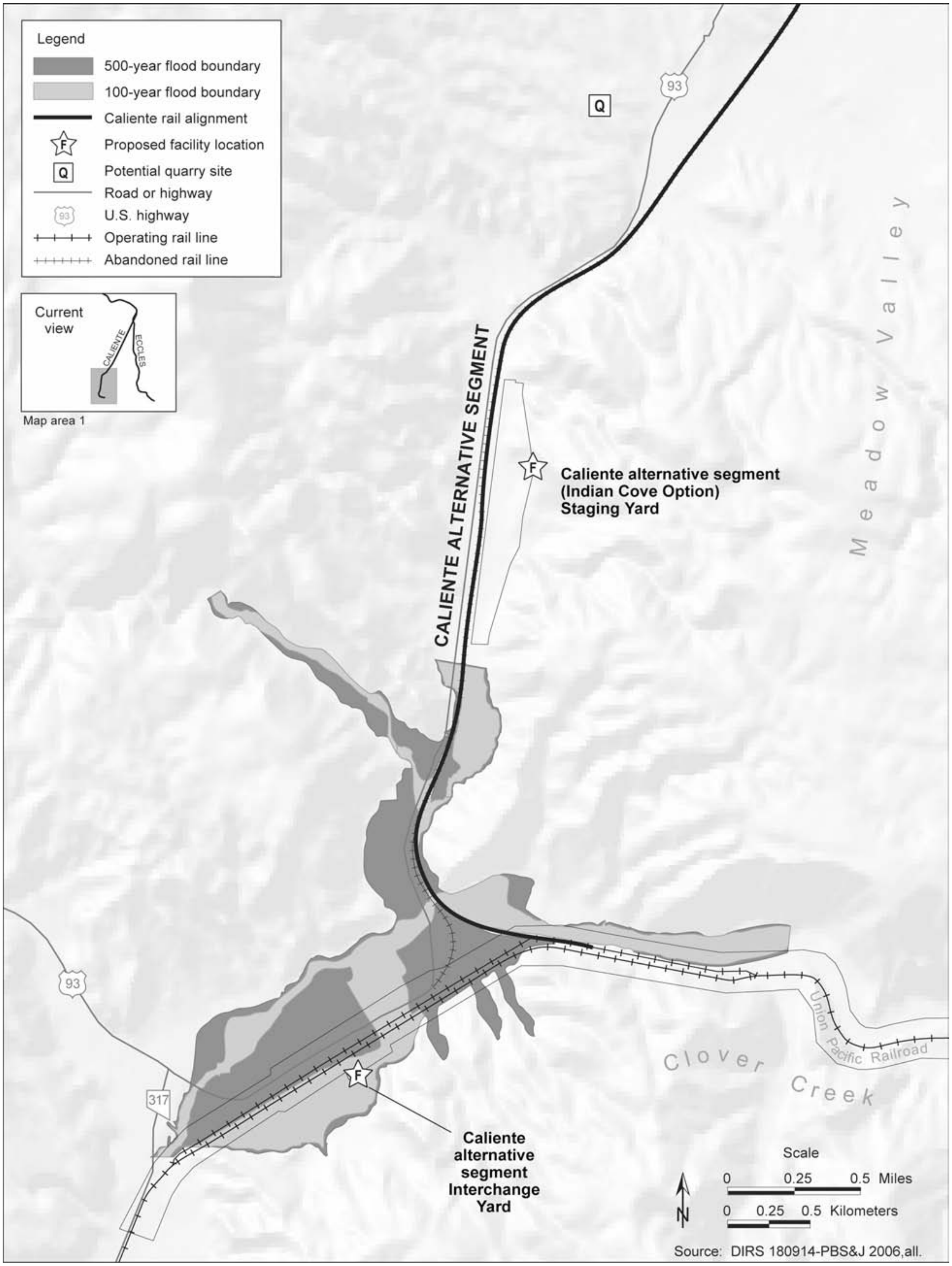


Figure 3-64. FEMA floodplain map for Caliente alternative segment.

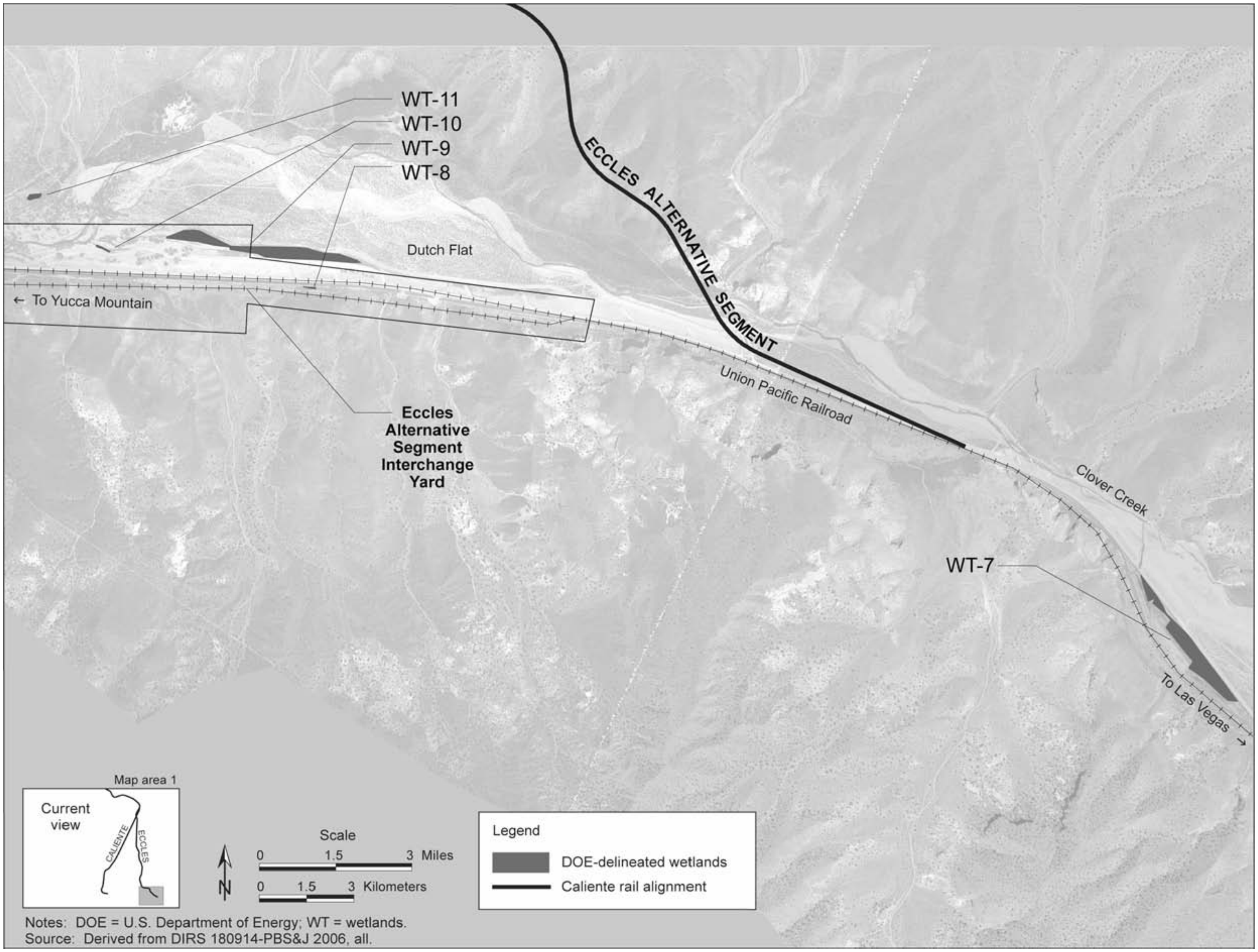


Figure 3-65. Wetlands in vicinity of Eccles Interchange Yard.

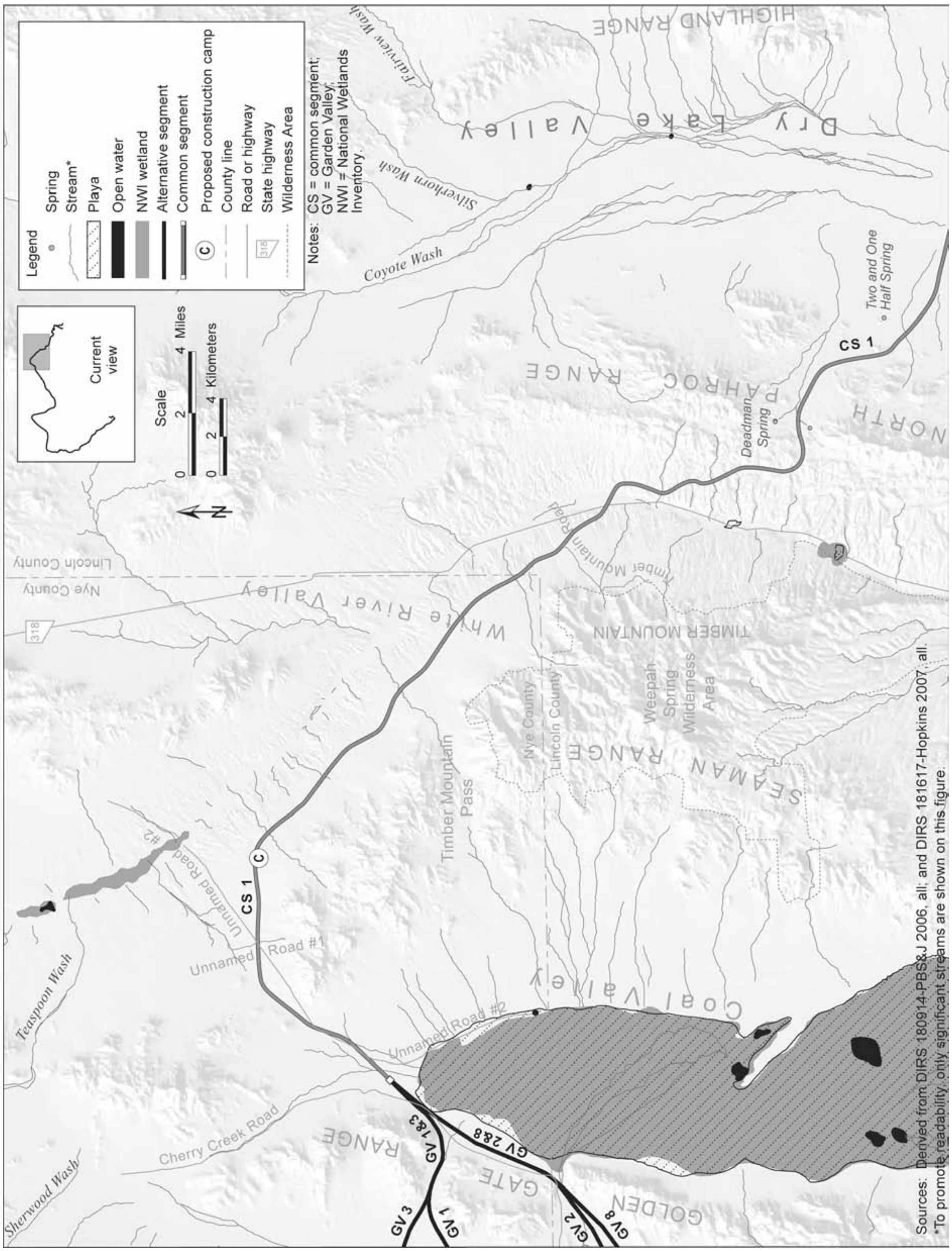


Figure 3.-66. Surface drainage within map area 2.

Table 3-24. Hydrologic features potentially relevant to Caliente rail alignment common segment 1.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from the Highland Range and the Chief Range. On the east side of these mountain ranges, flow travels down to Meadow Valley Wash. On the west side, the flow travels down through Bennett Pass and Dog Hollow to Coyote Wash and farther to Dry Lake Valley and Cliff Reservoir. Drainage from the east side of the North Pahroc Range to Dry Lake Valley Playa and Cliff Reservoir. Drainage from the Seaman Range and the North Pahroc Range to White River. Drainage from the western side of the Seaman Range to Coal Valley and on to Coal Valley Reservoir.	Segment would cross headwater tributaries of Bennett Springs Wash, Coyote Wash, and 20 unnamed tributaries. Alignment would cross seven of the unnamed tributaries multiple times. Alignment would cross White River and 54 unnamed tributaries, and two unnamed tributaries to the Coal Valley Playa. Alignment would cross a total of 144 washes.	Alignment would be within 1.6 kilometers of Casselton Wash and Little Red Wash. Alignment would cross within 1.2 kilometers of Dry Lake Valley Playa. White River Reservoir, Rye Patch Reservoir, pond/reservoir in the foothills of the Seaman Range. Three DOE-delineated isolated wetlands within 0.63 kilometer. Bennett Springs 1.1 kilometers north. Black Rock Spring 1.2 kilometers south. Deadman Spring 1.1 kilometers north. Sand Spring 1.2 kilometers south. Two and One Half Spring 1.4 kilometers north. Unnamed spring 0.63 kilometer south.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 62-63.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

In the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east), Caliente common segment 1 would pass within 600 meters (2,000 feet) of a small group of three isolated wetlands. DOE delineated these isolated, non-jurisdictional (not regulated under Section 404 of the Clean Water Act), wetlands during the field survey in support of this Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figure 4S). Appendix F provides additional information on these wetlands.

The Federal Emergency Management Agency has published one flood map for part of the area that Caliente common segment 1 would cross. This map covers a portion of land in White River Valley and the adjacent north end of the Seaman Range. According to this flood map, common segment 1 would not cross any floodplains, but the map does show a floodplain approximately 2 kilometers (1.2 miles) northeast of the rail alignment along the White River. It is reasonable to assume that the White River channel is a floodplain. It is also reasonable to assume that the playas of the Dry Lake Valley have associated floodplains. Appendix F provides additional information on floodplains.

There is a series of springs that would be outside the construction right-of-way but within 1.6 kilometers (1 mile), near the summit of the North Pahroc Range pass. Table 3-24 lists these springs. Bennett Springs is on private land in the general area of the eastward approach to Bennett Pass.

3.2.5.3.3 Garden Valley Alternative Segments

In Garden Valley, the Caliente rail alignment has four alternative segments (Table 3-25 and Figure 3-67). The four alternative segments that would cross Garden Valley are designated Garden Valley 1, Garden Valley 2, Garden Valley 3 (the northernmost route) and Garden Valley 8 (the southernmost route).

Table 3-25. Hydrologic features potentially relevant to the Garden Valley alternative segments (page 1 of 2).[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Garden Valley alternative segment 1		
Drainage from the Quinn Canyon Range, the Grant Range, and the Worthington Mountains across Garden Valley and through the Golden Gate Range to join drainage from the Seaman Range and flow farther to Coal Valley and to Coal Valley Reservoir. Alternative segment encompasses a small headwater section of the Sand Spring Valley drainage system.	Segment would cross Cottonwood Creek, Pine Creek, Cherry Creek, Bruno Creek, Sand Creek, and 20 other tributaries. Coal Valley Playa.	30 unnamed washes/tributaries for described drainage systems. Ponds/reservoirs. Modes Hole Spring 1.3 kilometers north.
Garden Valley alternative segment 2		
Drainage from the Quinn Canyon Range, the Grant Range, and the Worthington Mountains across Garden Valley and through the Golden Gate Range to join drainage from the Seaman Range and flow farther to Coal Valley and to Coal Valley Reservoir. Alternative segment encompasses a small headwater section of the Sand Spring Valley drainage system.	Segment would cross Cottonwood Creek, the Golden Gate Range water gap, and 17 other tributaries. The segment would follow the drainage of Garden Valley down though the Golden Gate Range Water Gap and cross the drainage system in multiple places. Coal Valley Playa.	22 unnamed washes/tributaries for described drainage systems.
Garden Valley alternative segment 3		
Drainage from the Quinn Canyon Range, the Grant Range, and the Worthington Mountains across Garden Valley and through the Golden Gate Range to join drainage from the Seaman Range and flow farther to Coal Valley and to Coal Valley Reservoir. Alternative segment encompasses a small headwater section of the Sand Spring Valley drainage system.	Segment would cross Cottonwood Creek, Pine Creek, Cherry Creek, Bruno Creek, Sand Creek, and 23 other tributaries. Coal Valley Playa.	Pond/reservoir. Modes Hole Spring 1.3 kilometers east.

Table 3-25. Hydrologic features potentially relevant to the Garden Valley alternative segments (page 2 of 2).

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Garden Valley alternative segment 8		
Drainage from the Quinn Canyon Range, the Grant Range, and the Worthington Mountains across Garden Valley and through the Golden Gate Range to join drainage from the Seaman Range and flow farther to Coal Valley and to Coal Valley Reservoir. Alternative segment encompasses a small headwater section of the Sand Spring Valley drainage system.	Segment would cross Cottonwood Creek, the Golden Gate Range Water Gap, and 16 other tributaries. Coal Valley Playa.	Ponds/reservoirs. Put Back Spring 0.42 kilometer west.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 61-62.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Construction camp 4 would be along Joe Barney Pass Road, approximately 4.8 kilometers (3 miles) northeast of the junction any of the Garden Valley alternative segments with Caliente common segment 2 (Figure 3-63). There are no potential quarry sites along the Garden Valley alternative segments (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

All four of the Garden Valley alternative segments would cross through the Golden Gate Range, but at two different locations. The southerly alternative segments (Garden Valley 2 and 8) would pass through the topographic feature designated as Water Gap and the northerly alternative segments (Garden Valley 1 and 3) would cross an unnamed pass approximately 7.2 kilometers (4.5 miles) north of Water Gap. In Garden Valley, intermittent surface water from the Quinn Canyon Range, the Grant Range, and the Worthington Mountains drains via Cottonwood Creek and its tributaries through the Golden Gate Water Gap. After the Garden Valley alternative segments pass through the Golden Gate Range, they would cross Garden Valley at different locations on their way to a common point on the north end of the Worthington Mountains. Along Garden Valley alternative segments 1 and 3, surface water flows from the Quinn Canyon Range, the Grant Range, and Worthington Mountains via Cottonwood Creek, Bruno Creek, Sand Creek, Pine Creek, Cherry Creek, and unnamed tributaries through the Golden Gate Water Gap to join drainage from the Seaman Range and flow farther to Coal Valley. In Coal Valley, the water from Garden Valley seeps into basin fill sediments. Garden Valley alternative segment 3, which would loop a bit farther to the north, would cross these drainage features closest to their source in the Quinn Canyon Range. There are no streamflow or water-quality data available for the ephemeral washes the Garden Valley alternative segments would cross.

The Garden Valley alternative segments would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin. Therefore, there are no stream channels or washes identified along the proposed segments designated as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, p.7).

The National Wetlands Inventory dataset identifies Coal Valley Playa as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the rail alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 3). Garden Valley alternative segment 2 would skirt (within 1 kilometer [0.62 mile]) Coal Valley Playa. Coal Valley Playa is an area expected to be susceptible to flooding and standing water.

The Federal Emergency Management Agency has not published flood maps of this region; however, it is likely that areas in Garden Valley experience periodic flooding. Garden Valley alternative segment 2 would cross the drainage feature designated as Water Gap, which is described as a topographically constricted area through which several small drainage channels run. Although the area is normally dry, Water Gap must be considered a suspect area for flooding. Appendix F discusses floodplains and wetlands.

There are two springs within the region of influence for the Garden Valley alternative segments. Modes Hole Spring is 1.3 kilometers (0.78 mile) east of Garden Valley alternative segments 1 and 3 and Put Back Spring is 0.42 kilometer (0.26 mile) west of Garden Valley alternative segment 8 (see Figure 3-63).

3.2.5.3.4 Caliente Common Segment 2 (Quinn Canyon Range Area)

Leaving the west end of Garden Valley, Caliente common segment 2 would cross west along the northern edge of Sand Spring Valley, skirting the Quinn Canyon Range, before it crossed into Railroad Valley, and then Reveille Valley (Table 3-26 and Figures 3-67 and 3-68). Construction camp 5 would be along Caliente common segment 2 approximately 11 kilometers (6.5 miles) east of the junction of Caliente common segment 2 and the South Reveille alternative segments. There are no potential quarry sites along common segment 2 (DIRS 180922-Nevada Rail Partners 2007, Figure 3-D).

Caliente common segment 2 would cross several stream channels or washes, as listed in Table 3-26. The segment would run perpendicular to drainage flow from the Quinn Canyon Range to a playa in Sand Spring Valley. After crossing Sand Spring Valley, Caliente common segment 2 would enter Railroad Valley and cross State Highway 375. After crossing State Highway 375 in Railroad Valley, Caliente common segment 2 would cross unnamed washes that originate in the northern tip of the Belted Range (Gray Top Mountain) and drain to the northeast and north in Railroad Valley toward a playa area. Caliente common segment 2 would terminate south of the Reveille Range. There is a notable unnamed wash less than 0.8 kilometer (0.5 mile) to the north of the end of Caliente common segment 2.

Caliente common segment 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin. Therefore, there are no stream channels or washes identified along the segment designated as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, p. 7). There are no streamflow or water-quality data available for the streams and washes Caliente common segment 2 would cross.

The National Wetlands Inventory dataset does not indicate the presence of wetlands along Caliente common segment 2. Appendix F provides additional information on wetlands along the Caliente rail alignment.

Federal Emergency Management Agency flood maps cover only the west end of Caliente common segment 2 in Railroad and Reveille Valleys. The maps show that Caliente common segment 2 would not cross any floodplains. Appendix F provides additional information on floodplains along the Caliente rail alignment.

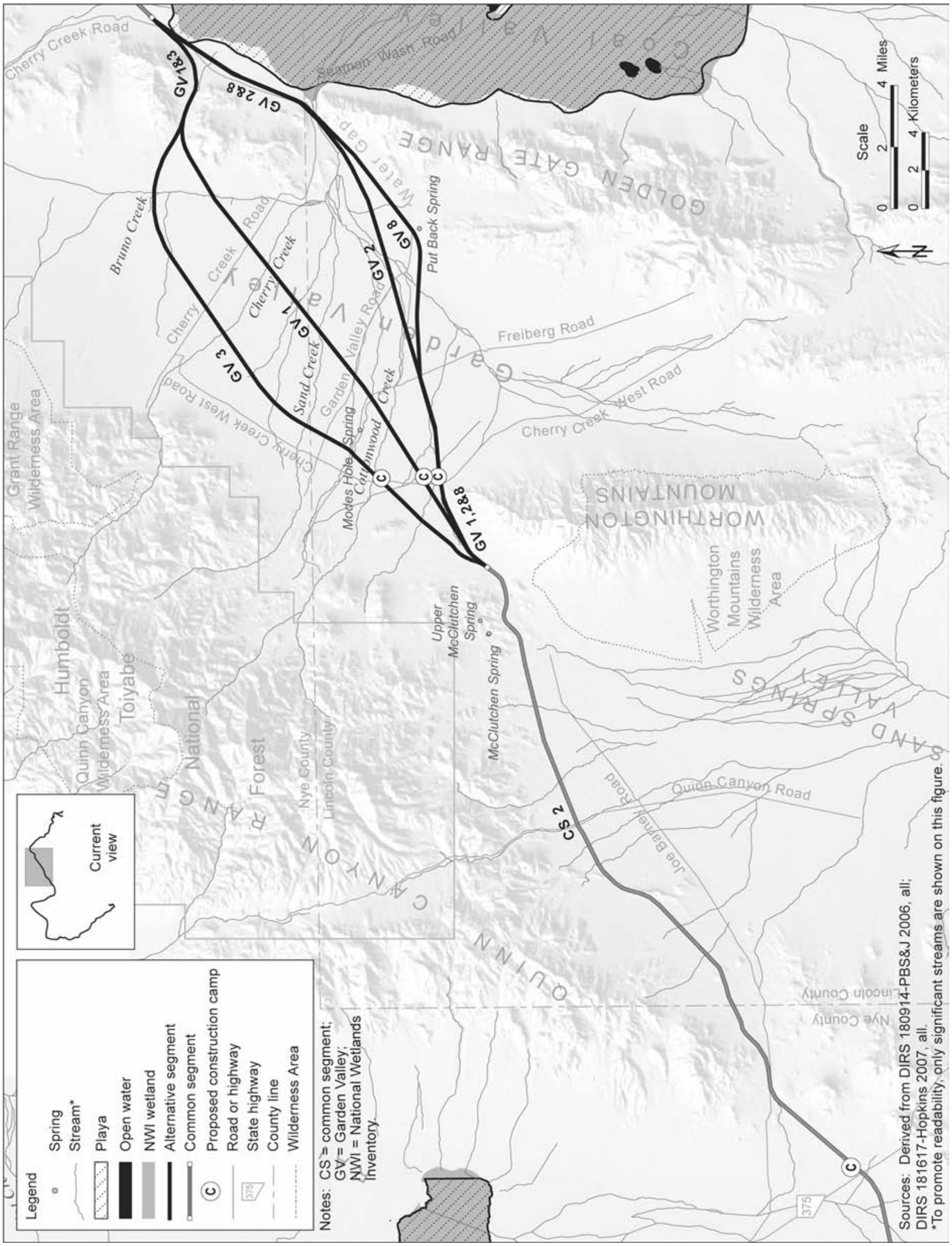


Figure 3-67. Surface drainage within map area 3.

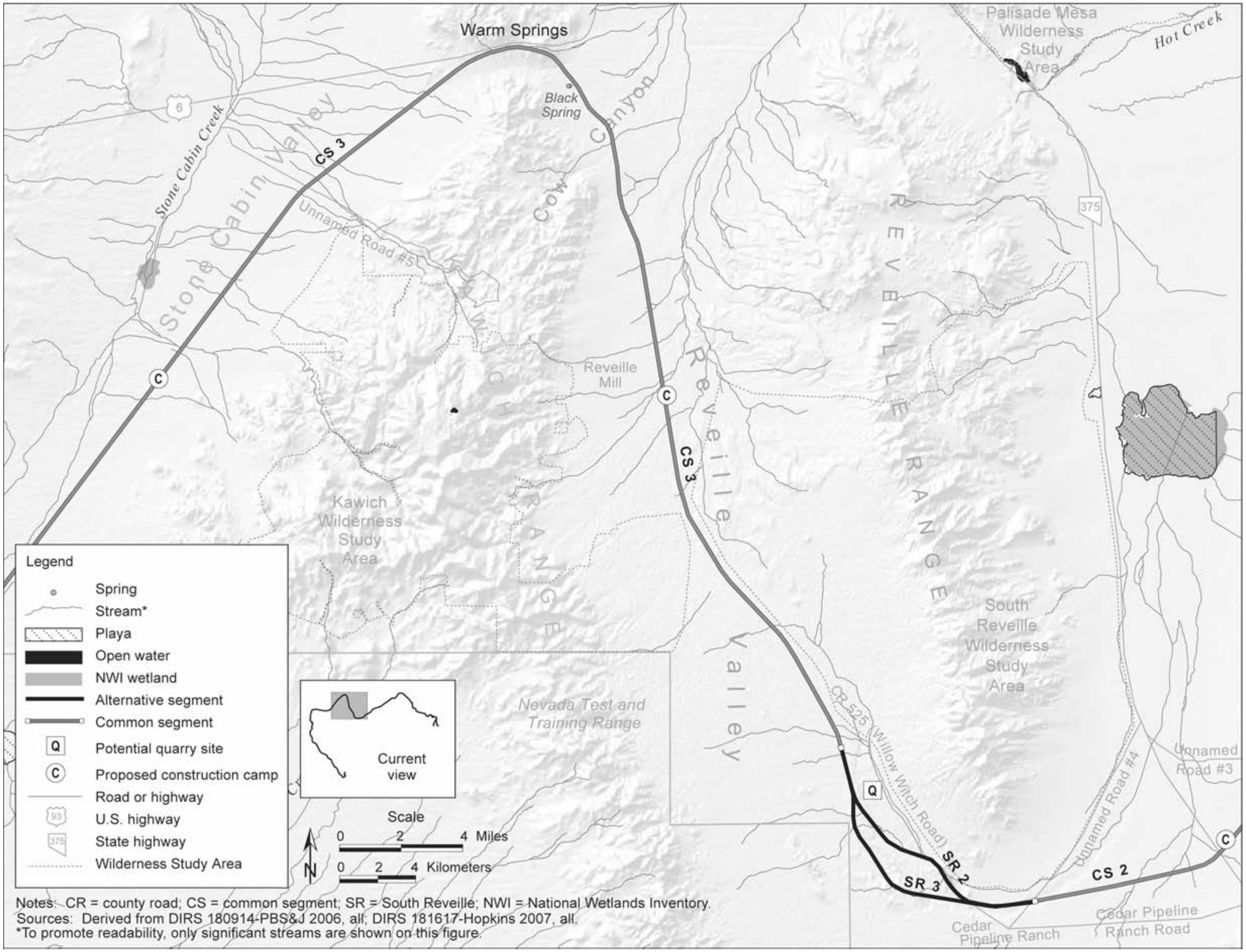


Figure 3-68. Surface drainage within map area 4.

Table 3-26. Hydrologic features potentially relevant to Caliente rail alignment common segment 2.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from the Worthington Mountains and the southern tip of the Quinn Canyon Range to playas in Sand Spring Valley and Railroad Valley, respectively. Drainage from southern end of Reveille Range and northern tip of the Belted Range (Gray Top Mountain) to Railroad Valley.	Segment would cross 27 unnamed tributaries and 8 tributaries to Railroad Valley Wash.	McCutchen Spring 1 kilometer north. Upper McCutcheon Spring 1.2 kilometers north. Cedar Pipeline Ranch Spring 1.6 kilometers south.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 61.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

McCutchen Spring would be 1 kilometer (0.65 mile) north and Upper McCutcheon Spring would be 1.2 kilometers (0.76 mile) north of Caliente common segment 2.

3.2.5.3.5 South Reveille Alternative Segments

Caliente common segment 2 would end near the south end of the Reveille Range where DOE is considering two short alternative segments (South Reveille 2 and 3) (Table 3-27 and Figure 3-68). There are two potential quarry sites, NN-9a and NN-9b, in Reveille Valley to the east of the junction of the South Reveille alternative segments and Caliente common segment 3. Potential quarry site NN-9A would be about 490 meters (1,600 feet) east of where the South Reveille alternative segments converge (as shown on Figure 3-26) before joining Caliente common segment 3. Quarry site NN-9B would be within 300 meters (1,000 feet) north of South Reveille alternative segment 2 (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

Both alternative segments would be within areas that receive drainage from the Kawich Range and the Reveille Range, which then flows into Railroad Valley. South Reveille alternative segment 2 would proceed north up Reveille Valley, along a notable unnamed braided wash, crossing it several times. South Reveille alternative segment 3 would run farther west before proceeding up Reveille Valley, thus avoiding the wash in this area. Both alternative segments would cross tributaries associated with this braided channel. There are no washes within the areas of the two potential South Reveille quarry sites. However, potential quarry NN-9A would overlie an unnamed tributary of the braided channel.

South Reveille alternative segments 2 and 3 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin. Therefore, there are no stream channels or washes identified along the alternative segments that are designated as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, p. 7). There are no streamflow or water-quality data available for the streams and washes these alternative segments would cross.

The National Wetlands Inventory dataset does not indicate the presence of wetlands along either of the South Reveille alternative segments. Appendix F provides additional information on wetlands located along the Caliente rail alignment.

Table 3-27. Hydrologic features potentially relevant to the South Reveille alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
South Reveille alternative segment 2		
Drainage from the Kawich Range and the Reveille Range to Reveille Valley and on to Railroad Valley.	Segment would cross tributaries to the unnamed notable braided wash running from Reveille Valley into Railroad Valley. Segment would run along and cross the same notable braided wash from Reveille Valley into Railroad Valley for approximately of 3.1 kilometers. Segment would cross a total of 9 washes.	None.
South Reveille alternative segment 3		
Drainage from the Kawich Range and the Reveille Range to Reveille Valley and on to Railroad Valley.	Segment would cross tributaries to unnamed braided wash running from Reveille Valley into Railroad Valley. Segment would cross a total of 11 washes.	None.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 61.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Federal Emergency Management Agency flood maps cover all of the land area of these two short alternative segments. Although South Reveille alternative segment 2 would run alongside a notable unnamed braided wash, it would not cross it. South Reveille 2 would run through a 3.1-kilometer (1.9-mile) stretch of the 100-year floodplain associated with five of the tributaries that drain to the notable unnamed braided wash. South Reveille alternative segment 3, farther away from the wash, would not cross any 100-year floodplains. Appendix F provides additional information on the floodplains South Reveille alternative segment 2 would encounter.

There are no springs within the South Reveille alternative segments regions of influence.

3.2.5.3.6 Caliente Common Segment 3 (Stone Cabin Valley Area)

Caliente common segment 3 would run northward through the Reveille Valley (Table 3-28 and Figures 3-68 and 3-69) and then skirt the western side of the Kawich Range in a southerly direction approximately 3.2 to 4.8 kilometers (2 to 3 miles) from and parallel to Stone Cabin Valley. DOE would construct the Maintenance-of-Way Trackside Facility in the southwestern portion of Stone Cabin Valley near the northern boundary of the Nevada Test and Training Range. The Maintenance-of-Way Trackside Facility would be on the north side of the common segment approximately 26 kilometers (16 miles) east of its junction with the Goldfield alternative segments (Figure 3-65). ***Construction camps*** 6, 7, and 8 would be along Caliente common segment 3. There are no surface-water features at or near the proposed locations of the Maintenance-of-Way Trackside Facility or construction camps. There are no potential quarry sites along this common segment (DIRS 180922-Nevada Rail Partners 2007, Figure 3-F).

Table 3-28. Hydrologic features potentially relevant to Caliente common segment 3.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from the Kawich Range and the Reveille Range to Reveille Valley and on to Hot Creek Valley.	36 tributaries/washes, 33 flowing toward Reveille Valley and on to Hot Creek Valley; the other 3 unnamed washes flowing toward a playa in Railroad Valley.	Mud Lake Playa. Black Spring 0.31 kilometer east.
Drainage from the Kawich Range and the Reveille Range to Stone Cabin Valley and Reveille Valley, respectively. Drainage from the west side of the Kawich Range flows to Stone Cabin Valley. Drainage from the east side of the Kawich Range flows to Reveille Valley and on to Hot Creek Valley.	Segment would cross 6 tributaries of Stone Cabin Creek/Willow Creek and 15 tributaries of Hot Creek, including Cow Canyon Wash. Segment would run parallel to drainage running to the Reveille Range.	
Drainage from the west side of the Kawich Range, Monitor Range, Monitor Hills, San Antonio Mountains to Stone Cabin Valley and Ralston Valley and on to Mud Lake Playa and Cactus Flats.	Segment would cross Ralston Valley Wash, Saulsbury Wash, and Willow Creek (also referred to as Stone Cabin Creek), and 32 unnamed tributaries. Maintenance-of-Way Trackside Facility would cross one notable drainage.	

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 54-55, 59, 61.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Drainage from the east side of the Kawich Range and drainage from the Reveille Range flows to Reveille Valley and on to Hot Creek Valley. Drainage from the west side of the Kawich Range flows down to Stone Cabin Valley. Common segment 3 would cross three tributaries to the unnamed braided channel that flows toward Railroad Valley, tributaries that flow on to Hot Creek Valley, including Cow Canyon Wash, and tributaries of Willow Creek in Stone Cabin Valley. The Cow Canyon wash drains northeast to a notable north-flowing wash on the floor of the Reveille Valley.

After crossing Warm Springs Summit, Caliente common segment 3 would turn to the southwest and proceed through Stone Cabin Valley skirting the western side of the Kawich Range in a southerly direction generally parallel to Stone Cabin Valley. Closer to the northern boundary of the Nevada Test and Training Range, common segment 3 would turn west and cross the braided drainage path designated as Willow Creek. Willow Creek provides drainage for the southern end of the Monitor Range (including Monitor Hill) and the western portion of the Kawich Range. Tributaries such as Saulsbury Wash feed into this drainage from north of U.S. Highway 6, and the drainage terminates at Mud Lake Playa, approximately 5.1 kilometers (3.2 miles) south of the termination of common segment 3. It is joined by a second notable tributary of Mud Lake Playa flowing north to southwest out of the central portion of Ralston Valley. A large portion of Mud Lake Playa is within the Nevada Test and Training Range. Common segment 3 would skirt along the northern and western boundaries of this large playa, approximately 1.4 kilometers (0.89 mile) away from the playa.

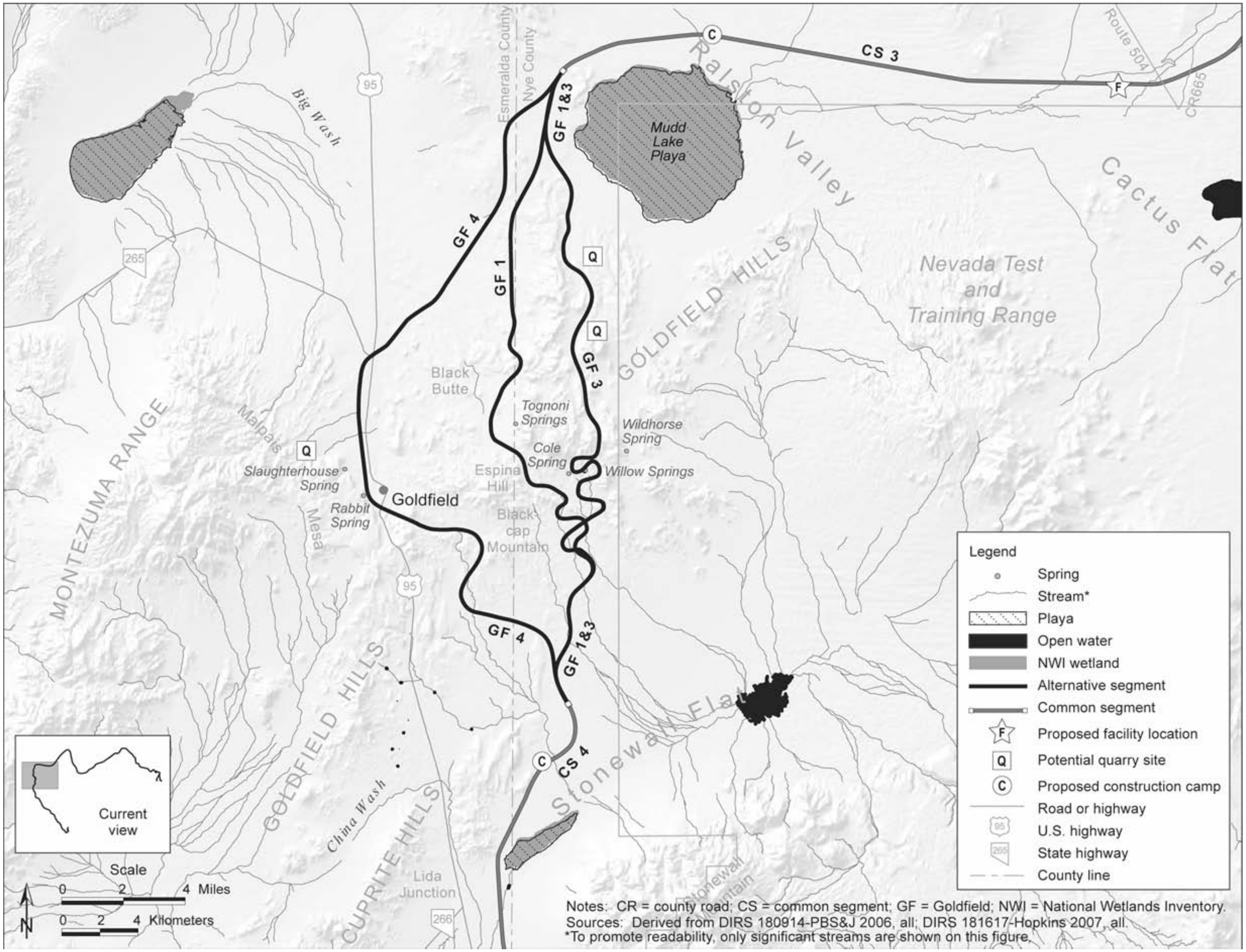


Figure 3-69. Surface drainage within map area 5.

Caliente common segment 3 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180914-PBS&J 2006, p. 7). No streamflow or water-quality data are available for the streams and washes common segment 3 would cross.

The National Wetlands Inventory map classifies Mud Lake Playa as a wetland; however, field studies conducted in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the rail alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 3). DOE did not identify any other wetlands along common segment 3. Appendix F provides additional information on wetlands along the Caliente rail alignment.

Most of common segment 3 would cross land that has Federal Emergency Management Agency flood map coverage. According to these maps, common segment 3 would not cross floodplains until it neared the vicinity of Mud Lake Playa and its tributaries. From the east, common segment 3 would first encounter a floodplain associated with Stone Cabin Creek and Saulsbury Wash as they converge on the area of the playa. The segment would then cross the floodplain of a notable wash draining the central Ralston Valley and finally cross through two legs of a drainage system coming down from western Ralston Valley. Appendix F provides more information on the floodplains common segment 3 would cross.

Black Spring is within the Caliente common segment 3 region of influence, approximately 0.31 kilometer (0.19 mile) east of the common segment.

3.2.5.3.7 Goldfield Alternative Segments

Turning south at Mud Lake Playa, the Caliente rail alignment has three proposed alternative segments: the western alternative segment (Goldfield 4), a central alternative segment (Goldfield 1), and an eastern alternative segment (Goldfield 3) (Table 3-29 and Figure 3-69). From the point where Caliente common segment 3 would end, Goldfield alternative segment 4 would proceed toward the southwest, passing around the west side of the community of Goldfield. Goldfield alternative segment 1 would pass southward through the center of the Goldfield Hills, first generally along the boundary between Esmeralda and Nye Counties, along the eastern side of Goldfield, and then winding southeastward toward a point beyond which the alternative segment would coincide with the southern portion of Goldfield alternative segment 3. The eastern alternative segment (Goldfield 3) would trend south-southeastward, in a meandering path, to the east of Goldfield and to the west of the western boundary of the Nevada Test and Training Range. The Goldfield alternative segments would end at the western part of Stonewall Flat, approximately 16 kilometers (10 miles) southeast of Goldfield.

There are three potential quarry sites along the Goldfield alternative segments – two along Goldfield alternative segment 3 and one that would be accessible from Goldfield alternative segment 4. Quarry sites NS-3A and NS-3B would be northeast of Goldfield 3 approximately 4 kilometers (2.5 miles) south of its junction with common segment 3. Quarry site ES-7 would be to the west of Goldfield 4 approximately 24 kilometers (15 miles) southwest of its junction with common segment 3 (DIRS 180922-Nevada Rail Partners 2007, Figure 3-F).

Generally, drainage within the area of the Goldfield alternative segments flows from the Goldfield Hills, the Montezuma Range, and the Chispa Hills to Mud Lake, Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat. While still north of Goldfield, Goldfield alternative segments 1 and 4 would cross a notable tributary to Indian Springs Canyon Wash, which drains the northwestern side of the Montezuma Range. Indian Springs Canyon Wash merges with Big Wash along the east side of U.S. Highway 95 and then terminates approximately 10 kilometers (6.2 miles) west of U.S. Highway 95 at the Alkali Lake

Playa. As they passed through the community of Goldfield and the Chispa Hills, each alternative segment would cross numerous unnamed tributaries, as listed in Table 3-29.

Table 3-29. Hydrologic features potentially relevant to the Goldfield alternative segments.a

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Goldfield alternative segment 1		
Drainage from the Goldfield Hills and Chispa Hills to Mud Lake, Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat.	Segment would cross tributary to Big Wash and unnamed tributaries that flow to Mud Lake, Stonewall Flat Playa, Mud Lake Playa, and Alkali Lake Playa. Segment would cross a total of 25 washes.	Mud Lake Playa 1.4 kilometers west. Cole Spring 1 kilometer east. Tognoni Springs 1.2 kilometers east.
Goldfield alternative segment 3		
Drainage from the Goldfield Hills and Chispa Hills; to Mud Lake, Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat.	Segment would cross unnamed tributaries that flow to Mud Lake, Stonewall Flat Playa, and Mud Lake Playa. Segment would cross unnamed wash draining southeastern Goldfield Hills to Stonewall Flat. Segment would cross a total of 15 washes. Willow Springs 0.14 kilometer north.	Mud Lake Playa 1.4 kilometers west. Cole Spring 0.33 kilometer west. Wildhorse Spring 1.5 kilometers east.
Goldfield alternative segment 4		
Drainage from the Montezuma Range, Goldfield Hills, and Chispa Hills to Mud Lake, Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat.	Segment would cross 26 unnamed tributaries that flow to Mud Lake, Stonewall Flat Playa, Alkali Lake Playa, and Mud Lake Playa.	Rabbit Spring 0.22 kilometer west. Slaughterhouse Spring 0.97 kilometer west.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

In the area where Goldfield alternative segments 1, 3, and 4 would end (just before the start of Caliente common segment 4), the alternative segments would cross another notable drainage – an unnamed wash that drains the southeastern Goldfield Hills and into Mud Lake. Goldfield 4 would actually cross this same drainage feature four times – twice at points farther up the hill, then again in the area where it would be the same as the other two Goldfield alternative segments. Goldfield alternative segments 1 and 3 and a small portion of Goldfield alternative segment 3 would skirt around the western end of Mud Lake Playa, approximately 1.3 to 1.5 kilometers (0.83 to 0.94 mile) away.

The Goldfield alternative segments would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin. Therefore, there are no stream channels or washes identified along the alternative segments designated as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, p. 7). No streamflow or water-quality data are available for the stream channels and washes these alternative segments would cross.

The potential quarry sites to the northeast of the Goldfield alternative segments, NS-3A and NS-3B, would excavate and extract rock from two hills along the east side of Goldfield alternative segment 3 and a hill centered along Goldfield alternative segment 3. An unnamed wash that would run nearly parallel to Goldfield 3 flows between the two hills DOE would quarry as part of the NS-3A quarry site. This unnamed wash appears to originate from the hills that would be excavated and flows toward Mud Lake Playa. The proposed access road to potential quarry NS-3A would cross one unnamed wash that flows toward Mud Lake Playa. The NS-3B quarry site would not intersect any washes. The potential quarry site to the west of the Goldfield alternative segments, ES-7, would not intersect any surface-water features; however, the proposed access road to this quarry would run alongside and cross one unnamed wash draining this area and would cross another. The first half of this road would run along existing roads, while the final stretch would be newly constructed (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

The National Wetlands Inventory dataset does not indicate the presence of wetlands or identify any hydric soils along the Goldfield alternative segments. Appendix F provides additional information on wetlands along the Caliente rail alignment.

Federal Emergency Management Agency flood maps cover the northern and southern portions of the Goldfield alternative segments, but not the central area that includes the community of Goldfield. According to these maps, the alternative segments would cross a small portion of the floodplain associated with Mud Lake Playa and each alternative segment would cross a small portion of the floodplain associated with the notable drainage channel leading to Stonewall Flat Playa. Appendix F provides more information about this floodplain.

There are several springs in the region of influence for all three Goldfield alternative segments (see Table 3-29). Willow Springs would be within the rail line construction right-of-way 0.14 kilometer (0.09 mile) north of Goldfield alternative segment 3. Cole Spring would be 1 kilometer (0.63 mile) east and Tognoni Springs 1.2 kilometers (0.76 mile) east of Goldfield alternative segment 1. Wildhorse Spring would be 1.5 kilometers (0.91 mile) east and Cole Spring would be 0.33 kilometer (0.21 mile) west of Goldfield 3. Rabbit Spring would be 0.22 kilometer (0.14 mile) and Slaughterhouse Spring 0.97 kilometer (0.6 mile) west of Goldfield alternative segment 4.

3.2.5.3.8 Caliente Common Segment 4 (Stonewall Flat Area)

South of the Goldfield Hills, Caliente common segment 4 would run south, crossing Stonewall Flat and Alkali Flat (both within the Lida Valley) (Table 3-30 and Figures 3-65 and 3-66). Construction camp 9 would be alongside the common segment approximately 5 kilometers (3 miles) south of its junction with the Goldfield alternative segments. There are no potential quarry sites along this common segment (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

The U.S. Geological Survey has designated Stonewall Flat and Alkali Flat as playas. Common segment 4 would pass around the southwest end of Stonewall Flat Playa and then to the east of Alkali Flat Playa. Surface water from Stonewall Flat discharges to Lida Valley. The estimated runoff for Stonewall Flat is 490,000 cubic meters (17 million cubic feet) per year (DIRS 101811-DOE 1996, Section 4.2.5.1). Common segment 4 would cross this drainage path. There are no ***perennial streams*** in any of the surrounding basins; rather, the many washes that drain the upland areas convey ephemeral flow that ponds on the playas during periods of intense precipitation. Common segment 4 would cross 10 unnamed channels from Stonewall Mountain and the Cuprite Hills.

Caliente common segment 4 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin.

Table 3-30. Hydrologic features potentially relevant to Caliente common segment 4.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from northwest side of Stonewall Mountain and the Cuprite Hills to Stonewall Flat Playa and Lida Valley Alkali Flat Playa.	Jackson Wash, China Wash, and seven unnamed washes.	Alkali Flat/Lida Valley Playa, Stonewall Flat Playa.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Therefore, there are no stream channels or washes identified along the segment designated as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, p. 7). No streamflow or water-quality data are available for the stream channels and washes this common segment would cross.

The National Wetlands Inventory map identifies the playas associated with Stonewall Flat as wetlands; however, field studies conducted in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 6). There are no wetlands within the region of influence for common segment 4. Appendix F provides additional information on wetlands along the Caliente rail alignment.

Federal Emergency Management Agency flood maps provide coverage for a good portion of common segment 4. The maps show that the common segment would cross 1 kilometer (0.6 mile) of the 100-year floodplain associated with the drainage between Stonewall Flat Playa and Alkali Flat Playa in Lida Valley. Appendix F provides more information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of Caliente common segment 4.

3.2.5.3.9 Bonnie Claire Alternative Segments

Bonnie Claire alternative segment 2 would begin south of Stonewall Flat, exit Lida Valley, and turn to the east, entering Sarcobatus Flat, a large playa. Sarcobatus Flat is bounded by Pahute Mesa on the east and Gold Mountain on the west (Table 3-31 and Figure 3-70). There are no construction camps or quarries proposed for Bonnie Claire 2.

Bonnie Claire 2 would be in an area that receives drainage from Stonewall Mountain, the foothills of Gold Mountain, and Northern Pahute Mesa, which flows toward Lida Valley, Alkali Flat, and the Bonnie Claire area of Sarcobatus Flat. Unnamed washes run northeast to southwest, providing a path for overland flow from Pahute Mesa, including the south and southeast sides of Stonewall Mountain to Sarcobatus Flat. Bonnie Claire 2 would cross a notable braided wash at the north end of Sarcobatus Flat before running adjacent to the same wash for several kilometers. This braided wash flows from Stonewall Pass to the Bonnie Claire area of Sarcobatus Flat. There are no streamflow or water-quality data available for the stream channels and washes Bonnie Claire 2 would cross.

Bonnie Claire 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin.

Table 3-31. Hydrologic features potentially relevant to the Bonnie Claire alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Bonnie Claire alternative segment 2		
Drainage from Stonewall Mountain, the foothills of Gold Mountain, Stonewall Pass, and Northern Pahute Mesa to Lida Valley, Alkali Flat, and Bonnie Claire area within Sarcobatus Flat.	Segment would cross 31 unnamed washes, including an unnamed braided wash.	Alkali Flat/Lida Valley Playa.
Bonnie Claire alternative segment 3		
Drainage from the foothills of Gold Mountain, Stonewall Mountain, Stonewall Pass, and Northern Pahute Mesa to Lida Valley, Alkali Flat, and Bonnie Claire area within Sarcobatus Flat.	Segment would cross Alkali Flat/Lida Valley Playa. Segment would cross 23 washes.	None.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, pp. 59, 60, and 68.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Therefore, none of the washes along Bonnie Claire 2 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water (DIRS 180914-PBS&J 2006, p. 3).

There are no wetlands within the region of influence for Bonnie Claire 2.

Federal Emergency Management Agency flood maps cover most of Bonnie Claire 2, but do not include a portion of the land on the eastern side of the segment, which is shown on the maps as an old boundary of the Nevada Test and Training Range. Flood mapping does not extend east of this boundary. The flood maps also show a floodplain for an unnamed drainage feature from Pahute Mesa. The floodplain ends just south of Bonnie Claire 2 near one of the old Nevada Test and Training Range boundaries. It is possible that this floodplain would extend far enough to the northeast to be encountered by Bonnie Claire 2; however, the distance is too far to support such an assumption. In addition, Bonnie Claire 2 would run farther up in the foothill area where the wash would involve few tributaries. Appendix F provides additional information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of Bonnie Claire 2.

Bonnie Claire 3 would begin south of Stonewall Flat, exit Lida Valley, and continue south into Sarcobatus Flat, a large playa. Sarcobatus Flat is bounded by Pahute Mesa on the east and Gold Mountain on the west (Table 3-31 and Figure 3-66). There are no potential quarry sites or proposed construction camps along Bonnie Claire 3.

Bonnie Claire 3 would be in an area that receives drainage from Stonewall Mountain, the foothills of Gold Mountain, and the Northern Pahute Mesa, which flows toward the Lida Valley, Alkali Flat, and the Bonnie Claire area of Sarcobatus Flat. Unnamed washes run northeast to southwest, providing a path for overland flow from Pahute Mesa, including the south and southeast sides of Stonewall Mountain to Sarcobatus Flat.

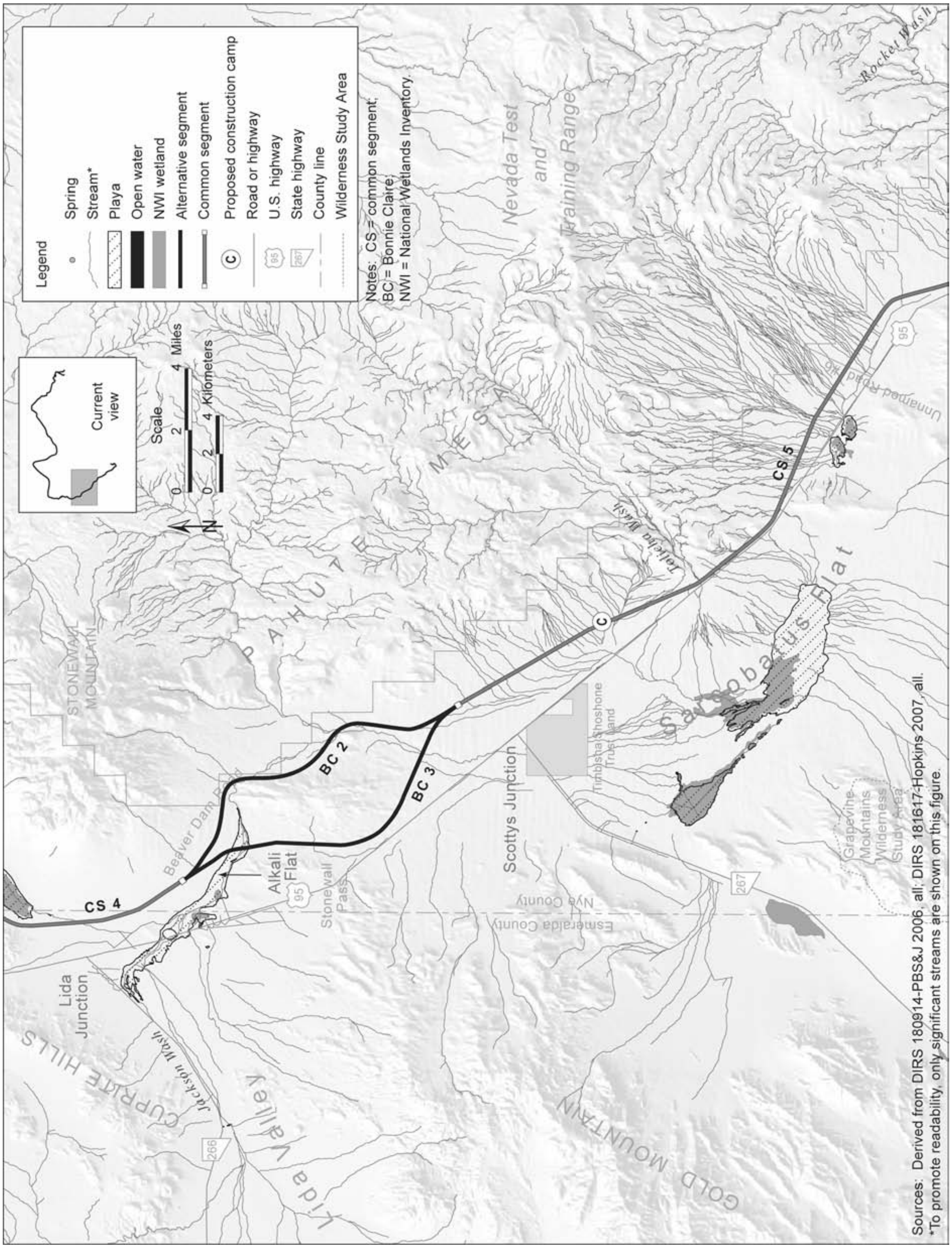


Figure 3-70. Surface drainage within map area 6.

Bonnie Claire 3 would pass through Alkali Flat Playa, a major playa shown in Figure 3-66, and cross a notable braided wash in Sarcobatus Flat. This braided wash flows from Stonewall Pass to the Bonnie Claire area of Sarcobatus Flat. There are no streamflow or water-quality data available for the stream channels and washes Bonnie Claire 3 would cross.

Bonnie Claire 3 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180914-PBS&J 2006, p. 3). Therefore, none of the washes along Bonnie Claire 3 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act because there are no connections to surface-water bodies with a connection to interstate water.

There are no wetlands within the region of influence for Bonnie Claire 3.

Federal Emergency Management Agency flood maps cover most of Bonnie Claire 3, but do not include a portion of the land on the eastern side of the segment, which is shown on the maps as an old boundary of the Nevada Test and Training Range. Flood mapping does not extend east of this boundary. Bonnie Claire 3 would cross a 100-year floodplain associated with Alkali Flat Playa. The flood maps also show a floodplain for an unnamed drainage feature from Pahute Mesa. The floodplain ends just south of Bonnie Claire 3 at one of the old Nevada Test and Training Range boundaries. The floodplain is close enough to Bonnie Claire alternative segment 3 that it is reasonable to assume it would be at a similar width if it extended farther up the wash to where Bonnie Claire 3 would cross. Appendix F provides additional information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of Bonnie Claire 3.

3.2.5.3.10 Common Segment 5 (Sarcobatus Flat Area)

Common segment 5 would begin approximately 3.1 kilometers (1.9 miles) east of U.S. Highway 95 and trend generally southeast, through the Sarcobatus Flat Area, and along the east side of U.S. Highway 95 (Table 3-32 and Figures 3-70 and 3-71). Common segment 5 would end approximately 6.4 kilometers (4 miles) north of Springdale. Construction camp 10 would be adjacent to the rail alignment and east of U.S. Highway 95. Numerous ephemeral washes draining downslope of Pahute Mesa would run through the construction camp. There are no potential quarry sites along common segment 5 (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

Common segment 5 would cross washes that drain the Tolicha Peak area of Pahute Mesa. Drainage from Pahute Mesa flows from the east into Sarcobatus Flat. The alluvial flat terrain between Tolicha Peak and U.S. Highway 95 is characterized by numerous braided washes. Although Sarcobatus Flat is an extensive topographic feature, there is only one portion designated as a minor playa that would be close to the rail alignment. The northern edge of this small playa is adjacent to U.S. Highway 95, and would be approximately 1.7 kilometers (1.1 miles) south of common segment 5 to the southeast of the point where Tolicha Wash crosses U.S. Highway 95. The segment would then cross surface drainage originating from Tolicha Peak and Springdale Mountain. No streamflow or water-quality data are available for the stream channels and washes common segment 5 would cross.

Common segment 5 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180914-PBS&J 2006, p. 3). Therefore, none of the washes along common segment 5 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface water bodies with a connection to interstate water.

Table 3-32. Hydrologic features potentially relevant to common segment 5.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from Pahute Mesa and Bullfrog Hills flows to playas within Sarcobatus Flat and Bonnie Claire Lake within Sarcobatus Flat.	Segment would cross Tolicha Wash and 123 other washes. The alluvial flat terrain between Tolicha Peak and U.S. Highway 95 is characterized by numerous braided washes. Washes within this type of soil and terrain can shift in number and geography with a variation of precipitation intensity.	Dry lake bed 0.5 kilometer south.

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, pp. 59, 60, 64, and 68.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

The National Wetlands Inventory map identifies the playas associated with Sarcobatus Flat as wetlands, but field studies conducted in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the rail alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 6). Appendix F provides more information about wetlands in this area.

Federal Emergency Management Agency flood maps provide coverage for almost all of common segment 5. The maps show that the segment would cross a 100-year floodplain associated with Tolicha Wash where it drains toward Sarcobatus Flat. Appendix F provides more information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of common segment 5.

3.2.5.3.11 Oasis Valley Alternative Segments

Oasis Valley alternative segment 1 would begin north of Oasis Mountain and would run southeast for approximately 9.8 kilometers (6.1 miles) before joining common segment 6 (Table 3-33 and Figure 3-71). Construction camp 11 would be along the west side of Oasis Valley 1 approximately 3.1 kilometers (1.9 miles) north of its junction with common segment 6. Several ephemeral washes flowing downslope from Bullfrog Hills and mountains to the east would run through the construction camp. There are no potential quarry sites along Oasis Valley 1 (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

Oasis Valley alternative segment 1 would cross the Amargosa River and its tributaries. Although referred to as a river, the Amargosa River and tributary branches and washes receive ephemeral flows from winter and summer storms, and perennial flows near springs and seeps. For most of the year, the tributaries carry no water. The Amargosa River has approximately 20 branches and 40 tributary washes in Oasis Valley. The main branch enters the valley from the north through Thirsty Canyon. Most of the drainage into Oasis Valley is from Pahute Mesa (including Oasis and Springdale Mountains to the north) and the Bullfrog Hills to the southwest. There are no streamflow or water-quality data available for this area; however, there is regional data for the Death Valley Basin (DIRS 176325-USGS 2006, all).

The Amargosa River interstate drainage system flows to Death Valley in California. A survey of washes along the Caliente rail alignment identified the Amargosa River and one tributary that Oasis Valley 1 would cross as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, p. 7 and Figure 3D).

There are no wetlands identified within the region of influence for Oasis Valley 1.

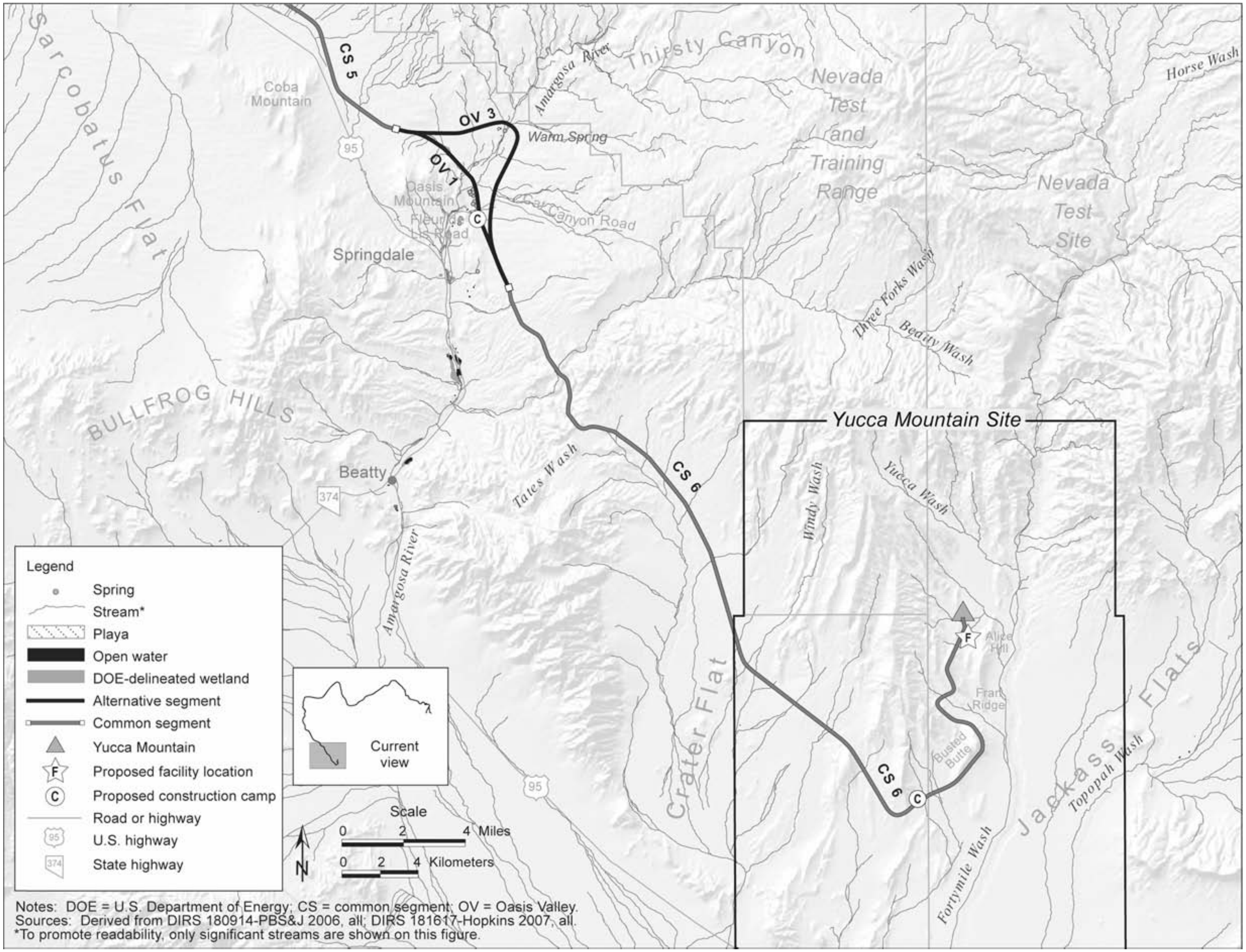


Figure 3-71. Surface drainage within map area 7.

Table 3-33. Hydrologic features potentially relevant to the Oasis Valley alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Oasis Valley alternative segment 1		
Drainage from Bull Frog Hills and the Pahute Mesa, including the Amargosa River and Amargosa River tributaries.	Segment would cross the Amargosa River and 23 unnamed washes.	Unnamed springs: 1.5 kilometers west 0.53 kilometer west 0.74 kilometer west 0.69 kilometer west 0.47 kilometer west 0.59 kilometer west 0.46 kilometer west 0.59 kilometer west 0.67 kilometer west 0.54 kilometer west 0.48 kilometer west 1.4 kilometers west 1.5 kilometers west
Oasis Valley alternative segment 3		
Drainage from Bull Frog Hills and the Pahute Mesa, including the Amargosa River and Amargosa River tributaries.	Segment would cross the Amargosa River, and 27 washes/tributaries to the Amargosa River.	Colson Pond (spring fed) 0.24 kilometer southwest. Small wetland 0.5 kilometer from Colson Pond. Unnamed springs: 0.2 kilometer west 1.1 kilometers west 1.2 kilometers west 1.2 kilometers west 1.3 kilometers west 1.3 kilometers west 1.3 kilometers west 1.4 kilometers west 1.4 kilometers west 1.5 kilometers west 1.5 kilometers west 1.6 kilometers west

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 64.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Federal Emergency Management Agency flood maps provide complete coverage for Oasis Valley 1. The maps show that the segment would cross a 100-year floodplain associated with the Amargosa River. Appendix F provides more information about this floodplain.

There are numerous springs in Oasis Valley and Thirsty Canyon near where Oasis Valley 1 would cross. Oasis Valley 1 would pass within 0.48 kilometer (0.30 mile) of several springs identified as the upper Oasis Valley Ranch Springs (DIRS 169384-Reiner et al. 2002, Figure 3). These springs are near the narrows through which the Amargosa River leaves Oasis Valley. Table 3-33 lists these springs. Oasis Valley alternative segment 3 would begin north of Oasis Mountain, generally run east and then south for approximately 14 kilometers (8.8 miles) and would cross Oasis Valley approximately 0.24 kilometer

(0.15 mile) northeast of Colson Pond before converging with common segment 6 (Table 3-33 and Figure 3-68). There are no potential quarry sites or proposed construction camps along Oasis Valley 3.

Oasis Valley 3 would cross the Amargosa River and its tributaries, as described above for Oasis Valley alternative segment 1.

A survey of washes along the Caliente rail alignment identified the Amargosa River, which Oasis Valley 3 would cross, as a water of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, p. 7 and Figure 3D).

DOE field surveys identified a small wetland associated with an unnamed seep approximately 0.5 kilometer (0.31 mile) from Colson Pond (DIRS 180914-PBS&J 2006, Figure 4T). Appendix F provides additional information about this wetland.

Federal Emergency Management Agency flood maps provide complete coverage for Oasis Valley 3. The maps show that the segment would cross a 100-year floodplain associated with the Amargosa River. Appendix F provides more information about this floodplain.

There are numerous springs in Oasis Valley and Thirsty Canyon near where Oasis Valley 3 would cross (see Table 3-33). Colson Pond is spring fed and would be within 0.24 kilometer (0.15 mile) of the alternative segment. This spring is commonly known as Colson Pond Spring (DIRS 169384-Reiner et al. 2002, Plate 2), but is also referred to as Warm Spring.

3.2.5.3.12 Common Segment 6 (Yucca Mountain Approach)

Common segment 6 would begin at the south juncture of the end of the Oasis Valley alternative segments and proceed to the southeast toward Yucca Mountain (Table 3-34 and Figure 3-71). The proposed location for construction camp 12 is adjacent to the rail line approximately 9.7 kilometers (6 miles) south of the ***geologic repository*** operations area. There are no potential quarry sites along common segment 6 (DIRS 180922-Nevada Rail Partners 2007, Figure 3-B).

Table 3-34. Hydrologic features potentially relevant to common segment 6.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from northern Yucca Mountain Range, including Tram Ridge, and Timber Mountain. Drainage from Yucca Mountain Range to Crater Flat and Amargosa Valley.	Segment would cross Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash, and 39 unnamed washes.	Fortymile Wash Midway Valley Wash

a. Sources: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, pp. 64 and 65.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Common segment 6 would cross terrain that drains from the southern end of Pahute Mesa and the Yucca Mountain Range to Crater Flat and the Amargosa River. The first significant tributary common segment 6 would cross is Beatty Wash and its tributaries, which provide drainage from Timber Mountain and Tram Ridge at the northern reaches of Yucca Mountain, to Oasis Valley and the Amargosa River at a point approximately 4.8 kilometers (3 miles) northeast of the community of Beatty. Beatty Wash is one of the largest tributaries of the Amargosa River. Common segment 6 would cross Beatty Wash at the north end of the Yucca Mountain Range, approximately 5.4 kilometers (3.4 miles) southeast of Oasis

Valley. After crossing Beatty Wash, common segment 6 would proceed to the southeast toward Yucca Mountain, where it would cross several tributaries of Tates Wash. Approximately 26 kilometers (16 miles) from the start of common segment 6, the segment would cross Windy Wash and unnamed washes carrying drainage from the eastern side of Yucca Mountain. The segment would then continue around the southern tip of the Yucca Mountain Range before turning northeast, skirting the eastern edge of Busted Butte and continuing between Bow and Fran Ridges.

Near the Yucca Mountain Site, Fortymile Wash, a major wash that flows to the Amargosa River, drains the eastern side of Yucca Mountain (DIRS 169734-CRWMS M&O 2004, p. 7.1-3). The tributaries draining into Fortymile Wash at Yucca Mountain include Yucca Wash to the north; Drill Hole Wash, which, together with a tributary in Midway Valley, drains most of the repository site; and Busted Butte Wash (also known as Dune Wash) to the south. Common segment 6 would cross Busted Butte Wash, some of its unnamed tributaries, and unnamed tributaries of Drill Hole Wash. The segment would not actually cross Drill Hole Wash, but the wash would be within the common segment 6 region of influence. Fortymile Wash runs parallel to the end of common segment 6 at the Yucca Mountain Site, but common segment 6 would not cross the wash. Fortymile Wash is the most prominent drainage through Jackass Flats to the Amargosa River (DIRS 155970-DOE 2002, p. 3-36, Figure 3-11).

All of common segment 6 is within the Amargosa River interstate drainage system in the Death Valley Basin. Of the numerous washes along common segment 6, 14 were identified as waters of the United States, as designated under Section 404 of the Clean Water Act (DIRS 180914-PBS&J 2006, Figures 3D and 3E). The Rail Equipment Maintenance Yard would be where the proposed rail line ends at Yucca Mountain. There are no perennial streams, natural bodies of water, or naturally occurring wetlands at Yucca Mountain (DIRS 155970-DOE 2002, p. 3-35). The facility would overlie an ephemeral stream but would not cross any waters of the United States.

No streamflow or water-quality data are available for drainage channels along common segment 6. There are no wetlands identified within the region of influence for common segment 6. Appendix F provides additional information on wetlands identified along the Caliente rail alignment.

Slightly more than half of common segment 6 has coverage on Federal Emergency Management Agency flood maps. These maps show that common segment 6 would cross a short span of the 100-year floodplain associated with Beatty Wash. Although the flood maps do not provide coverage for the area of the repository on the eastern side of Yucca Mountain, DOE has performed flood studies on several washes in that area, as addressed in the Yucca Mountain FEIS. An overlay of the Caliente rail alignment with Yucca Mountain FEIS Figure 3-12 indicates that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash. The rail line would terminate just before reaching a floodplain associated with Midway Valley Wash (also known as Sever Wash) (DIRS 155970-DOE 2002, pp. 3-38 and 3-39, and Figure 3-12). Appendix F further describes the floodplains associated with common segment 6.

There are no springs identified within 1.6 kilometers (1 mile) of common segment 6. Ute Springs, 270 meters (890 feet) west of U.S. Highway 95 in Oasis Valley, would be within about 0.6 to 0.88 kilometer (0.37 to 0.55 mile) of potential alternative well sites OV9 through OV12 (see Figure 3.7) near U.S. Highway 95 (DIRS 169384-Reiner et al. 2002, Plate 2).

3.2.6 GROUNDWATER RESOURCES

This section describes groundwater resources along the Caliente rail alignment. Section 3.2.6.1 describes the region of influence for groundwater resources; Section 3.2.6.2 is a general overview of groundwater features along the Caliente rail alignment; and Section 3.2.6.3 describes more specific features for each of the Caliente rail alignment alternative segments and common segments.

3.2.6.1 Region of Influence

The region of influence for groundwater resources along the Caliente rail alignment includes aquifers that would underlie areas of railroad construction and operations, portions of groundwater aquifers DOE would use to obtain water for construction and operations support and that would be affected by these groundwater withdrawals, and nearby springs that might be affected by such groundwater withdrawals. The horizontal extent of the region of influence varies depending on the particular aspects of the specific project activity, as follows:

- DOE used the nominal width of the rail line construction right-of-way and the footprints of construction and operations support facilities to define where there would be construction or other land disturbances. These areas could be susceptible to changes in groundwater ***infiltration***, discharge (for example, spring discharge), or quality. There could also be damage to, or loss of use of, an existing well (including potential need for well abandonment), if that well fell within the rail ***roadbed*** or was disturbed during construction activities. Review of the available information on the locations of existing wells indicates that rail roadbed construction would not disturb any existing wells. However, the precise locations of existing wells have not been field-verified and actual well locations might vary from the coordinates identified and cataloged for the wells in State of Nevada and U.S. Geological Survey (USGS) well databases (see Section 3.2.6.2.1).
- DOE used an initial screening-level distance of 1.6 kilometers (1 mile) on either side of the rail alignment centerline and an initial radius of 1.6 kilometers surrounding each proposed new well if that well would be outside of the nominal width of the construction right-of-way to define areas in the general vicinity of the rail alignment and proposed well locations that could also be affected by changes in groundwater discharge or quality at existing wells or springs. DOE used the same distance criteria to identify whether there could be damage to, or loss of use of, an existing well if that well fell within the rail roadbed or was disturbed during construction activities.
- DOE considered both the individual groundwater basins (hydrographic areas) that underlie the Caliente rail alignment and the railroad construction and operations support facilities and adjacent hydrographic areas for evaluating areas that might be affected by proposed groundwater withdrawals for construction or operations support. This would include areas that could be susceptible to changes in groundwater discharge or flow to an adjacent groundwater basin.

3.2.6.2 General Hydrogeologic Setting and Characteristics

This section is an overview of the general hydrogeologic setting and characteristics of groundwater underlying the area along the Caliente rail alignment. Water-resource features, primarily those associated with groundwater, are described primarily in relation to the hydrographic areas in which they lie.

Groundwater in central and southern Nevada is affected by low precipitation and high annual evaporation rates typical of desert climates. Most ***recharge*** to aquifers in the region of influence is derived from precipitation falling in the higher parts of the interbasin mountain ranges (DIRS 103136-Prudic, Harrilll, and Burbey 1993, pp. 2, 58, 84, and 88).

3.2.6.2.1 Groundwater Hydrographic Areas and Groundwater Use in Nevada

Acre-foot is a unit commonly used to measure water volume. It is the quantity of water required to cover 4,047 square meters (1 acre) to a depth of 0.3048 meter (1 foot), and is equal to 1,233.5 cubic meters (325,851 gallons). Section 3.2.6 lists perennial yields, committed groundwater resources, and consumptive use in acre-feet because it is the common unit used by industry and government agencies.

To classify hydrographic regions and areas and to facilitate the management of groundwater resources within the State of Nevada, the state has been divided into a series of groundwater basins (designated as hydrographic areas) (DIRS 176488-State of Nevada 2006, all; DIRS 177741-State of Nevada 2005, all; DIRS 106094-Harrill, Gates, and Thomas 1988, all).

A total of 260 hydrographic areas are recognized within the western United States Great Basin; all or parts of 232 hydrographic areas fall within Nevada (DIRS 106094-Harrill, Gates, and Thomas 1988, all; DIRS 177741-State of Nevada 2005, all).

Three types of aquifers are the principal sources of groundwater found in central and southern Nevada, as follows (DIRS 172905-USGS 1995, all):

- Alluvial valley fill: Composed primarily of unconsolidated alluvial sand and gravel. The distribution of sediment size is directly associated with distance from the mountains. In general, the coarsest materials (such as gravel and boulders) were deposited near the mountains, and the finer materials (such as sand, silt, and clay) were deposited in the central parts of the basins or in the lakes and playas. Alluvial fans are important hydrologic features within the hydrographic basins, sometimes serving as targets for groundwater development, and with alluvial valley-fill portions of the basins receiving some of their recharge through the coarse sediment deposits in the alluvial fans. Alluvial deposits consisting of alluvial sand and gravel are present along the courses of modern ephemeral streams or ancestral streams that generally parallel the long axes of the basins. Alluvial deposits underlie most of the Caliente rail alignment.
- Volcanic-rock aquifers: Composed primarily of tuffs (ash flows, ash falls), rhyolite, or basalt. Groundwater movement in these materials is often controlled by the number and degree of joint interconnections, ***fractures*** or faults, or vesicle (small cavities in minerals or rock) interconnection in lavas.
- Carbonate-rock aquifers: Composed primarily of limestones and dolomites. The carbonate rocks are commonly highly fractured and are locally fragmented. Groundwater flow in the carbonate rock aquifers is controlled by interconnected fractures.

Tectonic forces superimposed faulting on existing groundwater-bearing formations (aquifers) in this region. As a result, several aquifer units underlying the Caliente rail alignment are fractured and faulted in some locations. These faults and fractures locally can influence groundwater flow patterns within the affected aquifer areas, with such features being capable of acting as either barriers to, or conduits for, groundwater flow (see Appendix G).

Within the Basin and Range Province, any or all of the three basic aquifer types discussed above might be present within a particular area and might constitute three separate, hydraulically distinct, sources of groundwater. Alternatively, any or all of the three aquifer types might underlie an area but might be hydraulically connected to form a single groundwater source (DIRS 172905-USGS 1995, all).

Groundwater levels fluctuate seasonally and annually in response to changes in withdrawal (consumptive use) and climatic conditions, with levels generally rising from late winter to early summer and generally declining from summer to early winter (DIRS 172904-Berris et al. 2002, p. 6). In 2000, an estimated 1.75 billion cubic meters (1.42 million ***acre-feet***) of groundwater were pumped in Nevada (DIRS 175964-

Lopes and Evetts 2004, p. 7). Irrigation and stock watering was the primary groundwater use, accounting for approximately 46 percent of the total groundwater withdrawal, followed by mining (approximately 26 percent), drinking-water systems (approximately 14 percent), geothermal production (approximately 8 percent), self-supplied domestic (approximately 5 percent), and miscellaneous (1 percent) (DIRS 175964-Lopes and Evetts 2004, p. 7) (see Figure 3-72). Virtually all major groundwater development in Nevada has been in alluvial valley fill, with withdrawals from approximately the upper 460 meters (1,500 feet) of these aquifers. The carbonate rock aquifers in eastern and southern Nevada supply water to numerous springs (DIRS 106094-Harrill, Gates, and Thomas 1988, all).

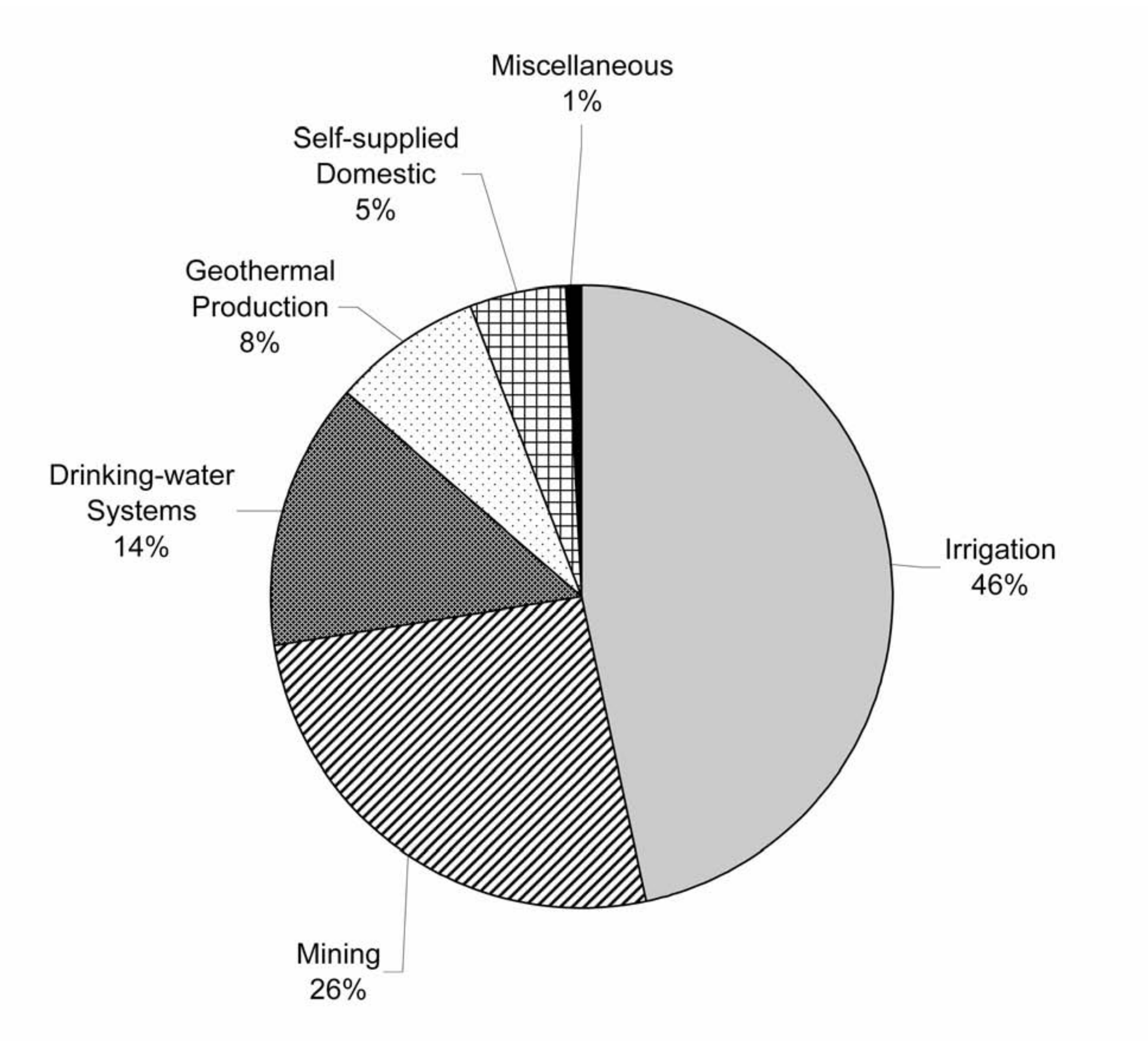


Figure 3-72. Groundwater usage in Nevada in 2000.
(Source: DIRS 175964-Lopes and Evetts 2004, p. 7).

Figure 3-73 shows generalized regional groundwater flow patterns in the vicinity of the Caliente rail alignment. Available information regarding groundwater "interbasin" inflow and outflow (groundwater flow across hydrographic area boundaries) characteristics for hydrographic areas (groundwater basins) within central Nevada (DIRS 177524-Anning and Konieczki 2005, pp. 10 and 11, and Plate 1) indicates interbasin groundwater outflow or groundwater inflow through alluvial valley-fill aquifer materials or through consolidated rock aquifers appears to occur at some locations; at other locations, there appears to be no substantial interbasin groundwater flow occurring through either or both of these aquifer units. The figure depicts generalized flow directions within alluvial valley-fill units and within consolidated rock aquifers, in areas where such flow is inferred to be occurring across hydrographic area boundaries.

Perennial yield is the amount of useable water from a groundwater aquifer that can be economically withdrawn and consumed each year for an indefinite period. It cannot exceed the natural recharge to that aquifer and ultimately is limited to the maximum amount of discharge that can be utilized for beneficial use.

The State of Nevada may identify a hydrographic area as a **designated groundwater basin** where permitted groundwater rights approach or exceed the estimated average annual recharge and the water resources are being depleted or require additional administration, including a state declaration of preferred uses (for example, municipal and industrial, domestic supply) (DIRS 103406-Nevada Division of Water Planning 1992, p. 18). Designated groundwater basins are also referred to as administered groundwater basins.

This section describes groundwater resources in relation to hydrographic areas. Figure 3-74 shows the 19 hydrographic areas the Caliente rail alignment could cross, depending on alternative segments selected. Table 3-35 lists the estimated annual ***perennial yields*** for the 19 hydrographic areas, and identifies which are State of Nevada-***designated groundwater basins***. The hydrographic areas are listed in the order the Caliente rail alignment would cross them, beginning near Caliente or Clover Creek Valley, moving westward across Nevada toward Goldfield, and then southward toward Yucca Mountain.

There are a number of published estimates of perennial yield for many of the hydrographic areas in Nevada, and those estimates often differ by large amounts. The perennial-yield values listed in Table 3-35 predominantly come from a single source, the Nevada Division of Water Planning (DIRS 103406-Nevada Division of Water Planning 1992, for Hydrographic Regions 10, 13, and 14); therefore, the table does not show a range of values for each hydrographic area. In the Yucca Mountain area, the Nevada Division of Water Planning identifies a combined perennial yield for hydrographic areas 225 through 230. DOE obtained perennial yields from *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel 1999, pp. 6 to 12) to provide estimates for hydrographic areas the Caliente rail alignment would cross: 227A, 228, and 229. That 1999 document presents perennial-yield estimates from several sources. Table 3-35 lists the lowest (that is, the most conservative) values cited in that document, which is consistent with the approach DOE used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-136).

Table 3-35 also summarizes existing annual ***committed groundwater resources*** for each hydrographic area along the Caliente rail alignment. However, all committed groundwater resources within a hydrographic area might not be in use at the same time. Table 3-35 also includes information on pending annual duties within each of these hydrographic areas. A ***pending annual duty*** represents the amount of water for which an appropriation application has been submitted to the State Engineer for consideration and that the State Engineer has classified as a pending annual duty value within a hydrographic area in accordance with applicable state statutes. Unless otherwise noted, the source of data for pending annual duties in the hydrographic areas crossed by the alignment is the Water Rights Data Update (DIRS 182288-NDWR 2007, all). These data were acquired on May 30, 2007.

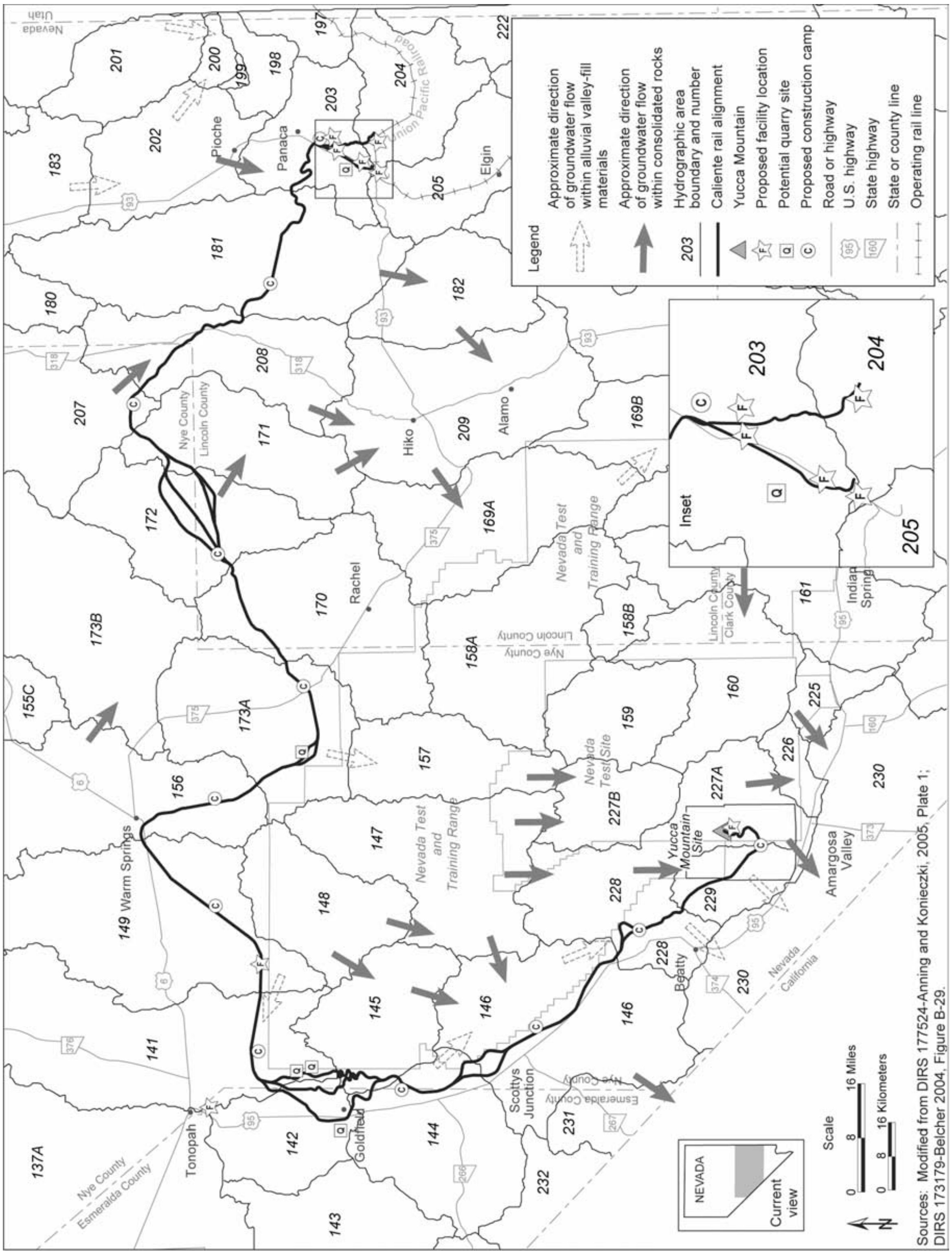


Figure 3-73. Generalized groundwater flow direction through alluvial valley-fill and consolidated rock aquifers in the vicinity of the Caliente rail alignment.

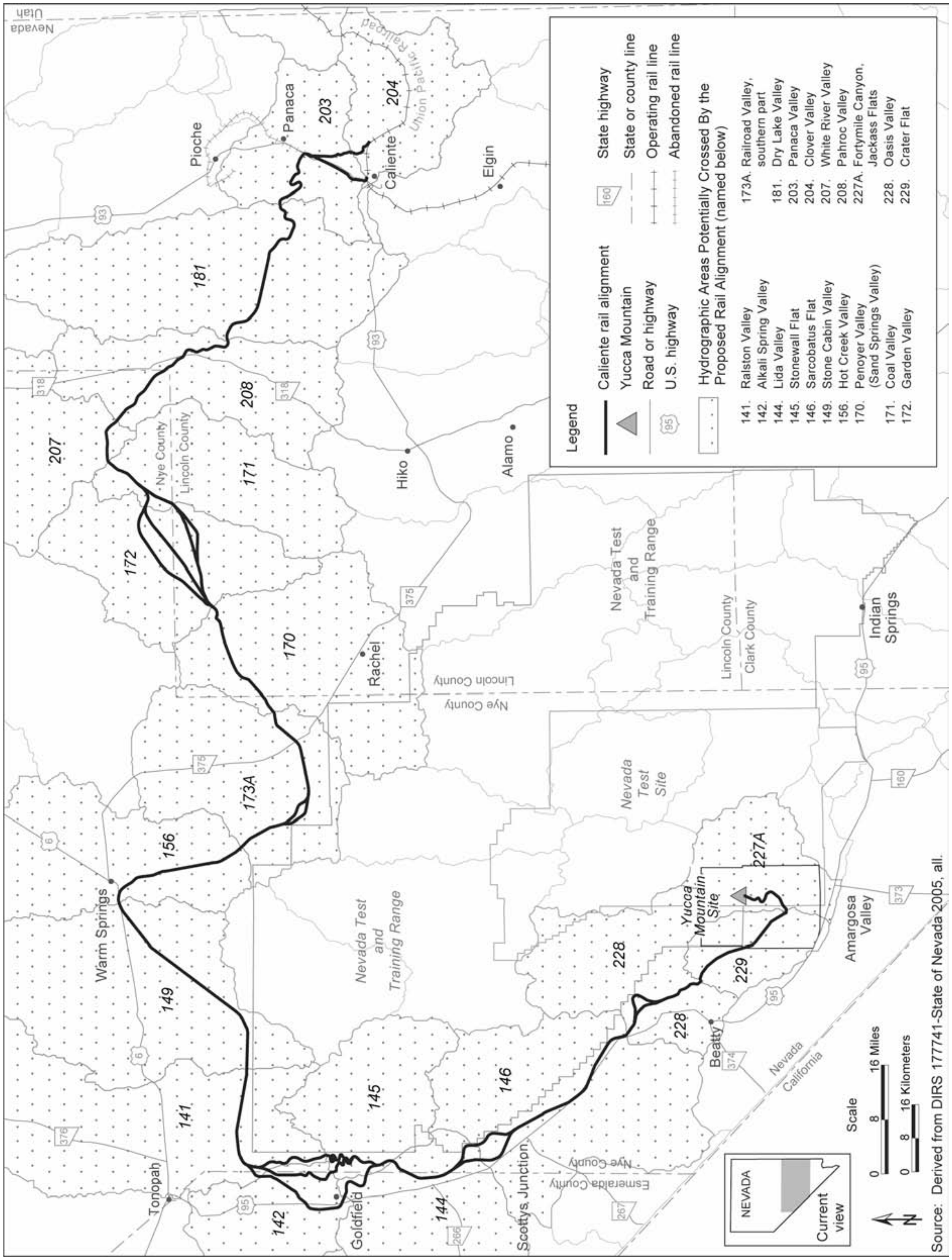


Figure 3-74. Hydrographic areas the Caliente rail alignment would cross.

Table 3-35. Perennial yield and annual committed groundwater resources of hydrographic areas the Caliente rail alignment would cross (page 1 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e,f]
Caliente alternative segment, Eccles alternative segment	204	Clover Valley	1,000	3,787/0	No
Caliente alternative segment, Eccles alternative segment, Caliente common segment 1	203	Panaca Valley	9,000	31,367/0	Yes
Caliente common segment 1	181	Dry Lake Valley	2,500	57/21,824	No
Caliente common segment 1	208	Pahroc Valley	21,000	30/0	No
Caliente common segment 1	207	White River Valley	37,000	31,819/42,512	No
Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8	171	Coal Valley	6,000	38/33,071	No
Garden Valley alternative segments 1, 2, 3, and 8; Caliente common segment 2	172	Garden Valley	6,000	559/12,224	No
Caliente common segment 2	170	Penoyer Valley (Sand Spring Valley)	4,000	14,461/11,888	Yes
Caliente common segment 2; South Reveille alternative segments 2 and 3; Caliente common segment 3	173A	Railroad Valley, Southern Part	2,800	3,867/0	No
Caliente common segment 3	156	Hot Creek Valley	5,500	4,231/0	No
Caliente common segment 3	149	Stone Cabin Valley	2,000	11,532/6,400	Yes
Caliente common segment 3; Goldfield alternative segments 1, 3, and 4	141	Ralston Valley	6,000	4,330/1	Yes
Goldfield alternative segments 1 and 4	142	Alkali Spring Valley	3,000	2,596/0	No
Goldfield alternative segments 1 and 3	145	Stonewall Flat	100	12/0	No

Table 3-35. Perennial yield and annual committed groundwater resources of hydrographic areas the Caliente rail alignment would cross (page 2 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e,f]
Goldfield alternative segments 1, 3, and 4; Caliente common segment 4; Bonnie Claire alternative segments 2 and 3	144	Lida Valley	350	72/0	No
Bonnie Claire alternative segments 2, 3, and 5	146	Sarcobatus Flat	3,000	3,591/0	Yes
Common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6	228	Oasis Valley	1,000	1,299/0	Yes
Common segment 6	229	Crater Flat	220	1,147/82	No
Common segment 6	227A	Fortymile Canyon, Jackass Flats	880[g]	58[g] /5	No

a. Source: DIRS 106094-Harrill, Gates, and Thomas 1988, Summary, Figure 3, with the proposed rail alignment map overlay.
b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel 1999, pp. 6 to 12. The perennial yield value shown for area 228 is the lowest value in range of estimated values (1,000 to 2,000 acre-feet per year) presented by Thiel Engineering Consultants 1999.
c. To convert acre-feet to cubic meters, multiply by 1,233.49. To convert acre-feet to gallons, multiply by 3.259×10^5.
d. Data for committed groundwater resources are current as of May 30, 2007 (DIRS 182288-NDWR 2007, all). Data for pending groundwater resources include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.
e. Sources: DIRS 176488-State of Nevada 2006, Regions 10, 13, and 14; DIRS 177741-State of Nevada 2005, all.
f. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in area 227A. However, water-rights information from the Nevada Department of Water Resources indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 176600-Converse Consultants 2005, p. 29 and Table 4-45). The perennial-yield value shown for area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel 1999, p. 8) for the western two-thirds of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

As part of an effort to assess water resources in the vicinity of the Caliente rail alignment, DOE performed studies to identify groundwater conditions, the locations of springs, and the locations, use, and water rights status of groundwater-supply wells within 32 kilometers (20 miles) of either side of the centerline of the rail alignment. Information on groundwater characteristics in hydrographic areas the rail alignment would cross and identified groundwater uses and use types within the 62-kilometer (39-mile) search area are compiled in the *Water Resources Assessment Report, Caliente Rail Corridor, Yucca Mountain Project, Nevada, Task 3.4, Rev. 0* (the Water Resources Assessment Report, Caliente Rail Corridor) (DIRS 176600-Converse Consultants 2005, all). DOE reviewed several other published reports and maps providing information regarding hydrogeologic and groundwater characteristics in hydrographic areas the rail alignment would cross to obtain information to support the groundwater resources impacts assessment.

DOE reviewed several well and spring databases, including Nevada Division of Water Resources (NDWR) and U.S. Geological Survey National Water Information System (USGS NWIS) databases to identify existing wells and springs located within the potential region of influence of proposed new groundwater withdrawal wells. Unless noted otherwise, the sources for the spring and well data in this section are as follows: DIRS 176325-USGS 2006, all; DIRS 177712- MO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000, all; DIRS 182898-NDWR 2007,all; DIRS 177293-MO0607PWMAR06D.000, all; DIRS 177294-MO0607USGSWNVD.000; DIRS 176600-Converse Consultants 2005, all; and DIRS 176979- MO0605GISGNISN.000, all. An initial screening process identified existing wells within 1.6 kilometers (1 mile) of the centerlines of the respective alternative segments, or within 1.6 kilometers of DOE-proposed new wells. As described later in this section, before analyzing potential impacts to groundwater resources, DOE extended the search radius for identifying existing beneficial-use wells and springs up to 2.4 kilometers (1.5 miles) away from a proposed new well if the initial search for such wells or springs within 1.6 kilometers did not reveal the presence of any such wells or springs. Additionally, on a case-by-case basis (see Section 4.2.6 and Appendix G), for a selected set of new groundwater withdrawal wells specifically targeted for installation within a fault zone or an extensive fracture zone, DOE identified the locations of existing wells and springs up to 10 kilometers (6 miles) away from each such proposed well (to address the possibility of fault zones or extensive fracture zones acting as conduits for groundwater flow). The Department derived information for completing this compilation through a review of well-log data and water-rights information obtained from the NDWR. NDWR well-log database entries include a general and legal description of the location of existing wells, along with ***borehole*** and well completion information and well testing data (if available). The NDWR water-rights database includes data on the locations, manner of use, and appropriations status of wells having appropriated water rights in Nevada. The USGS website generally includes site information (for example, well location coordinates, elevation, depth) and water-level data. DOE eliminated from consideration in the impacts analysis wells in the NDWR well-log database and the NDWR water-rights database that did not have an appropriated water right or were not domestic wells (such as abandoned or plugged wells, monitoring wells, thermal gradient test wells, oil or gas exploration or groundwater investigation wells). DOE considered all USGS-identified wells.

The compiled well locations had varying levels of accuracy. For example, well locations recorded in the NDWR water-rights database are generally considered to be at the center of each 0.16-square-kilometer (40-acre) parcel representing each quarter-quarter section. Additionally, the well driller might have mapped the well incorrectly, or a well might have been inadvertently recorded in the NDWR water-rights database in the wrong hydrographic area (for example, for wells very near a hydrographic area boundary). Figures 3-75 through 3-82 identify well locations within 1.6 kilometers (1 mile) of the centerline of the Caliente rail alignment or proposed wells. As a result of the characteristics of the well location specifications, there might be more than one existing well at some locations on these figures. Table 3-36 lists hydrographic areas the Caliente rail alignment would cross and the corresponding number of

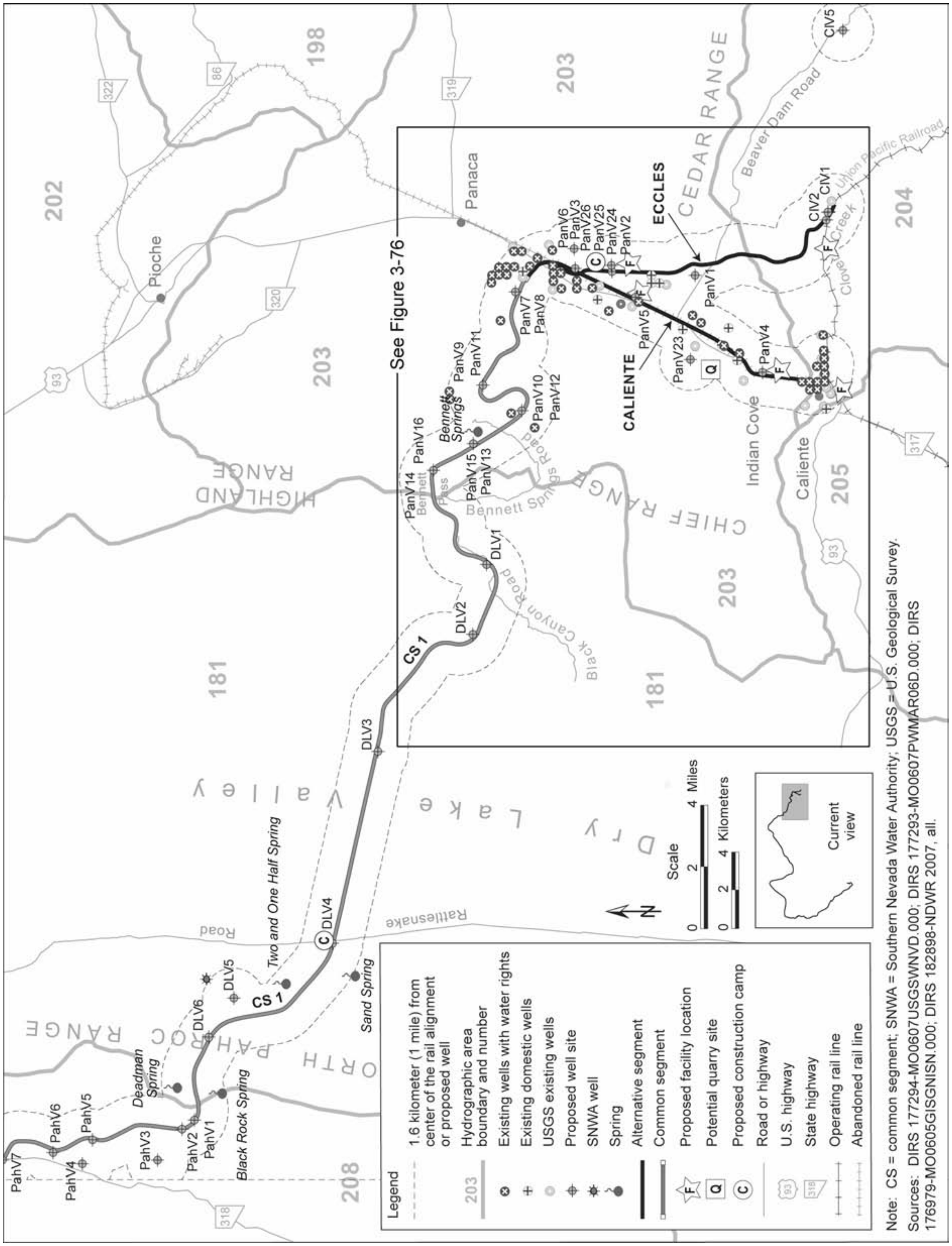
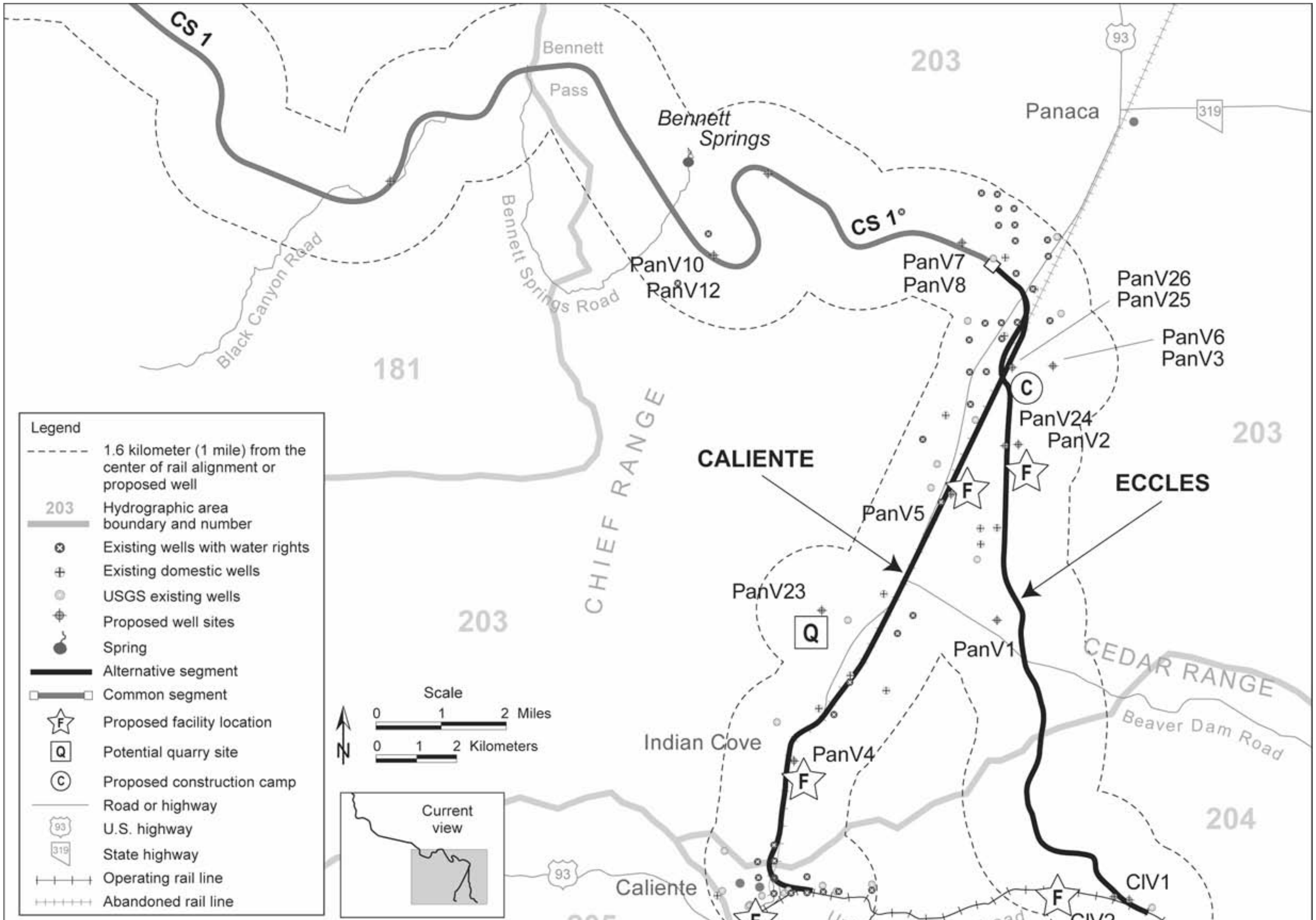


Figure 3-75. Proposed wells and existing USGS and NDWR wells and springs within map area 1.



Note: CS = common segment; USGS = U.S. Geological Survey.

Sources: DIRS 177294-MO0607USGSWNVD.000; DIRS 176979-MO0605GISGNISN.000; DIRS 182898-NDWR 2007, all.

Figure 3-76. Proposed wells and existing USGS and NDWR wells and springs within map area 1 - INSET.

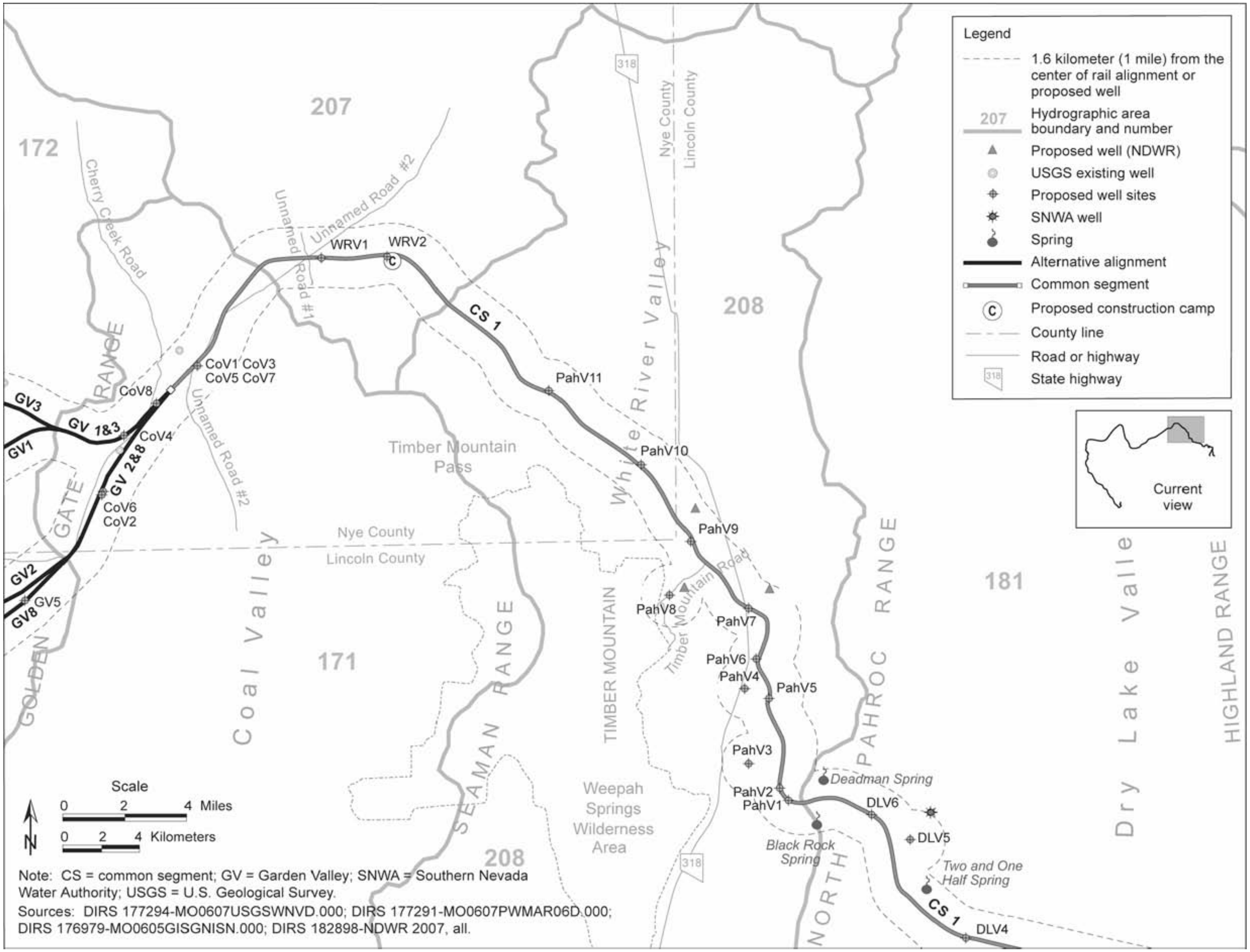


Figure 3-77. Proposed wells and existing USGS and NDWR wells and springs within map area 2.

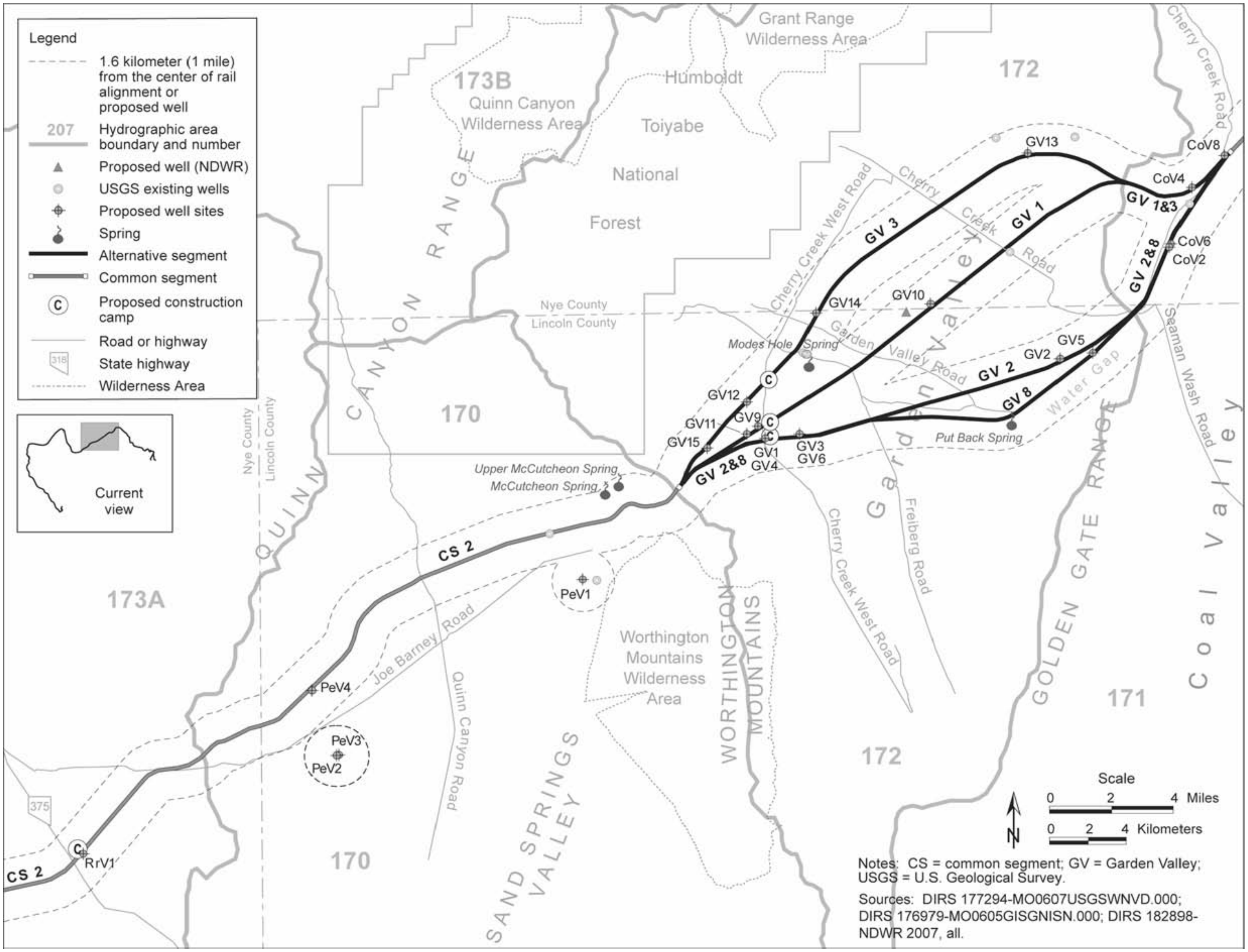


Figure 3-78. Proposed wells and existing USGS and NDWR wells and springs within map area 3.

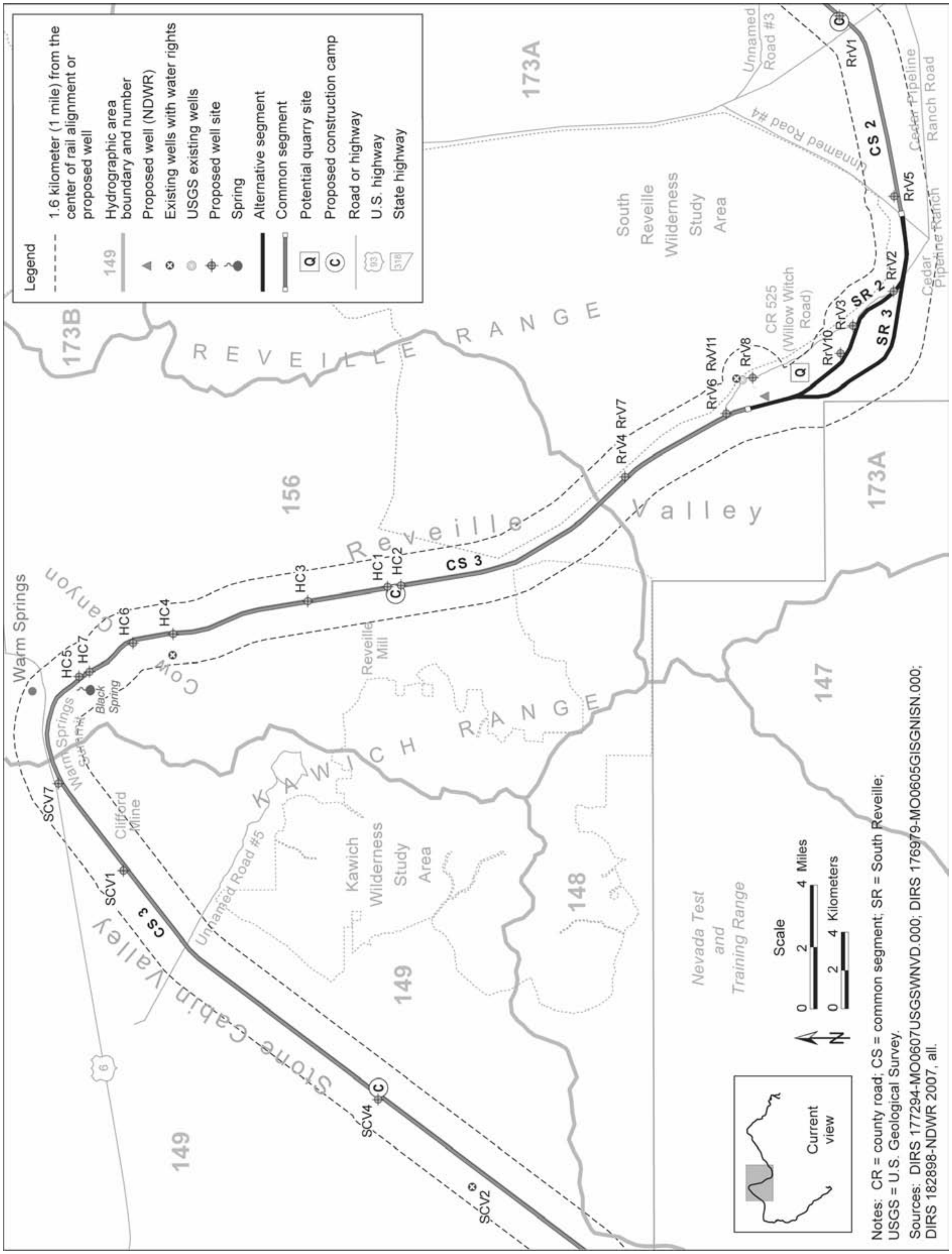


Figure 3-79. Proposed wells and existing USGS and NDWR wells and springs within map area 4.

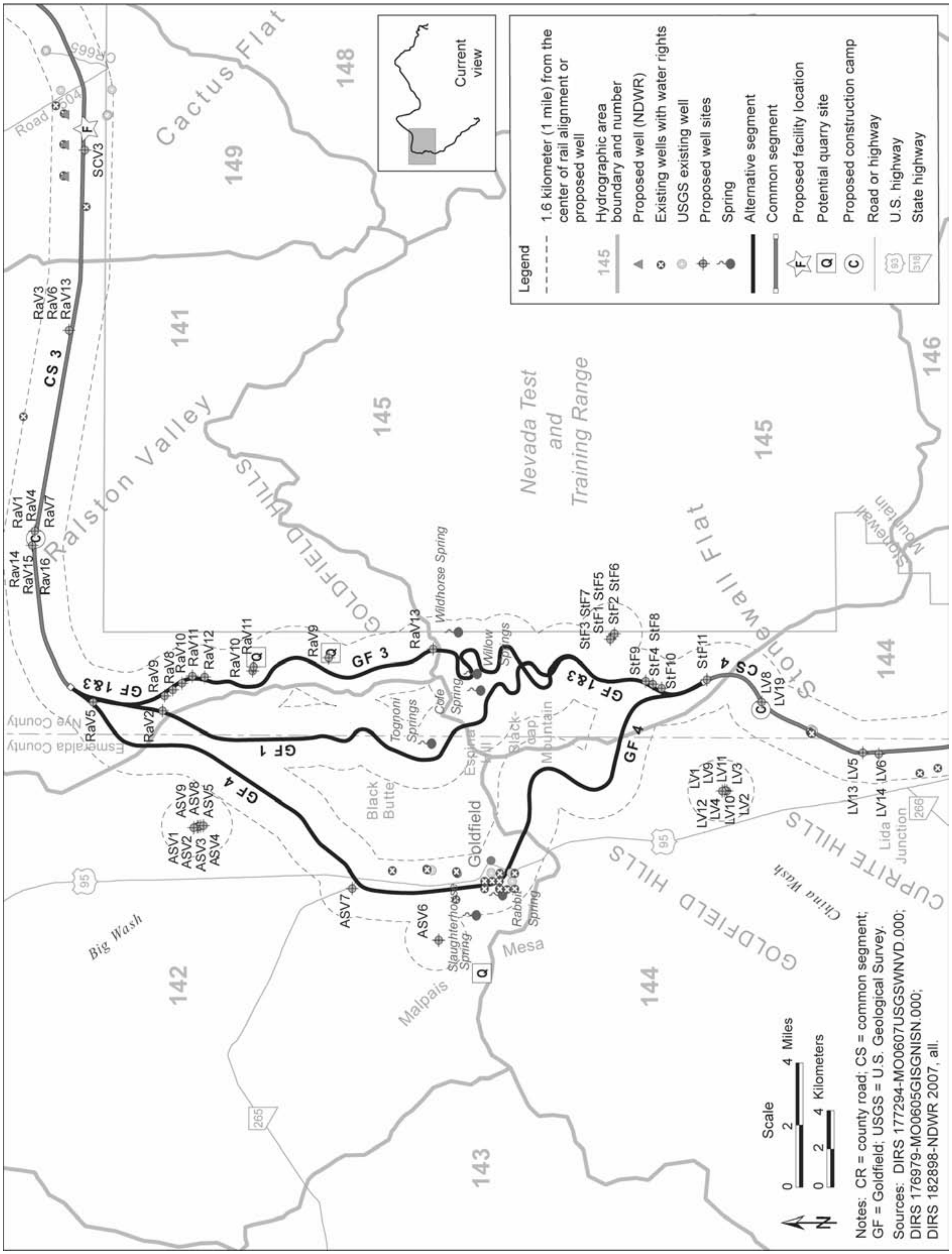


Figure 3-80. Proposed wells and existing USGS and NDWR wells and springs within map area 5.

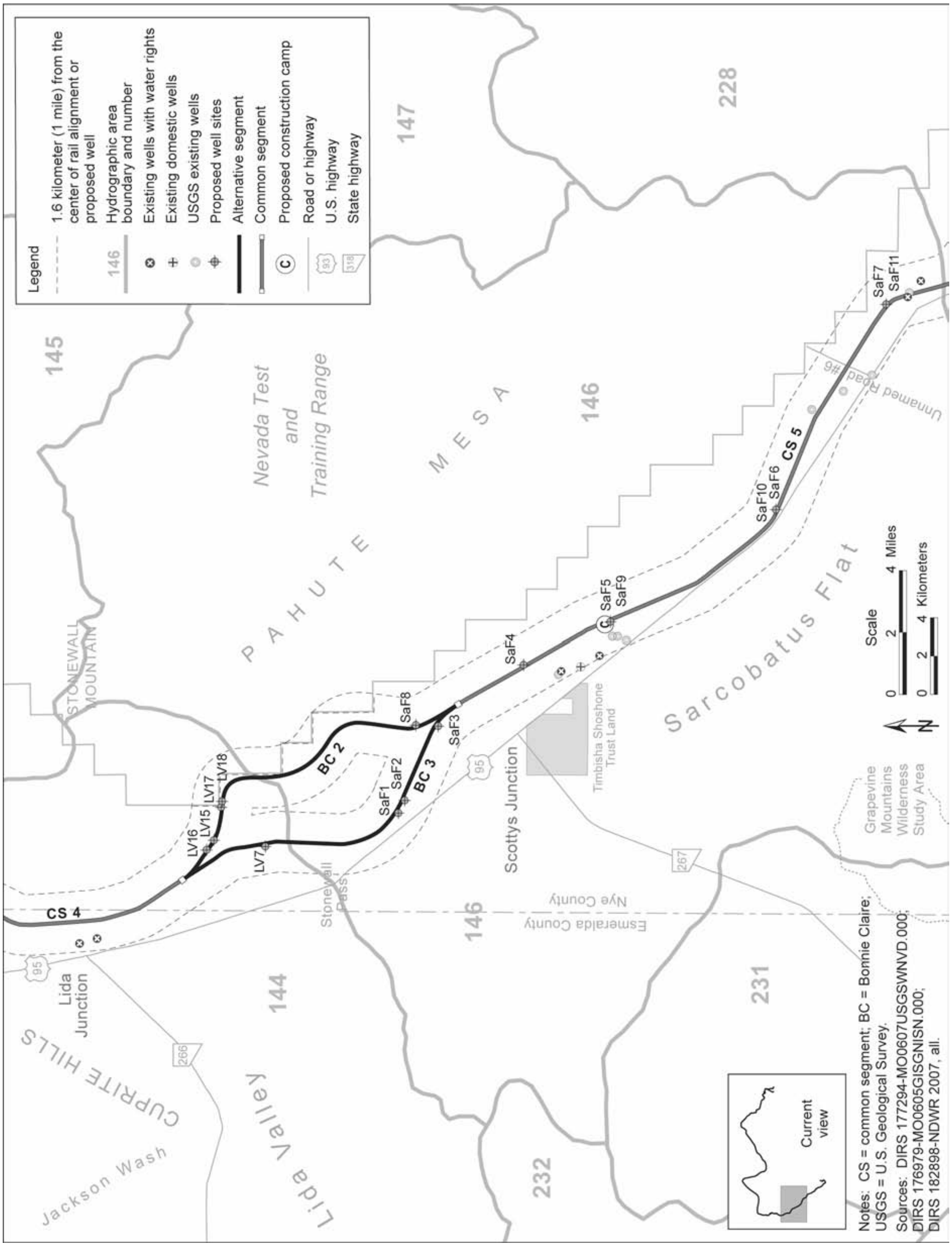


Figure 3-81. Proposed wells and existing USGS and NDWR wells and springs within map area 6.

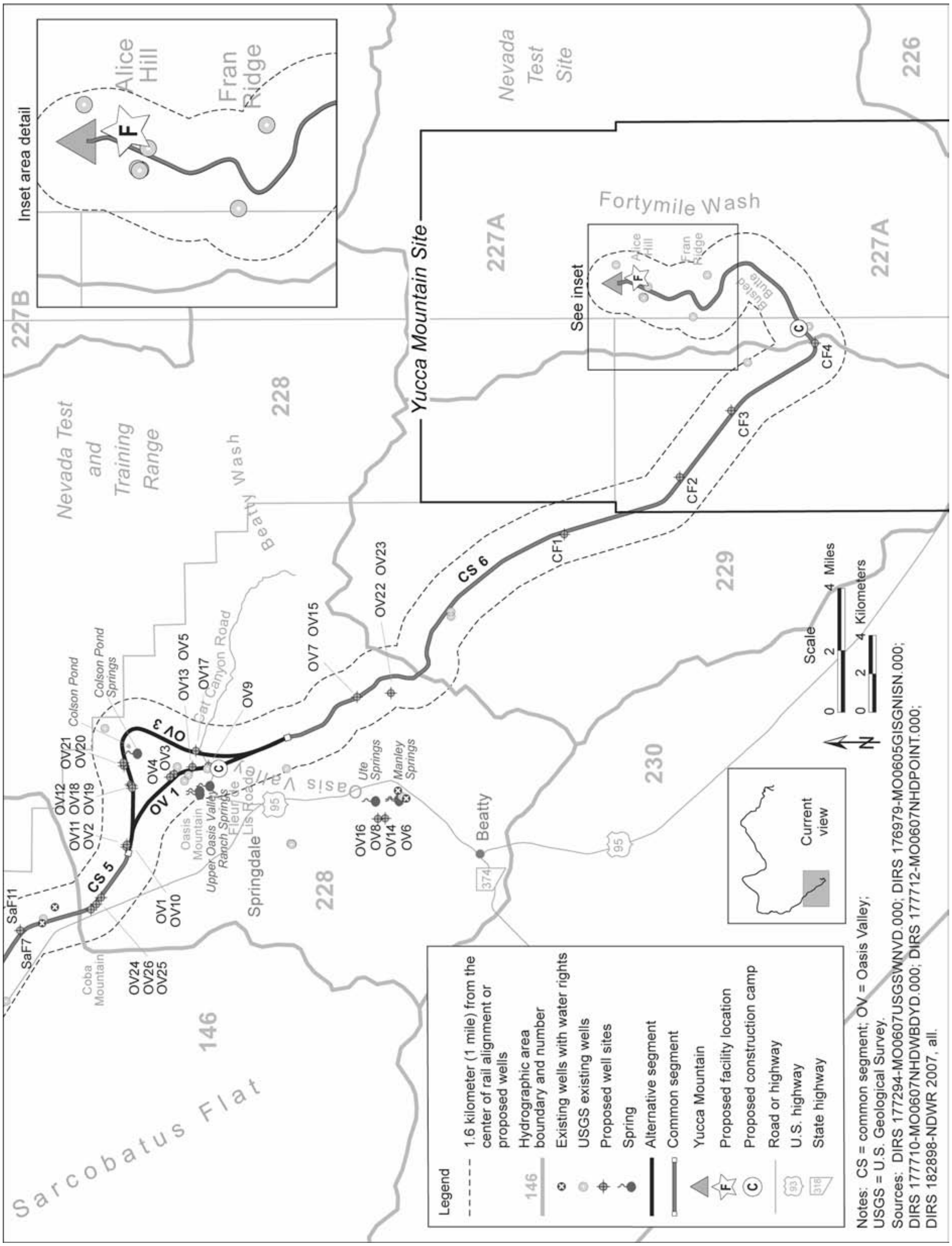


Figure 3-82. Proposed wells and existing USGS and NDWR wells and springs within map area 7.

Table 3-36. Existing wells and proposed new wells within 1.6 kilometers[a] of the centerline of the Caliente rail alignment by hydrographic area and/or within 1.6 kilometers of proposed new wells outside the rail line construction right-of-way (page 1 of 2).[b]

Hydrographic area		Total number of wells and number of NDWR[c] wells with water rights by proposed-use category[d,e]										
Name	Area number	Number of wells[f,g]	C	G	H	I	K	N	P	S	X	Z
Lower Meadow Valley Wash	205	1	0	0	1	0	0	0	0	0	0	0
Clover Valley	204	29	1	0	1	6	0	0	1	1	0	6
Panaca Valley	203	71	4	0	11	35	0	0	5	1	0	5
Dry Lake Valley	181	1	0	0	0	0	0	0	0	0	0	0
Pahroc Valley	208	0	0	0	0	0	0	0	0	0	0	0
White River Valley	207	0	0	0	0	0	0	0	0	0	0	0
Coal Valley	171	2	0	0	0	0	0	0	0	0	0	0
Garden Valley	172	6	0	0	0	0	0	0	0	0	0	0
Penoyer (Sand Spring) Valley	170	2	0	0	0	0	0	0	0	0	0	0
Railroad Valley, Southern Part	173A	1	0	0	0	0	0	0	0	0	0	0
Hot Creek Valley	156	2	0	0	0	0	0	0	0	2	0	0
Stone Cabin Valley	149	11	0	0	0	2	0	0	0	3	0	0
Ralston Valley	141	0	0	0	0	0	0	0	0	0	0	0
Alkali Spring Valley	142	5	0	0	0	0	0	0	1	0	0	0
Stonewall Flat	145	0	0	0	0	0	0	0	0	0	0	0
Lida Valley	144	3	0	0	0	0	0	0	0	0	0	0
Sarcobatus Flat	146	17	0	0	1	4	0	0	2	2	0	0
Oasis Valley	228	12	1	0	0	0	1	0	0	0	0	0
Crater Flat	229	3	0	0	0	0	0	0	0	0	0	0
Fortymile Canyon, Jackass Flats	227A	14	0	0	0	0	0	0	0	0	0	0
Totals		180	6	0	14	47	2	0	9	9	0	11

a. To convert kilometers to miles, multiply by 0.62137.
b. Source: DIRS 177293-DTN MO0607PWMAR06D.000.
c. NDWR=Nevada Division of Water Resources.
d. C = commercial; G = monitoring wells; H = domestic; I = irrigation; K = mining and milling; N = industrial (includes those designated in the database as N for "industrial" and as J for "industrial-cooling"); P = municipal or quasi-municipal; S = stock; X = test wells; Z = other (includes those designated in the database as Z for "other," R for "recreation," and U for "unused").
e. Proposed use categories are tabulated only for wells (98 of the 180 wells) listed as NDWR wells with water rights or NDWR domestic wells.
f. Includes total number of NDWR-documented existing wells with water rights, plus NDWR domestic wells, plus U.S. Geological Survey National Water Information System-listed wells within 1.6 kilometers from the centerline of the rail alignment or within 1.6 kilometers of any DOE-proposed new well. The number of NDWR wells listed by proposed use category applies only to NDWR wells with water rights and NDWR wells. U.S. Geological Survey wells are not included in the well counts; the Geological Survey database does not provide information regarding well use category.
g. Well locations have not been field-verified. Therefore, some of the identified wells might be farther than 1.6 kilometers from the centerline of the rail alignment or proposed new wells.

wells within 1.6 kilometers of the centerline of the rail alignment, as recorded by the NDWR and the USGS NWIS. Table 3-36 identifies the associated proposed use category of the NDWR-catalogued wells (as defined in the State of Nevada well-log database). The USGS NWIS database does not categorize wells according to their use.

The distance of 1.6 kilometers (1 mile) reflects the first two of three aspects considered in establishing the groundwater region of influence, as described in Section 3.2.6.1. Most of the wells shown in Figures 3-75 through 3-80 are along the easternmost extent of the Caliente rail alignment; a smaller number of wells are clustered in several groups along the western portion. Few existing wells are present elsewhere along the rail alignment. The wells identified in these figures were compiled from information in *Water Resources Assessment Report, Caliente Corridor* (DIRS 176600-Converse Consultants 2005, all) and databases administered by the NDWR and the USGS NWIS. DOE would field-verify the locations of wells that could be affected during rail line construction before starting construction activities.

DOE-compiled well data include data on well locations and uses as documented in the *Water Resources Assessment Report, Caliente Corridor*, and include well records coded as "new" or "replacement" wells in the Nevada well-log database. Because each entry in the well-log database represents an event at a well site (for example, installation, re-drilling, abandonment), there is a possibility that there is more than one record to represent a particular well. To preclude duplication, DOE summarized only records that identified wells as new or replacement.

As shown in Table 3-36, there are a total of 180 NDWR wells with water rights, NDWR domestic wells, and USGS NWIS wells within 1.6 kilometers (1 mile) of the centerline of the Caliente rail alignment or within 1.6 kilometers of proposed new wells. Most of these wells are in areas 203 and 204. Table 3-36 lists irrigation (41 of the 77 NDWR-listed wells with water rights and domestic wells in areas 203 and 204) as the predominant use category for those NDWR-listed wells that are within 1.6 kilometers of the centerline of the Caliente rail alignment or within 1.6 kilometers of any proposed new well.

3.2.6.2.2 Groundwater-Quality Characteristics

Water quality in aquifers in Nevada varies with location (DIRS 106094-Harrill, Gates, and Thomas 1988, all). In the Basin and Range, total dissolved solids concentrations can range from less than 500 to more than 10,000 milligrams per liter (DIRS 172905-USGS 1995, all). In general, at hydrographic area margins and on the slopes of alluvial fans, groundwater quality is good. In discharge areas (such as playas) and other selected areas, groundwater quality can be brackish. However, groundwater in deeper alluvial valley-fill units underlying some playa areas can be of better quality (DIRS 172905-USGS 1995, all). Groundwater quality in the carbonate aquifers in southern and central Nevada, including total dissolved solids concentrations, is generally more uniform in character and with depth within the aquifer (DIRS 101167-Winograd and Thordarson, 1975, p. C103). Total dissolved solids concentrations in alluvial valley fill underlying the Caliente rail alignment generally range from less than 500 to 1,000 milligrams per liter, or approximately 500 to 1,000 parts per million, but a few locations might be in the 1,000 to 3,000 milligrams per liter (approximately 1,000 to 3,000 parts per million) range (DIRS 172905-USGS 1995, Figure 7, with overlay of hydrographic area boundaries). The U.S. Environmental Protection Agency has set an aesthetic standard of 500 milligrams per liter of total dissolved solids for drinking water (40 CFR Part 143). Water with a total dissolved solids concentration of 500 milligrams per liter or less is regarded as acceptable and pleasing for general consumption. A secondary preferred drinking water standard for total dissolved solids concentrations of 500 milligrams per liter for public water supplies has been adopted for Nevada. If water supplies that meet the preferred standard are not available, the Maximum Contaminant Level of 1,000 milligrams per liter is enforceable by the State of Nevada. At higher concentrations, general consumption issues (pertaining to hardness, deposits, color, staining, and salty taste) could develop, but the water could be used for other purposes (for example, agriculture or earthwork compaction as part of embankment construction). Another parameter of interest for gauging the quality of groundwater in Nevada is arsenic. A revised drinking water standard for arsenic (for water systems meeting certain specified criteria) of 0.010 milligrams per liter became enforceable in January of 2006 (40 CFR 141.23).

3.2.6.3 Hydrogeologic Setting and Characteristics along Alternative Segments and Common Segments

3.2.6.3.1 Interface with the Union Pacific Railroad Mainline

The Caliente alternative segment and the Eccles alternative segment would both overlie a small portion of Clover Valley (hydrographic area 204) and would cross Panaca Valley (hydrographic area 203) (see Figure 3-75). The Caliente and Eccles alternative segments would predominately overlie alluvial valley fill (Table 3-37).

Groundwater quality underlying the areas of the Caliente and Eccles alternative segments varies according to location within the hydrographic areas the segments would cross. Table 3-37 summarizes the general groundwater-quality and aquifer characteristics of this area.

Table 3-37. General groundwater-quality and aquifer characteristics – Interface with the Union Pacific Railroad Mainline, Caliente and Eccles alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
204 Clover Valley	Quaternary-age alluvial valley fill and volcanic rocks[e]	6 to 20	Upper 30 meters: 650,000[e]	Total dissolved solids: 30 to 350 mg/L[f]
203 Panaca Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks and other crystalline rocks, with some terraced areas comprised of fine-grained lakebed deposits[e]	12 to 30	Upper 30 meters: 1.4 million[f]	Total dissolved solids: 230 to 770 mg/L[e]

a. Source: DIRS 176600-Converse Consultants 2005, Plates 4-13a and 4-15. The listed depth ranges generally apply to areas underlying the alternative segments; groundwater is deeper in the southern part of area 204 beneath the Clover Mountains (DIRS 176600-Converse Consultants 2005, p. 93) and in some other parts of area 203 (DIRS 176600-Converse Consultants 2005, p. 88).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Source: DIRS 176600-Converse Consultants 2005, pp. 86, 87, 92, and 93, and Plates 4-13a and 4-13b.
f. Source: DIRS 180754-Rush et al. 1971, all.

Hydrographic area 204, Clover Valley, is not a designated groundwater basin (see Table 3-35). Committed groundwater resources exceed estimated perennial yield of 1.2 million cubic meters (1,000 acre-feet). However, as noted previously, all committed resources within a hydrographic area might not be in use at the same time. Groundwater depth throughout Clover Valley varies from less than 1 meter to 60 meters (2.5 to 200 feet). The depth at which groundwater occurs varies from 6 meters (20 feet) to 20 meters (60 feet) below ground along the short segments of the Caliente and Eccles alternative segments that would lie within area 204 (see Table 3-37). Groundwater is primarily produced from the alluvial valley fill. Geologic units encountered in boreholes drilled in the Clover Valley area include alluvial valley fill and volcanic rocks.

DOE determined that there are a total of 29 combined existing NDWR wells with water rights, NDWR domestic wells, and USGS NWIS wells in hydrographic area 204 within 1.6 kilometers (1 mile) of the centerlines of the Caliente and Eccles alternative segments. Figures 3-75 and 3-76 show the locations of these wells. The locations of existing wells are based on data on well locations as available in NDWR and USGS NWIS databases. Not all existing wells in area 204 that lie within 1.6 kilometers of the centerlines of the Caliente and Eccles alternative segments may be depicted on Figures 3-75 and 3-75 because some wells are at very nearly the same locations and cannot be shown at the scale used in these figures. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 204.

Hydrographic area 203, Panaca Valley, is a designated groundwater basin. Committed groundwater resources exceed the estimated annual perennial yield of 11.1 million cubic meters (9,000 acre-feet) (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. The depth at which groundwater occurs ranges from above the ground surface to about 60 meters (200 feet) below ground, although in most areas, it is generally less than approximately 20 meters (60 feet) below ground. Along the Caliente alternative segment, the shallowest depth to groundwater in this basin is in its central portion, along U.S. Highway 93, where depth to groundwater is generally approximately 12 to 30 meters (40 to 100 feet) (see Table 3-37) (DIRS 176600-Converse Consultants 2005, Plate 4-13a). Groundwater is primarily produced from the alluvial valley fill, although some low-yielding wells have produced groundwater from thin sand beds in lakebed deposits of the Panaca Formation. Groundwater also occurs in fractured volcanic rocks and carbonate rocks (DIRS 176600-Converse Consultants 2005, pp. 86 and 87).

There are 60 wells (total number of NDWR wells with water rights, NDWR domestic wells, and USGS NWIS wells) in hydrographic area 203 within 1.6 kilometers (1 mile) of the centerlines of the Caliente and Eccles alternative segments. Figures 3-75 and 3-76 show the locations of these wells. As described above for the case of hydrographic area 204, not all existing wells in area 203 that lie within 1.6 kilometers of the centerlines of the proposed Caliente and Eccles alternative segments may be depicted on Figures 3-75 and 3-76 because some wells are at very nearly the same locations and cannot be shown at the scale used in these figures.

The predominant use categories for the NDWR wells with water rights within 1.6 kilometers (1 mile) of the centerlines of the Caliente and Eccles alternative segments in area 203 are irrigation, domestic municipal, or quasi-municipal, or other. Based on the information in Table 3-36, groundwater use associated with about 53 percent of NDWR wells with water rights or NDWR domestic wells in hydrographic areas 203 and 204 within 1.6 kilometers of the centerlines of those two alternative segments is categorized as irrigation; about 16 percent of those wells are listed as domestic wells; about 14 percent are listed as having other uses; about 8 percent are listed as municipal or quasi-municipal water-supply wells; about 6 percent are listed as commercial-use wells. Listed individual water-use types from other wells each represent 5 percent or less of the total well use.

The Panaca Valley area is underlain by alluvial valley fill, volcanic rocks and other crystalline rocks, and older carbonate and clastic rocks, with some terraced areas comprised of fine-grained lakebed deposits (DIRS 176519-Rowley and Shroba 1991, all; DIRS 176600-Converse Consultants 2005, pp. 86 and 87). Geologic materials present in the vicinity of the potential quarry site northwest of Caliente (west of proposed new well location PanV23) include lava flows; mudflow breccias; ash-flow tuffs; alluvium and alluvial fan materials; limestone and dolomite; and sandstone, mudstone, and conglomeratic rocks (DIRS 176947-Rowley et al. 1994, all; DIRS 176519-Rowley and Shroba 1991, all).

There is groundwater under both confined and unconfined conditions in the Meadow Valley Wash area (DIRS 176502-Rush 1964, p. 18), which generally includes the area between Caliente and Panaca. Groundwater storage values for the alluvial aquifers within the uppermost 30 meters (100 feet) of saturated material in Panaca Valley and Clover Creek Valley were previously estimated at 1.75 billion cubic meters (1.4 million acre-feet) and 802 million cubic meters (650,000 acre-feet), respectively (Table 3-37). Because most wells are no deeper than approximately 46 meters (150 feet), the total thickness of the alluvial aquifer groundwater reservoir is not known in many parts of the Meadow Valley Wash area (DIRS 176502-Rush 1964, p. 18). In this area, well-pumping rates on the order of 40 to 190 liters per minute (10 to 50 gallons per minute) to more than 4,000 liters per minute (1,000 gallons per minute) have been reported (DIRS 176502-Rush 1964, Table 15). NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 203.

Figures 3-75 and 3-76 show DOE-proposed wells for supplying water to support construction of the Caliente or Eccles alternative segment. In addition to construction within the nominal width of the rail line construction right-of-way, a potential quarry in this area would also require up to two new wells. Quarry wells proposed for the Caliente and Eccles alternative segments would be outside the nominal width of the construction right-of-way of either alignment. Although the potential quarry location and its associated new well(s) would be outside the construction right-of-way, they are described in this Rail Alignment EIS in the context of the rail alignment segment(s) with which they are most closely associated, because each quarry would be accessed in a generally perpendicular direction from the rail line. A well proposed to provide water to potential quarry CA-8B (PanV23 on Figures 3-75 and 3-76) is approximately 1.6 kilometers (1 mile) northwest of the proposed Caliente alternative segment, respectively, and would overlie hydrographic area 203.

3.2.6.3.2 Caliente Common Segment 1 (Dry Lake Valley Area)

Crossing from east to west, Caliente common segment 1 would overlie hydrographic areas Panaca Valley (203), Dry Lake Valley (181), Pahroc Valley (208), White River Valley (207), and Coal Valley (171) (see Figure 3-74). Caliente common segment 1 would predominantly overlie alluvial valley fill (DIRS 176600-Converse Consultants 2005, Plates 4-13a and 4-13b). The depth to groundwater underlying common segment 1 varies according to locale. Groundwater quality underlying common segment 1 varies according to location within the hydrographic areas the rail line would cross. Table 3-38 summarizes the groundwater-quality and aquifer characteristics in the hydrographic areas common segment 1 would cross.

Section 3.2.6.3.1 discusses hydrographic area 203, Panaca Valley, in detail. Two existing wells in areas 203, one NDWR well with a water right and one USGS NWIS well, are within 1.6 kilometers (1 mile) of the centerline of the rail alignment in area 203. One existing spring (Bennett Springs) is within 1.6 kilometers of the centerline of common segment 1. Figure 3-75 shows the locations of these wells and the spring.

Hydrographic area 181, Dry Lake Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 3.08 million cubic meters (2,500 acre-feet) (see Table 3-35).

The depth to groundwater depth in most parts of Dry Lake Valley generally exceeds 60 meters (200 feet), and in many places exceeds 240 meters (800 feet). Depth to groundwater underlying the common segment varies from 50 to 160 meters (160 to 520 feet) (Table 3-38). Groundwater is generally calcium–sodium–sulfate type (DIRS 101811-DOE 1996, Section 4.6.5.2). The primary source of groundwater in Dry Lake Valley is mountain front recharge. Geologic units in the Dry Lake Valley area include alluvial valley-fill deposits, volcanic rocks, clastic rocks, and older carbonate rocks.

Table 3-38. General groundwater-quality and aquifer characteristics – Caliente common segment 1.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
203 Panaca Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks and other crystalline rocks, with some terraced areas comprised of fine-grained lakebed deposits[e]	Less than 60	Upper 30 meters: 1.4 million[f]	Total dissolved solids: 230 to 8,770 mg/L
181 Dry Lake Valley	Alluvial valley fill deposits, volcanic rocks, and older carbonate rocks[e]	50 to 160	Upper 30 meters: for both aquifer types – *Alluvial valley fill*: 2.8 million[f] *Carbonate rock aquifer*: 800,000[f]	Total dissolved solids: 377 mg/L[e] Sulfate: 30 mg/L[e] Fluoride: Less than 1 mg/L[e]
208 Pahroc Valley	Alluvial sediments, carbonate rocks, quartzite, volcanics, and a clastic aquitard[e]	50 to 180	Upper 30 meters: for both aquifer types – *Alluvial valley fill*: 1.3 million[f] *Carbonate rock aquifer*: 325,000[f]	Total dissolved solids: 475 mg/L[e] Sulfate: Less than 30 mg/L[e]
207 White River Valley	Alluvial valley-fill and older carbonate rocks[e]	30 to 50	*Alluvial valley fill*: 4.9 million[f]	Total dissolved solids: 257 to 470 mg/L[e]
171 Coal Valley	Alluvial valley fill, volcanic rocks, clastic rocks, and older carbonate rocks[e]	50 to 90	Upper 30 meters: for both aquifer types – *Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000[f]	Total dissolved solids: 200 to 300 mg/L[e]

a. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 176600-Converse Consultants 2005, Plates 4-10 through 4-13a); groundwater can vary over a wide range of depth depending on location in each hydrographic area (DIRS 176600-Converse Consultants 2005, pp.76, 78, 79, 83, and 88).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Source: DIRS 176600-Converse Consultants 2005, pp. 75 to 90.
f. Sources: DIRS 180754-Rush et al. 1971, all; DIRS 176883-Brothers, Katzer, and Johnson 1996, pp. 27 and 28; DIRS 176851-Brothers, Bugo, and Tracy 1993, pp. 17 to 30; DIRS 176852-Drici, Garey, and Bugo 1993, p. 36.

Unconsolidated alluvial materials and older carbonate rock comprise the best aquifers in area 181 (DIRS 176600-Converse Consultants 2005, p. 83). Beneath Dry Lake Valley, the thickness of the alluvial materials varies from a few meters to more than 300 meters (1,000 feet) (DIRS 176883-Brothers, Katzer, and Johnson 1996, p. 15). There is an estimated 3.5 billion cubic meters (2.8 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within this basin, and there might be an additional 990 million cubic meters (800,000 acre-feet) of recoverable groundwater in the carbonate aquifer underlying the basin. There is one existing well (181M-1) and four springs in hydrographic area 181 within 1.6 kilometers (1 mile) of the centerline of common segment 1. Figures 3-75 and 3-77 identify the locations of this well and the springs. Well 181M-1 is shown on Figures 3-75 and 3-77 as the "SNWA well." This well is an exploration well drilled by the Southern Nevada Water Authority.

In addition to existing groundwater wells in hydrographic area 181 that have water-rights appropriations, NDWR data indicate that there are approximately 26.9 million cubic meters (22,000 acre-feet) of documented pending annual duties (see Table 3-35) in area 181. These total pending annual duties include 14.3 million cubic meters (12,000 acre-feet) for water-rights applications originally filed by the Las Vegas Valley Water District in 1989 to appropriate water at some future time from a series of proposed new wells in Dry Lake Valley (DIRS 177516-SNWA 2006, p. 3). Ownership of these water-rights applications was subsequently transferred to the Southern Nevada Water Authority. Caliente rail alignment common segment 1 would cross one of five different proposed groundwater exploration areas the Water Authority identified in area 181 (DIRS 176469-SNWA [n.d.], all) from which groundwater might be developed. The additional water-rights applications comprise pending annual duties of 12.6 million cubic meters (10,000 acre-feet) and were filed with the Nevada State Engineer by the Lincoln County Water District to appropriate water at some future time from a series of proposed new wells in Dry Lake Valley. Until the outcomes of agency and public scoping and the water-rights application process are known and the Nevada State Engineer makes permitting decisions, details about the specific future groundwater development in this valley pursuant to these applications (including final locations of any proposed new wells, or the precise timing of such development) are not known. However, according to the NDWR Water Rights Database, an application has been filed for a future irrigation well that would be within approximately 1.7 kilometers (1.1 miles) of a proposed new well location (DLV3) in Dry Lake Valley. The proposed production rate for the municipal well would be up to 17,000 liters (4,448 gallons) per minute and the well would operate year round. This water rights application is under protest. The potential for impacts associated with this well application, if it were to be approved and the well installed and used at the same time as proposed well location DLV3, is evaluated in Section 5.2.2.6. Chapter 5, Cumulative Impacts, includes additional information about these water-rights applications.

Hydrographic area 208, Pahroc Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 25.9 million cubic meters (21,000 acre-feet) (see Table 3-35). In addition to existing wells with water rights in area 208, Lincoln County and two other entities have filed water-rights applications with the Nevada State Engineer to possibly appropriate water at some future time from a series of proposed new wells in Pahroc Valley (DIRS 175909-Hafen et al. 2003, pp. 1 and 2, and Exhibit B). Pending the outcome of agency and public scoping and water rights permitted by the Nevada State Engineer, details pertaining to the specific future groundwater development in this valley pursuant to these applications (including final locations of any proposed new wells, or the precise timing of such development) are not known. However, according to the NDWR Water Rights Database, there are NDWR water-rights applications with "Ready for Action" (RFA) or "Ready for Protest" (RFP) status on file, and the most recent amended application applies to a proposed well location in Pahroc Valley that would be within approximately 1.7 kilometers (1.1 miles) of a proposed location (PahV9) for installation of up to two new withdrawal wells. This application has an RFA status, the proposed production rate for this municipal well would be up to 10,200 liters (2,690 gallons) per minute, and the well would operate year round. Water-rights applications have also been submitted for a proposed municipal well that would be approximately 1.5 kilometers (0.9 mile) northeast of the proposed PahV7 well location and a proposed municipal well that would be approximately 1 kilometer (0.6 mile) northeast of the proposed PahV8 well location. The potential for impacts associated with these well applications is evaluated in Section 5.2.2.6. Chapter 5, Cumulative Impacts, includes additional information pertaining to proposed future groundwater development projects in eastern Nevada.

The depth to groundwater beneath the Pahroc Valley hydrographic area generally exceeds 61 meters (200 feet) (see Table 3-38). Depth to groundwater underlying the rail alignment in Pahroc Valley ranges from 50 to 180 meters (160 to 600 feet). Available data regarding characteristics of the aquifers underlying area 208 indicate that approximately 1.6 billion cubic meters (1.3 million acre-feet) of recoverable groundwater might exist within the upper 30 meters (100 feet) of saturated aquifer material within this basin. It is also estimated that there could be an additional 400 million cubic meters (320,000 acre-feet) of recoverable groundwater in the carbonate aquifer underlying this area (Table 3-38). NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 208.

Geologic units underlying the Pahroc Valley hydrographic area include alluvial sediments, carbonate rocks, quartzite, volcanics, and an older clastic rock (rock formed from fragments of pre-existing rock) aquitard. Mountain front precipitation and inflow from adjacent valleys (primarily White River Valley to the north) provide most of the flow to Pahroc Valley.

There are no NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no springs in hydrographic area 208 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 1 (see Table 3-36).

Hydrographic area 207, White River Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 45.6 million cubic meters (37,000 acre-feet) (see Table 3-35). In addition to existing groundwater wells in hydrographic area 207 with water-rights appropriations, preliminary NDWR data indicate that that there are approximately 52.4 million cubic meters (42,500 acre-feet) of pending annual duties in area 207. None of the pending water-rights locations are within 1.6 kilometers (1 mile) of the centerline of the Caliente common segment 1.

Groundwater depth throughout White River Valley varies from above surface to 120 meters (–1 to 400 feet). In the portion of hydrographic area 207 the rail line would cross, groundwater is approximately 20 meters (60 feet) below ground surface (Table 3-38). Available data regarding characteristics of the aquifer underlying area 207 indicate that approximately 6.04 billion cubic meters (4.9 million acre-feet) of recoverable groundwater might exist within the upper 30 meters (100 feet) of saturated aquifer material within this basin. Groundwater is a calcium-bicarbonate type. Groundwater is primarily obtained from alluvial valley fill, but water does occur in carbonate rocks. The primary geologic units comprising White River Valley include alluvial valley fill and older carbonate rocks. There are no NDWR wells with water rights, USGS NWIS wells, or springs in hydrographic area 207 within 1.6 kilometers (1 mile) of the centerline of common segment 1 (see Table 3-36 and Figure 3-77).

Hydrographic area 171, Coal Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Table 3-35). Groundwater is primarily obtained from alluvial valley fill, but water does occur in fractured volcanic rocks and carbonate rocks. An oil exploration well in north-central Coal Valley penetrated 820 meters (2,700 feet) of alluvium. Depth to groundwater throughout Coal Valley varies from 30 meters to more than 240 meters (100 to more than 800 feet). Depth to groundwater along the rail alignment beneath area 171 varies from 50 to 90 meters (160 to 280 feet) (Table 3-38). It is estimated that there could be approximately 1.9 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 171. It is estimated that there could be an additional 740 million cubic meters (600,000 acre-feet) of recoverable groundwater in the carbonate aquifer underlying these two areas combined (DIRS 176851-Brothers, Bugo, and Tracy 1993, p. 29). NDWR data indicate that there are approximately 40.8 million cubic meters (33,100 acre-feet) of pending annual duties (see Table 3-35) in area 171.

There is one USGS NWIS well and no springs in hydrographic area 171 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 1. Figure 3-77 shows the location of the well. Table 3-36 lists two existing wells within 1.6 kilometers of the centerline of the rail alignment within hydrographic area 171. One of these wells are within 1.6 kilometers of the centerline of common segment 1; the other is within 1.6 kilometers of the centerline of the Garden Valley 2 alternative segment (Figure 3-77).

The predominant proposed use category for the existing NDWR wells with water rights that are within approximately 1.6 kilometers (1 mile) of the centerline of Caliente common segment 1 is irrigation. Table 3-36 (columns 4 through 13) summarizes the proposed use categories of these wells. Figures 3-75, 3-77, and 3-78 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of common segment 1. In addition to a series of new wells proposed for installation within the rail line construction right-of-way, DOE might install a series of additional wells at selected locations outside the construction right-of-way, either as alternative water wells or as alternative wells used in combination with other water wells installed within the construction right-of-way. These wells would be drilled in areas where groundwater resources within the construction right-of-way were not adequate to meet railroad construction or operations needs. No potential quarry sites have been identified along Caliente common segment 1. Proposed new wells that might be required outside the nominal width of the rail line construction right-of-way not related to water-supply requirements for potential quarries include:

- Location DLV5 (Figures 3-75 and 3-77) in the western part of Dry Lake Valley 1.1 kilometers (0.7 mile) northeast of the centerline of the rail alignment
- Locations PahV3, PahV4, and PahV8 (Figure 3-77) in southern, central, and western Pahroc Valley approximately 1.3 to 2.7 kilometers (0.8 to 1.7 miles) west to southwest of the centerline of the rail alignment

There are no known existing wells within 1.6 kilometers (1 mile) of proposed well site DLV5, and the closest existing springs are Deadman Spring and Black Rock Spring, about 2.4 kilometers (1.5 miles) northwest or west of this location (DIRS 176189-Converse Consultants 2006, Appendixes A and B). There are no known existing wells or springs within 1.6 kilometers of the proposed well locations at PahV3, PahV4, and PahV8.

3.2.6.3.3 Garden Valley Alternative Segments

Crossing from east to west, alternative segments Garden Valley 1, Garden Valley 2, Garden Valley 3, and Garden Valley 8 would overlie hydrographic areas 171 (Coal Valley) and 172 (Garden Valley) (see Figure 3-78). Areas 171 and 172 each have a perennial yield of 7.40 million cubic meters (6,000 acre-feet), and are not designated groundwater basins (see Table 3-35). Committed groundwater resources in these areas do not exceed estimated perennial yields. In addition to existing groundwater wells in hydrographic area 172 that have water-rights appropriations, NDWR data indicate that there are approximately 15 million cubic meters (12,200 acre-feet) in pending underground annual duties (see Table 3-35) in area 172. These pending annual duties applications correspond to water-rights applications filed with the Nevada State Engineer by the Las Vegas Valley Water District and Lincoln County to appropriate water at some future time from a series of proposed new wells within hydrographic area 172 (DIRS 175909-Hafen et al. 2003, all). According to the NDWR Water Rights Database, an application for a future municipal well has been filed by the Lincoln County Water District and by a private entity to appropriate groundwater from a location approximately 1.2 kilometers (0.8 mile) southwest of a proposed location (GV10) for up to two new withdrawal wells in Garden Valley. The potential for impacts associated with this well application is evaluated in Section 5.2.2.6.

Groundwater quality underlying the areas of the Garden Valley alternative segments varies according to location within the hydrographic areas the rail line would cross. Table 3-39 summarizes general groundwater-quality and aquifer characteristics in the two hydrographic areas underlying the Garden Valley alternative segments.

Along the Caliente rail alignment, depth to groundwater in Garden Valley varies from approximately 40 to 120 meters (120 to 400 feet) below ground (Table 3-39). Groundwater quality underlying the Garden Valley alternative segments varies according to location. Data from four wells in Garden Valley indicate the groundwater is a calcium-bicarbonate type. Table 3-39 summarizes generalized groundwater-quality characteristics in this area.

Table 3-39. General groundwater-quality and aquifer characteristics – Garden Valley alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality [d]
171 Coal Valley	Alluvial valley fill, volcanic rocks, clastic rocks, and carbonate rocks[e]	50 to 80	*Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000 (total for hydrographic areas 171 and 172)[f]	Total dissolved solids: 200 to 300 mg/L[e]
172 Garden Valley	Alluvial valley fill, with surrounding mountain ranges comprised of older carbonate and clastic rocks, and younger volcanic rock units[e]	40 to 120	*Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000 (total for hydrographic areas 171 and 172)[f]	Total dissolved solids: 200 to 300 mg/L[e]

a. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 176600-Converse Consultants 2005, Plate 4-10); groundwater can vary over a wide range of depth depending on location in the hydrographic area (DIRS 176600-Converse Consultants 2005, pp. 74 and 76).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Source: DIRS 176600-Converse Consultants 2005, pp. 73 to 77.
f. Sources: DIRS 180754-Rush et al. 1971, all; DIRS 176851-Brothers, Bugo, and Tracy 1993, pp. 29 and 30.

Geologic units in the Garden Valley area include primarily alluvial valley fill, with surrounding mountain ranges comprised mostly of carbonate rocks, rock units, and clastic rocks (Table 3-39). The Garden Valley alternative segments would predominantly overlie alluvial valley fill. It is estimated that there could be approximately 1.85 billion cubic meters (1.50 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 172. It is estimated that there could be an additional 740 million cubic meters (600,000 acre-feet) of recoverable groundwater (DIRS 176851-Brothers, Bugo, and Tracy 1993, p. 30) in the carbonate aquifer underlying these two areas combined (Table 3-39). Review of available data for existing wells and springs indicates the following (Figure 3-78):

- There is one existing USGS NWIS well and no springs in hydrographic area 171 within 1.6 kilometers (1 mile) of the Garden Valley 2 alternative segment.
- In hydrographic area 172, there are no NDWR wells with water rights, no NDWR domestic wells, six USGS NWIS wells, and one spring within approximately 1.6 kilometers of the centerline of Garden Valley alternative segment 3; no NDWR well with water rights or NDWR domestic wells,

one USGS NWIS well, and one spring within 1.6 kilometers of the centerline of Garden Valley alternative segment 1; no NDWR wells with water rights or NDWR domestic wells, no USGS NWIS wells, and no springs within 1.6 kilometers of Garden Valley alternative segment 2; and no NDWR wells with water rights or NDWR domestic wells, no USGS NWIS wells, and one spring within approximately 1.6 kilometers of the centerline of Garden Valley alternative segment 8.

Figure 3-78 identifies NDWR wells with water rights and USGS NWIS wells within approximately 1.6 kilometers (1 mile) of the centerlines of the Garden Valley alternative segments. As described above for the cases of hydrographic areas 203 and 204, all existing wells in areas 171 and 172 that lie within 1.6 kilometers of the centerlines of the proposed Garden Valley alternative segments may not be depicted on Figure 3-78 because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.

Figure 3-78 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Garden Valley alternative segments. All proposed water wells would be within the construction right-of-way of the selected alignment alternative. There are no potential quarry sites along the Garden Valley alternative segments.

3.2.6.3.4 Caliente Common Segment 2 (Quinn Canyon Range Area)

Crossing from east to west, Caliente common segment 2 would overlie hydrographic areas 172 (Garden Valley), 170 (Penoyer Valley), and 173A (Railroad Valley) (Figures 3-78 and 3-79). Section 3.2.6.3.3 describes the hydrogeologic characteristics of area 172. Committed groundwater resources in areas 170 and 173A exceed estimated perennial yields, but not in area 172 (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. Caliente common segment 2 would cross over a small portion of hydrographic area 172. Groundwater depth underlying the rail alignment in hydrographic area 172 varies from 50 to 90 meters (180 to 280 feet) (Table 3-40).

Groundwater quality underlying Caliente common segment 2 varies according to location within the hydrographic areas (172, 170, and 173A) the rail alignment would cross (Figures 3-78 and 3-79). Area 173A typically exhibits low dissolved-solids concentrations, with either bicarbonate with sodium or calcium as primary constituents. Table 3-40 summarizes general groundwater-quality and aquifer characteristics in this area.

Hydrographic area 170, Penoyer Valley, is a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of 4.93 million cubic meters (4,000 acre-feet). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. In addition to existing groundwater wells in hydrographic area 170 that have water-rights appropriations, preliminary NDWR data indicate that there are approximately 14.7 million cubic meters (11,900 acre-feet) of pending annual duties (see Table 3-35) in area 170. This pending water-right location is not within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 2.

Groundwater in area 170 is produced primarily from valley fill, although consolidated rocks (including volcanic rocks) underlying and surrounding Railroad Valley and Penoyer Valley transmit water through fractures associated with faulting (DIRS 176848-Van Denburgh and Rush 1974, p. 11). Depth to groundwater throughout Penoyer Valley varies from approximately 5 to 100 meters (10 to 330 feet) (DIRS 176600-Converse Consultants 2006, p. 71). Depth to groundwater varies from 50 to 60 meters (160 to 200 feet) along common segment 2 (Table 3-40). It is estimated that there could be approximately 2.71 billion cubic meters (2.2 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 170. Figures 3-78 and 3-79 show wells within approximately 1.6 kilometers (1 mile) of common segment 2. There are no NDWR wells with water rights, no NDWR domestic wells, two USGS NWIS wells (classified as monitoring wells), and two springs in area 170 within 1.6 kilometers of the centerline of common segment 2 or within 1.6 kilometers of any DOE-proposed new well.

Hydrographic area 173A is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yields of 3.45 million cubic meters (2,800 acre-feet) (see Table 3.2.6-1). Groundwater in area 173A is produced primarily from valley fill, although consolidated rocks (including volcanic rocks) underlying and surrounding Railroad Valley and Penoyer Valley transmit water through fractures associated with faulting (DIRS 176848-Van Denburgh and Rush 1974, p. 11). Depth to groundwater throughout hydrographic area 173A varies from 5 to 120 meters (17 to 400 feet). Depth to groundwater varies from 50 to 55 meters (160 to 180 feet) along common segment 2 (Table 3-40). It is estimated that there could be approximately 2.59 billion cubic meters (2.1 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer material within area 173A.

Table 3-40. General groundwater-quality and aquifer characteristics – Caliente common segment 2.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
172 Garden Valley	Alluvial valley fill, with surrounding mountain ranges comprised of older carbonate and clastic rocks, and younger volcanic rock units[e]	50 to 90	*Alluvial valley fill*: 1.5 million[f] *Carbonate rock aquifer*: 600,000 (total for hydrographic areas 171 and 172)[f]	Total dissolved solids: 200 to 300 mg/L[e]
170 Penover Valley	Alluvial valley fill, volcanic rocks, and older carbonate rocks[e]	50 to 60	2.2 million[f]	Total dissolved solids: 300 to 700 mg/L[e]
173A Railroad Valley (Southern Part)	Alluvial valley fill, volcanic rocks, and older carbonate rocks[e]	50 to 55	2.1 million[f]	Total dissolved solids: 253 to 409 mg/L; 2,790 mg/L in one well[e] Fluoride: more than 4 mg/L[e]

a. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 176600-Converse Consultants 2005, Plates 4-8 and 4-10); groundwater can vary over a wide range of depths depending on location in the hydrographic area (DIRS 176600-Converse Consultants 2005, pp. 64 and 71).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Source: DIRS 176600-Converse Consultants 2005, pp. 63 to 75.
f. Sources: DIRS 180754-Rush et al. 1971, all; DIRS 176851-Brothers, Bugo, and Tracy 1993, pp. 29 and 30.

There are no NDWR wells with water rights, no USGS NWIS wells, and no springs in area 173A within 1.6 kilometers (1 mile) of the centerline of common segment 2. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 173A.

Geologic units in the Penoyer Valley (area 170) and the Railroad Valley South (area 173A) areas include alluvial valley fill, volcanic rocks, and older carbonate rocks (Table 3-40). Carbonate rocks make up part of the Reveille Range and a portion of the southern Quinn Canyon Range where common segment 2 would cross the east and west perimeters of Railroad Valley. Caliente common segment 2 would predominantly overlie alluvial valley fills.

Figures 3-78 and 3-79 show proposed well locations (see Section 4.2.6) for supplying water to support construction of Caliente common segment 2. New wells are proposed within and outside the rail line construction right-of-way. These wells would be drilled in areas where groundwater resources within the construction right-of-way would not be adequate to meet construction or operations needs. Up to two locations in the north-central portion of Penoyer Valley approximately 2.9 to 3.5 kilometers (1.8 to 2.2 miles) south of the rail alignment (locations PeV1, PeV2, and PeV3 on Figure 3-78) represent potential alternative new well locations. These two alternative well sites are within alluvial valley fill, and are proposed as alternative wells if needed, to allow for wells to be completed a greater distance from a geologic contact between alluvium and bedrock materials. There are no potential quarry sites along Caliente common segment 2.

3.2.6.3.5 South Reveille Alternative Segments

South Reveille alternative segments 2 and 3 would overlie the Railroad Valley Southern Part, hydrographic area 173A (Figure 3-79). Section 3.2.6.3.4 describes area 173A in detail. Table 3-40 summarizes generalized groundwater quality and aquifer characteristics in this area. Committed groundwater resources in this (designated) area exceed the estimated perennial yield (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There is one NDWR well with water rights, no NDWR domestic wells, and no USGS NWIS wells, and no springs in area 173A within 1.6 kilometers (1 mile) of the centerlines of the South Reveille alternative segments.

Geologic units in the general area of South Reveille alternative segments 2 and 3 include alluvial valley fill, with volcanic rocks primarily comprising the Kawich Range and older carbonate rocks and volcanic rocks comprising the Reveille Range adjacent to the alternative segments. About half of the total length of the South Reveille alternative segments would overlie alluvial valley fill. Groundwater is produced primarily from alluvial valley fill, although water does occur in fractured volcanic rocks. Based on data from six wells in the southern part of Railroad Valley, depth to groundwater ranges from approximately 5 to 120 meters (17 to 400 feet) (DIRS 176600-Converse Consultants 2006, p. 64). Near Caliente common segment 2 and the South Reveille alternative segments in the southern part of area 173A, the depth to groundwater could be more than 91 meters (300 feet) in some areas based on data from only two wells. Section 3.2.6.3.4 contains additional information on groundwater characteristics and groundwater availability in area 173A.

3.2.6.3.6 Caliente Common Segment 3 (Stone Cabin Valley Area)

Crossing from east to west, Caliente common segment 3 would overlie hydrographic areas 173A (Railroad Valley South), 156 (Hot Creek Valley), 149 (Stone Cabin Valley), and 141 (Ralston Valley) (Figures 3-79 and 3-80). Caliente common segment 3 would predominantly overlie alluvial valley fill. Depth to groundwater varies from approximately 24 to more than 90 meters (80 to more than 300 feet) along Caliente common segment 3 (Table 3-41). This range includes projected values in those areas where there are few or no wells.

Groundwater quality underlying Caliente common segment 3 varies according to location within the hydrographic areas the rail line would cross. Table 3-41 summarizes general groundwater-quality and aquifer characteristics in the three hydrographic areas underlying Caliente common segment 3.

Section 3.2.6.3.4 describes the hydrogeologic characteristics of area 173A. There is one USGS NWIS well in area 173A within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3 (Figure 3-79).

Area 156, Hot Creek Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 6.8 million cubic meters (5,500 acre-feet). Geologic units in hydrographic area 156 (Hot Creek) include alluvial valley fill, volcanic rocks in the Kawich Range adjacent to Caliente common segment 3, and volcanic and older carbonate rocks comprising part of the Hot Creek Range, north of Warm Springs (see Figure 3-79). Groundwater is produced primarily from alluvial valley fill, although there is water in fractured volcanic rocks and in carbonate rocks in the Hot Creek Range. There is groundwater under both confined and unconfined conditions in area 156 (DIRS 176950-Rush and Everett 1966, p. 16). The thickness of underlying alluvium is not known; however, three wells in the area penetrated between 47 and 97 meters (150 and 320 feet) of alluvial materials (DIRS 176950-Rush and Everett 1966, p. 35). There could be approximately 2.8 billion cubic meters (2.3 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 156.

Table 3-41. General groundwater-quality and aquifer characteristics – Caliente common segment 3 and South Reveille alternative segments 2 and 3.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
173A Railroad Valley, Southern Part	Alluvial valley fill, volcanic rocks, and older carbonate rocks[e]	20 to 50	2.1 million[f]	Total dissolved solids: 253 to 409 mg/L; 2,790 mg/L in one well[e] Fluoride: more than 4 mg/L[e]
156 Hot Creek Valley	Alluvial valley fill, volcanic rocks in the Hot Creek and Kawich Ranges adjacent to common segment 3, and older carbonate rocks comprising part of the Hot Creek Range[d]	Less than 60	2.3 million[f]	Total dissolved solids: 176 to 2,500 mg/L[e] Fluoride: 5 to 30 mg/L[e]
149 Stone Cabin Valley	Alluvial valley fill, volcanic rocks, and carbonate rocks[e,g]	20 to 40	2.2 million[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[h]
141 Ralston Valley	Alluvial valley fill, volcanic rocks, and older carbonate and clastic rocks[e,g]	50 to 70	2.7 million[f]	Total dissolved solids: 290 mg/L (in one well 3.2 kilometers [2 miles] northwest of Tonopah airport)[e]

a. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 176600-Converse Consultants 2005, Plates 4-6 to 4-8); groundwater can vary over a wide range of depths depending on location in the hydrographic area (DIRS 176600-Converse Consultants 2005, pp. 53 and 57.
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Source: DIRS 176600-Converse Consultants 2005, pp. 52 through 66.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Sources: DIRS 176600-Converse Consultants 2005, p. 55; DIRS 173179-Belcher 2004, Figure B-1.
h. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.

Groundwater is reported to be a sodium-bicarbonate type. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 156.

There is one NDWR well with water rights, no NDWR domestic wells, and no USGS NWIS wells in area 156 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3. One spring (Black Spring) in area 156 (Figure 3-79) is within 1.6 kilometers of the centerline of Caliente common segment 3.

Area 149, Stone Cabin Valley, is a designated groundwater basin with perennial yields of 2.5 million cubic meters (2,000 acre-feet). Committed groundwater resources in area 149 exceed the estimated perennial yield (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. In addition to existing groundwater wells in hydrographic area 149 with water-rights appropriations, NDWR data indicate that there are approximately 7.9 million cubic meters (6,400 acre-feet) of pending annual duties (see Table 3-35) in area 149.

Groundwater in area 149 is produced primarily from alluvial valley fill, although there is water in fractured volcanic rocks and in carbonate rocks in the Hot Creek Range, north of Warm Springs (see Table 3-41). There could be approximately 2.71 billion cubic meters (2.2 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 149. Table 3-41 summarizes groundwater-quality characteristics in this area. Depth to groundwater throughout hydrographic area 149 varies from 5 to 120 meters (18 to 390 feet). Depth to groundwater underlying the rail alignment in this area ranges from 20 to 40 meters (80 to 120 feet) (Table 3-41). There are five NDWR wells with water rights, no NDWR domestic wells, six USGS NWIS wells, and no springs in area 149 within approximately 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3 (Figures 3-79 and 3-80). The proposed use categories for the wells include irrigation and public supply–municipal. Figure 3-80 does not depict all existing wells in area 149 that lie within 1.6 kilometers of the centerline of Caliente common segment 3 because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.

Area 141, Ralston Valley, is a designated groundwater basin with perennial yields of 7.40 million cubic meters (6,000 acre-feet) (see Table 3-35). Committed groundwater resources do not exceed the estimated perennial yield. The thicknesses of underlying alluvium is not known; however, well logs for wells drilled in the area indicate alluvial materials up to at least 120 meters (380 feet) thick. Geologic units include alluvial valley fill, volcanic rocks in the central and southern parts of the basin, and older carbonate or clastic rocks in the northern part of the basin. Groundwater in area 141 is produced primarily from alluvial valley fill, with limited production from volcanic rocks where they are fractured and minor production from carbonate rocks in the northern part of the valley. Groundwater depths throughout hydrographic area 141 vary from less than 3 meters to 150 meters (less than 10 to 500 feet). Groundwater depth underlying the common segment 3 alignment in this area varies from 50 to 70 meters (Table 3-41). There could be approximately 3.33 billion cubic meters (2.7 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 141. Table 3-41 summarizes groundwater-quality characteristics in this area. There are no NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no springs in area 141 within 1.6 kilometers (1 mile) of the centerline of Caliente common segment 3 (see Figure 3-80). NDWR data indicate that there are approximately 1,230 cubic meters (1 ***acre-foot***) of documented pending annual duties (see Table 3-35) in area 141.

Figures 3-79 and 3-80 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of Caliente common segment 3. The potential quarry site east of Caliente common segment 3 in South Reveille Valley (see Figure 3-79) would overlie hydrographic area 173A. Host rock units in the vicinity of this potential quarry include basalt and lava flow rocks (DIRS 173842-Shannon &

Wilson 2005, Plate 2). Depth to groundwater in the area could be between 90 and 150 meters (300 and 500 feet) (DIRS 176189-Converse Consultants 2006, Appendix A).

3.2.6.3.7 Goldfield Alternative Segments

Crossing from north to south, Goldfield alternative segment 1 would overlie hydrographic areas 141 (Ralston Valley), 142 (Alkali Spring Valley), and 145 (Stonewall Flat); Goldfield alternative segment 3 would overlie areas 141 and 145; and Goldfield alternative segment 4 would overlie areas 141, 142, 144 (Lida Valley), and 145 (Figure 3-80).

Section 3.2.6.3.6 describes hydrographic area 141. There are no existing NDWR wells with water rights, USGS NWIS wells, or springs in area 141 within 1.6 kilometers (1 mile) of the centerlines of the proposed Goldfield alternative segments.

Depth to groundwater varies along the Goldfield alternative segments. However, based on projections from nearby areas, depth to groundwater could generally vary between approximately 15 and 90 meters (50 to 300 feet) (Table 3-42), but can locally be shallower, such as in areas where springs occur.

Groundwater quality underlying the Goldfield alternative segments varies according to location within the hydrographic areas the rail line would cross. Table 3-42 summarizes general groundwater-quality and aquifer characteristics in the three hydrographic areas underlying the Goldfield alternative segments.

Area 142, Alkali Spring Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-35). Groundwater depth throughout area 142 varies from 15 to 40 meters (50 to 120 feet). There could be approximately 1.6 billion cubic meters (1.3 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 142. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 142.

Near the western edge of Goldfield, along Goldfield alternative segment 4, the depth to groundwater is approximately 15 to 40 meters (50 to 120 feet) (Table 3-42). Water quality varies in area 142 according to location. Water in Alkali Spring, in the southern portion of area 142 approximately 13 kilometers (8 miles) northwest of Goldfield is reported to be a sodium sulfate type that exhibits elevated total dissolved solids concentrations (DIRS 176849-Rush 1968, Plate 1). Analyses have shown that the quality of water from various groundwater wells in the basin is good (Table 3-42).

In area 142 (see Table 3-36), there is one NDWR well with water rights (municipal use), no NDWR domestic wells, four USGS NWIS wells, and two springs within approximately 1.6 kilometers (1 mile) of the centerline of Goldfield alternative segment 4, and one spring within approximately 1.6 kilometers of the centerline of Goldfield alternative segment 1. In area 141, there are no existing NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no springs within 1.6 kilometers of the centerline of Goldfield alternative segment 3.

Area 144, Lida Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 430,000 cubic meters (350 acre-feet) (see Table 3-35). There could be approximately 1.85 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 142. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 144.

Depth to groundwater is uncertain along the Goldfield 4 alternative segment where it would cross area 144. However, based on projections from nearby areas, depth to groundwater could range from 50 to 90 meters (160 to 290 feet) (DIRS 176600-Converse Consultants 2005, pp. 46 and 47). There is one existing NDWR well with water rights, no NDWR domestic wells, no existing USGS NWIS wells, and no springs in area 144 within 1.6 kilometers (1 mile) of the centerline of Goldfield alternative segment 4.

Area 145, Stonewall Flat, is not a designated groundwater basin. Committed groundwater resources do not exceed the perennial yield of 124,000 cubic meters (100 acre-feet) (see Table 3-35). There could be approximately 1.01 billion cubic meters (820,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 145. Depth to groundwater is uncertain along Goldfield alternative segment 3 where it would cross area 145. However, based on projections from nearby areas, depth to groundwater could be approximately 37 to 60 meters (120 to 200 feet) (Table 3-42). There are no existing NDWR wells with water rights and no NDWR domestic wells, no existing USGS NWIS wells, and one spring in area 145 within 1.6 kilometers (1 mile) of the centerline of Goldfield alternative segment 1, and no existing NDWR wells with water rights and no NDWR domestic wells, no existing USGS NWIS wells, and three springs in area 145 within 1.6 kilometers of Goldfield alternative segment 3. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 145.

There are two potential quarry sites (NS-3A and NS-3B) east of Goldfield alternative segment 3 (Figure 3-80). These potential quarry sites would overlie hydrographic area 141. Host rock units include

Table 3-42. General groundwater-quality and aquifer characteristics – Goldfield alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
141 Ralston Valley	Alluvial valley fill, volcanic rocks, and older carbonate or clastic rocks[e]	43 to 67	2.7 million[f]	Total dissolved solids: 290 mg/L (in one well 3.2 kilometers [2 miles] northwest of Tonopah airport)[g]
142 Alkali Spring Valley	Alluvial valley fill deposits, volcanic rocks, and older sedimentary rocks[h]	15 to 40	1.3 million[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[i]
144 Lida Valley	Alluvial valley fill, rhyolite, volcanic sediments (including tuffs of the Stonewall Flat and tuffs of the Thirsty Canyon Group), and older rock units including claystone, siltstone, and limestone[d]	50 to 85	1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]
145 Stonewall Flat	Alluvial valley fill deposits, volcanic rocks, and older sedimentary rocks[h]	37 to 60	820,000[f]	Total dissolved solids: Less than 300 mg/L[g]

a. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 176600-Converse Consultants 2005, Plates 4-5 and 4-6); groundwater can vary over a wide range of depths depending on location in the hydrographic area (DIRS 176600-Converse Consultants 2005 pp. 41, 45 through 47, 49, and 51).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Source: DIRS 176600-Converse Consultants 2005, p. 52.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 176600-Converse Consultants 2005, pp. 42, 47, 49, and 54.
h. Sources: DIRS 173842-Shannon & Wilson 2005, pp. 23 and 24, 29, 30, 33 to 35, and Plate 2; DIRS 173179-Belcher 2004, Figure B-1.
i. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.

alluvial fan deposits, and the targeted water production zones for wells at these potential quarry sites, if required, are an alluvial fan or the underlying fractured volcanic rocks. The estimated total depths of these new wells (RaV9/10/11) would be between 120 and 150 meters (400 and 500 feet), and the target aquifer would be an alluvial unit (DIRS 176189-Converse Consultants 2006, Appendixes A and B). A potential alternative groundwater-supply well location west of Goldfield alternative segment 4 (AsV6) would be installed if necessary to obtain adequate water to support operation of a quarry (ES-7) west of Goldfield alternative segment 4 and southwest of this proposed well (Figure 3-80). This potential quarry site would overlie the southern portion of hydrographic area 142. Up to two wells that might be installed at this location would have total depths of between about 30 and 60 meters (100 and 200 feet), with the target aquifer being a fractured volcanic rock unit (DIRS 176189-Converse Consultants 2006, Appendixes A and B). Host rock units for this potential quarry site include basalt (DIRS 175986-Shannon & Wilson 2005, Plate 2 and Figure 3, Sheet 21 of 94; DIRS 173842-Shannon & Wilson 2005, Plate 2).

Geologic units underlying hydrographic areas 142, 144, and 145 include alluvial valley-fill deposits, volcanic rocks, and older sedimentary rocks (DIRS 173179-Belcher 2004, p. 28). Goldfield alternative segments 1 and 3 would cross alluvial deposits, basalt flows, rhyodacite lava flow deposits, and ash-flow tuff deposits (DIRS 175986-Shannon & Wilson 2005, Figures 2 and 3, Sheets 23 to 26). Goldfield alternative segment 3 would cross near a small cinder cone west of Mud Lake Playa (DIRS 175986-Shannon & Wilson 2005, Plate 2 and Sheets 23 and 26). Portions of the three Goldfield alternative segments would overlie alluvial valley fill (DIRS 176189-Converse Consultants 2006, Maps 11a and 11b). About two-thirds of the total length of Goldfield alternative segment 4 would overlie alluvial valley fill, compared to approximately one-third for Goldfield alternative segments 1 and 3. Goldfield alternative segment 1 and, to a considerably lesser extent, Goldfield alternative segment 3, would pass close to mine shafts at one or more locations (for example, along a section of Goldfield alternative segment 1 near Black Butte in the immediate vicinity of the City of Goldfield) (DIRS 175986-Shannon & Wilson 2005, Figure 3, Sheets 24 and 25).

Within area 142 (Alkali Spring Valley), which portions of Goldfield alternative segments 1 and 4 would cross, groundwater production is generally derived from valley-fill alluvium. Groundwater production in area 144 is limited to a few domestic wells, a municipal well at Lida, and stockwater wells. There are a few small stockwater wells near the general area of the rail alignment in area 144. These wells produce from valley fill materials; however, no aquifer test data are available for these wells (DIRS 176189-Converse Consultants 2006, Appendix B).

Figure 3-80 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Goldfield alternative segments. In addition to a series of new wells proposed for installation within the rail line construction right-of-way of the selected alternative segment, DOE might install a series of additional wells outside the nominal width of the rail line construction right-of-way, either as alternative water wells or as alternative wells used in combination with other water wells installed within the rail line construction right-of-way. These wells would be drilled in areas where groundwater resources within the construction right-of-way would not be adequate to meet construction or operations needs. Possible locations for wells in this category (Figure 3-80) include the following (locations used would depend on the alternative segment):

- Locations ASV1/2/3/4/5/8/9 in hydrographic area 142, approximately 3.5 kilometers (2.2 miles) west of the centerline of Goldfield alternative segment 4. Wells installed at this location would be expected to intercept alluvial valley fill deposits (alluvial fan), and could encounter groundwater at a depth of approximately 60 to 90 meters (200 to 300 feet) (DIRS 176189-Converse Consultants 2006, Appendixes A and B).
- Locations StF1/2/3/5/6/7 in hydrographic area 145, approximately 1.9 to 2.3 kilometers (1.2 to 1.4 miles) east of the centerline of Goldfield alternative segment 3. Wells installed at this location would be

expected to intercept alluvial valley fill deposits, and would have total depths of approximately 180 to 210 meters (600 to 700 feet) (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Maps 12a and 12b).

- Locations LV1/2/3/4/9/10/11/12 in hydrographic area 144, approximately 4.6 to 5.0 kilometers (2.9 to 3.1 miles) west of the centerline of Goldfield alternative segment 4. Wells installed at this location would be expected to intercept alluvial valley fill deposits, and would have total depths of approximately 120 to 150 meters (400 to 500 feet) (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Maps 12e and 12f).

3.2.6.3.8 Caliente Common Segment 4 (Stonewall Flat Area)

Caliente common segment 4 would overlie hydrographic area 144 (Figures 3-80 and 3-81). Section 3.2.6.3.7 describes the hydrogeologic characteristics of area 144. Committed groundwater resources in this area do not exceed the estimated perennial yield (see Table 3-35). As shown on Figures 3-80 and 3-81, there is one NDWR well with water rights, no NDWR domestic wells, two USGS NWIS wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of Caliente common segment 4.

Geologic units that common segment 4 would cross include primarily alluvial valley fill deposits and some volcanic rocks (DIRS 173179-Belcher 2004, p. 28). Specific volcanic units the segment would cross include Stonewall Flat and tuffs of the Thirsty Canyon Group. The estimated depth to groundwater throughout hydrographic area 144 can vary from 8 to 110 meters (26 to 360 feet) depending on location (DIRS 176600-Converse Consultants 2005, p. 45). The depth to groundwater underlying the alignment varies from 50 to 85 meters (160 to 280 feet) (Table 3-43) (DIRS 176600-Converse Consultants 2005, Plate 4-5). Section 3.2.6.3.7 and Table 3-42 summarize general groundwater quality and aquifer characteristics in area 144.

Figures 3-80 and 3-81 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of Caliente common segment 4. All proposed water wells would be within the rail alignment construction right-of-way. There are no potential quarry sites along Caliente common segment 4.

3.2.6.3.9 Bonnie Claire Alternative Segments

From north to south, Bonnie Claire alternative segments 2 and 3 would cross hydrographic areas 144 (Lida Valley) and 146 (Sarcobatus Flat) (Figure 3-81). Section 3.2.6.3.7 describes hydrographic area 144. There are no existing NDWR wells with water rights, no NDWR domestic wells, no existing USGS NWIS wells, and no existing springs in area 144 within 1.6 kilometers (1 mile) of the centerlines of the proposed Bonnie Claire alternative segments. There are four NDWR wells with water rights, no NDWR domestic wells, no USGS NWIS wells, and no existing springs in area 144 within 1.6 kilometers of the centerlines of the proposed Bonnie Claire alternative segments.

The Bonnie Claire alternative segments would predominantly overlie alluvial valley fill deposits and some volcanic rocks (DIRS 173842-Shannon & Wilson 2005, p. 28). The primary volcanic unit encountered along Bonnie Claire alternative segments 2 and 3 is tuff of the Timber Mountain Group (DIRS 173842-Shannon & Wilson 2005, p. 30 and Plate 2).

Area 146, Sarcobatus Flat, is a designated groundwater basin, and has a perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-35). Committed groundwater resources in area 146 exceed the estimated perennial yield, but as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 3 billion cubic meters (2.4 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 146. While the basin is primarily comprised of alluvial valley fill deposits, volcanic rocks make up the hills surrounding Sarcobatus Flat (Table 3-43). There are no existing water-supply wells or springs in area 146 within 1.6 kilometers (1 mile) of the centerlines of the Bonnie Claire alternative segments. Section 3.2.6.3.7 and Table 3-42 summarize general groundwater characteristics in area 144. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 146.

Groundwater in hydrographic area 146 contains elevated levels of sodium bicarbonate. Table 3-43 summarizes general groundwater-quality and aquifer characteristics in areas 144 and 146.

Most of the existing groundwater wells in area 146 are ***screened*** (installed with the well casing screened interval) in the alluvial valley fill; a few wells in the western portion of the basin are screened in volcanic rocks. The total volume of alluvial valley fill comprising the primary aquifer reservoir in area 146 is not known because of variations in the thickness of valley fill that result in variations in the surface of the underlying bedrock. However, Malmberg and Eakin (DIRS 106695-Malmberg and Eakin1962, pp. 13 and 19) suggested the maximum thickness of valley fill in area 146 could be as much as thousands of

Table 3-43. General groundwater-quality and aquifer characteristics – Caliente common segment 4 and Bonnie Claire alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
144 Lida Valley	Alluvial valley fill, rhyolite, volcanic sediments (including tuffs of the Stonewall Flat and tuffs of the Thirsty Canyon Group), and older rock units including claystone, siltstone, and limestone[e]	50 to 85	1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]
146 Sarcobatus Flat	Alluvial valley fill deposits and some volcanic rocks[f] (Volcanic units are tuff of the Timber Mountain Group)[h]	24 to 40	2.4 million[f]	Total dissolved solids: 540 mg/L[g]

a. The listed range of groundwater depths applies to the area underlying the proposed rail alignment (DIRS 176600-Converse Consultants 2005, Plates 4-4 and 4-5). The depth to groundwater can vary over a wide range of depths depending on location in a hydrographic area DIRS 176600-Converse Consultants 2005, pp. 41 and 45 through 47.
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Sources: DIRS 173842-Shannon & Wilson 2005, pp. 23 and 24, 29 and 30, 33 to 35, and Plate 2; DIRS 173179-Belcher 2004, Figure B-1.
f. Source: DIRS 176600-Converse Consultants 2005, pp. 42 and 47.
g. Source: DIRS 176600-Converse Consultants 2005, pp. 40 to 42, and Plates 4-4 and 4-5.
h. Source: DIRS 180754-Rush et al. 1971, all.

meters (several thousand feet). Figure 3-81 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Bonnie Claire alternative segments. All proposed water wells would be within the nominal width of the construction right-of-way of the selected alternative segment. There are no potential quarry sites along Bonnie Claire alternative segments.

3.2.6.3.10 Common Segment 5 (Sarcobatus Flat Area)

Crossing from north to south, common segment 5 would overlie hydrographic area 146 (Sarcobatus Flat) and a small portion of hydrographic area 228 (Oasis Valley) (Figures 3-81 and 3-82). Section 3.2.6.3.9 describes the groundwater-quality and aquifer characteristics of area 146, which are summarized in Table 3-43. There are four NDWR wells with water rights, one NDWR domestic well, eight USGS NWIS wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5 within area 146. The use categories for the NDWR wells with water rights are irrigation, quasi-municipal and stock-watering (see Table 3-36). Most wells in area 146 are screened in alluvial valley fill; a few wells are screened in volcanic rocks on the west side of the basin.

Section 3.2.6.3.11 describes the hydrogeologic characteristics of area 228, including groundwater-quality and aquifer characteristics; Table 3-44 summarizes those characteristics. Committed groundwater resources in these areas exceed estimated perennial yields (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There are no NDWR wells with water rights, no USGS NWIS wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5, as shown in Figure 3-81.

Common segment 5 would predominantly overlie alluvial valley fill, with depth to groundwater generally approximately 3 to 55 meters (10 to 180 feet) in those portions of areas 146 and 228 the rail line would cross. Volcanic rocks are the predominant rock type comprising the hills surrounding the basin.

Figures 3-81 and 3-82 show DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of common segment 5. All proposed water wells would be within the rail line construction right-of-way. There are no potential quarry sites along common segment 5.

Table 3-44. General groundwater-quality characteristics – Oasis Valley alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks clastic rocks, older carbonate rocks, and alluvial valley fill[e]	10 to 30	400,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g] Fluoride: 1 to more than 4 mg/L[h]

a. The listed depth to groundwater range applies to the area underlying the proposed Oasis Valley alternative rail alignments (DIRS 176600-Converse Consultants 2005, Plate 4-3). Depth to groundwater is much greater in the central and northern parts of area 228 (DIRS 176600-Converse Consultants 2005, p. 38).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Sources: DIRS 176600-Converse Consultants 2005, p. 36; DIRS 181909-Fridrich [n.d.] 2007, all; DIRS 181909-Fridrich et al. 2007, all.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.
h. Source: DIRS 176600-Converse Consultants 2005, p. 38.

3.2.6.3.11 Oasis Valley Alternative Segments

Oasis Valley alternative segments 1 and 3 would cross hydrographic area 228 (Oasis Valley) (Figure 3-82). This area is a designated groundwater basin with an estimated perennial yield in the range of 1.2 to 2.5 million cubic meters (1,000 to 2,000 acre-feet) (DIRS 147766-Thiel 1999, pp. 6 to 12 and Table 3-35). Committed groundwater resources in area 228 total 1.6 million cubic meters (1,300 acre-feet) per year (see Table 3-35). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 490 million cubic meters (400,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 228. NDWR data indicate that there are no documented pending annual duties (see Table 3-35) in area 228.

Geologic units Oasis Valley alternative segments 1 and 3 would cross include sedimentary rocks, small areas underlain by volcanic rocks, and some alluvial valley fill (Table 3-44). Depth to groundwater throughout Oasis Valley is generally 3 to 46 meters (10 to 150 feet), with the shallowest groundwater occurring along Oasis Valley alternative segment 1, northeast of Springdale. Depth to groundwater underlying the Oasis Valley alternative segments ranges from 10 to 30 meters (40 to 100 feet).

Oasis Valley has several springs and seeps. The locations of these springs and seeps are dictated by structurally controlled changes in rock unit lithology and thickness and conduits. The springs, seeps, and shallow groundwater in the valley are maintained primarily by groundwater flow moving into the area through a regional volcanic rock aquifer system (DIRS 169384-Reiner et al. 2002, p. 8). Most groundwater flowing south-southeastward into Oasis Valley through the ***welded tuff*** aquifer is diverted upward along faults where it either forms springs or flows laterally out of Oasis Valley as underflow, indicating a regional groundwater inflow component to the flow at the springs. Springs and seeps occur where upward diversion coincides with areas where the potentiometric surface is above the ground surface (DIRS 169384-Reiner et al. 2002, pp. 9 and 10). Most historical groundwater resource development in this area was from springs.

Available information indicates a non-welded confining volcanic tuff unit separates the alluvial aquifer from a regional welded tuff volcanic rock aquifer throughout much of Oasis Valley. This regional welded tuff aquifer has moderate fracture ***permeability*** (DIRS 169384-Reiner et al. 2002, p. 9).

Based on a review of the NDWR and USGS NWIS databases and other published information, Figure 3-82 identifies seven USGS NWIS wells, four springs, and one surface-water body within approximately 1.6 kilometers (1 mile) of the centerlines of the Oasis Valley alternative segments. As shown on the figure, there is a series of three springs (Upper Oasis Valley Ranch Springs) southwest of Oasis Valley alternative segment 1. Colson Pond and Colson Pond Spring are also near Oasis Valley alternative segment 3 (Figure 3-82).

There are no existing NDWR wells with water rights within 1.6 kilometers (1 mile) of the centerline of the Oasis Valley alternative segments. There is one cluster of three USGS-installed wells within approximately 0.64 kilometer (0.40 mile) of the centerline of Oasis Valley alternative segment 3 (wells ER-OV-01, ER-OV-06a, and ER-OV-06a2), and one USGS-installed well (ER-OV-02) within approximately 0.40 kilometer (0.25 mile) of Oasis Valley alternative segment 1 (DIRS 176600-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 176325-USGS 2006, all; DIRS 177294-MO0607USGSWNVD.000; DIRS 169384-Reiner et al. 2002, Plate 2). The use category for these wells is monitoring. There are three additional shallow USGS-installed wells (the OVU-Dune Well, OVU-Middle ET Well, and the OVU-Lower ET Well), used for monitoring groundwater levels, within approximately 0.32 to 0.48 kilometer (0.20 to 0.30 mile) of Oasis Valley alternative segment 1 (DIRS 176600-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 169384-Reiner et al. 2002, Plate 2). Figure 3-82 does not show all existing wells in area 228 that lie within 1.6 kilometers of the centerlines of Oasis Valley alternative segments because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.

Groundwater in much of Oasis Valley exhibits elevated levels of fluoride, in excess of the 4 milligrams per liter (approximately 4 parts per million) Nevada drinking water standard level (Table 3-44). Dissolved-solids concentrations in the alluvial valley fill are expected to be less than 500 milligrams per liter (approximately 500 parts per million) in the vicinity of the Oasis Valley alternative segments.

Figure 3-82 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of the Oasis Valley alternative segments. In addition to a series of new wells proposed for installation within the construction right-of-way, DOE might install wells at other locations outside the construction right-of-way, and use them either as principal water wells or in combination with other water wells installed within the construction right-of-way. These wells would be drilled in cases where either groundwater resources within the construction right-of-way would not be adequate for meeting construction or operations needs, or groundwater withdrawals would need to be distributed to reduce potential impacts on existing groundwater resources (see Section 4.2.6). Possible locations for wells in this category that could be used to obtain water for constructing the Oasis Valley alternative segments include the following (Figure 3-82):

- Up to two locations in the Oasis Valley groundwater basin, approximately 5.6 to 5.8 kilometers (3.5 to 3.6 miles) southwest of the centerline of common segment 6 (locations OV6 and OV8, or OV14 and OV16, depending on alternative segment). The target water source at this location would be alluvial valley fill (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Maps 14a and 14b).
- Locations in the southeastern part of Oasis Valley, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Maps 14a and 14b).

Review of NDWR and USGS database data and other published information (DIRS 169384-Reiner et al. 2002, Plate 2; DIRS 181909-Fridrich et al. 2007, all) on existing wells and springs indicates the following:

- There two existing NDWR wells with water rights, no NDWR domestic wells, and no USGS NWIS wells within 1.6 kilometers (1 mile) of locations OV6 and OV8, or OV14 and OV16. Two springs (Ute Springs and Manley Springs) lie within approximately 1.3 to 1.4 kilometers (0.8 to 0.9 mile) east of locations OV6 and OV8, or OV14 and OV16.
- There are no known existing wells or springs within 1.6 kilometers of the proposed alternative well location at OV22/OV23.

3.2.6.3.12 Common Segment 6 (Yucca Mountain Approach)

From north to south, common segment 6 would cross a portion of hydrographic area 228 (Oasis Valley), all of hydrographic area 229 (Crater Flat), and a portion of area 227A (Jackass Flats), as shown in Figure 3-82. Section 3.2.6.3.11 describes, and Table 3-44 summarizes groundwater-quality and aquifer characteristics of hydrographic area 228.

There are 14 USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-82. The figure does not show all existing wells in area 227A that lie within 1.6 kilometers of the centerline of common segment 6 because some wells, particularly in area 227A, are at very nearly the same locations and cannot be shown at the scale used in this figure.

Geologic units that common segment 6 would cross include volcanic rocks and basin-fill alluvium (DIRS 173179-Belcher 2004, p. 28; DIRS 176600-Converse Consultants 2005, Plate 4-3). Specific volcanic rock units the segment would cross include volcanic rocks of the Crater Flat and Paintbrush Groups (DIRS 173842-Shannon & Wilson 2005, Plate 2).

Hydrographic area 228, Oasis Valley, is a designated groundwater basin and is described in Section 3.2.6.3.11.

Hydrographic area 229, Crater Flat, is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of about 271,000 cubic meters (220 acre-feet) (see Table 3-35). As previously noted, all committed resources within a hydrographic area might not be in use at the same time. In addition to existing groundwater wells in hydrographic area 229 that have water-rights appropriations, preliminary NDWR data indicate that approximately 101,000 cubic meters (82 acre-feet) of pending annual duties (see Table 3-35) exist in area 229. The pending water right locations are not within 1.6 kilometers (1 mile) of the centerline of common segment 6. There could be approximately 430 million cubic meters (350,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 229.

Table 3-45 summarizes groundwater-quality and aquifer characteristics of hydrographic area 229. Groundwater is typically very deep in area 229 beneath the rail alignment, generally 180 to 370 meters (600 to 1,200 feet) below ground. In the northwestern portion of area 229 and west of the rail alignment, groundwater occurs within two aquifers and the estimated depth to groundwater varies from 55 to 200 meters (180 to 650 feet). There are three USGS NWIS wells, one NDWR well with a water right, and no springs in area 229 within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-82.

Hydrographic area 227A, Jackass Flats, is not a designated groundwater basin. Committed groundwater resources do not exceed the total perennial yield value of 1.1 million cubic meters (880 acre-feet) per year estimated for the entire hydrographic area (see Table 3-35). For evaluation purposes, the perennial yield estimate for hydrographic area 227A is assumed to be approximately 720,000 cubic meters (580 acre-feet) per year, representing the western two-thirds of the area. The perennial yield estimate for the eastern one-third of this hydrographic area has been estimated at approximately 370,000 cubic meters (300 acre-feet) per year. The value of 720,000 cubic meters (580 acre-feet) per year is used as a basis for evaluating the potential impacts of groundwater withdrawals (Section 4.2.6) because the western two-thirds of the hydrographic area is most representative of the potential source area from which groundwater required to support the project might be obtained. There could be approximately 910 million cubic meters (740,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 227A. NDWR data indicate that there are approximately 6,170 cubic meters (5 acre-feet) of documented pending annual duties (see Table 3-35) in area 227A.

Table 3-45 summarizes groundwater-quality and aquifer characteristics of hydrographic area 227A. In hydrographic area 227A, groundwater occurs in alluvial valley-fill deposits in the southern portion of the area and deeper in volcanic rocks in the central part of the basin. The depths to groundwater in wells throughout area 227A vary from approximately 12 to 650 meters (38 to 2,150 feet) (DIRS 176600-Conserve Consultants 2006, p. 31). Most groundwater storage in area 227A occurs toward the southern end of the basin, south of the rail alignment. Groundwater is typically very deep near the rail alignment, generally 180 to 370 meters (600 to 1,200 feet) below ground.

Most wells penetrating the volcanic rocks are monitoring wells used for monitoring groundwater conditions southwest, southeast, and south of the Yucca Mountain Site. Twelve of 15 NDWR existing new or replacement wells cataloged within all of hydrographic area 227A are groundwater monitoring wells; the others are listed as production wells. The volcanic rocks in this area generally have low porosity, and are not considered suitable for groundwater production except in major fractured areas.

Figure 3-82 shows DOE-proposed wells (see Section 4.2.6) for supplying water to support construction of common segment 6. All proposed water wells would be within the rail alignment construction right-of-way. There are no potential quarry sites along common segment 6.

Table 3-45. General groundwater-quality characteristics – common segment 6.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks clastic rocks, older carbonate rocks, and alluvial valley fill [e]	10 to 30	400,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g] Fluoride: 1 to more than 4 mg/L[h]
229 Crater Flat	Volcanic rocks and alluvial valley fill[e]	180 to 370	350,000 [f]	Total dissolved solids: 270 mg/L[h]
227A Fortymile Canyon, Jackass Flats	Volcanic rocks and alluvial valley fill[e]	210 to 370	740,000 [f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g]

a. The listed depth range for depth to groundwater generally applies to the area underlying the rail alignment (DIRS 176600-Converse Consultants 2005, Plates 4-1, 4-2, and 4-3). Depth to groundwater in each hydrographic area can vary over a greater range of depths depending on location (refer to text).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Source: DIRS 176600-Converse Consultants 2005, pp. 29, 30, 34, 35, and 36.
f. Source: DIRS 180754- Rush et al. 1971, all.
g. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.
h. Source: DIRS 176600-Converse Consultants 2005, pp. 35 and 38.

3.2.7 BIOLOGICAL RESOURCES

This section describes the biological resources that could be affected by construction and operation of the proposed railroad along the Caliente rail alignment.

Biological resources include vegetation, wildlife, special status species, game species, and wild horses and burros within or near the construction right-of-way described in Section 3.2.7.1. This discussion of biological resources is based on the results of a review of available data from federal, State of Nevada, and local agencies, and data gathered during field investigations.

Section 3.2.7.2 provides a general overview of biological resources, including vegetation, wildlife, special status species, game species, and wild horses and burros along the Caliente rail alignment. Section 3.2.7.3 describes biological resources unique to each Caliente rail alignment alternative segment and common segment. Appendix H, Biological Resources, provides additional information regarding biological resources along the Caliente rail alignment.

Special Status Species

Endangered species are classified under the Endangered Species Act as being in danger of extinction throughout all or a significant part of their range.

Threatened species are classified under the Endangered Species Act as likely to become endangered species in the foreseeable future.

Proposed species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats and that are the subject of a Fish and Wildlife Service *Federal Register* rulemaking notice to list them as endangered or threatened.

Candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information to support a proposal to list as endangered or threatened, but development of a listing regulation is precluded by other higher priority listing activities.

Endangered Species Act candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.

State protected plant and animal species. Wildlife species or subspecies are classified as protected under Nevada Administrative Code (NAC) Chapter 503 if one or more of the following criteria exists:

1. The wildlife is found only in the State of Nevada and its population, distribution, or habitat is limited.
2. The limited population or distribution within Nevada is likely to decline.
3. The population is threatened as a result of the deterioration or loss of its habitat.
4. The wildlife has ecological, scientific, educational, or other value that justifies its classification as protected.
5. The available data is not adequate to determine the exact status of the wildlife population, but does indicate a limited population, distribution, or habitat.
6. The wildlife is listed by the U.S. Fish and Wildlife Service as a candidate species, or it is classified as threatened or endangered in the federal Endangered Species Act.
7. Other evidence exists to justify classifying the wildlife as protected.

Under NAC Chapter 527, plants are classified as being in danger of extinction if their survival requires assistance because of overexploitation, disease, or other factors or because its habitat is threatened with destruction, drastic modification, or severe curtailment. There are no State of Nevada-listed endangered plants present in the areas of assessment.

BLM-designated sensitive species are species other than federally listed, proposed, or candidate species, and may include such native species as those that:

1. Could become endangered in or extirpated from a state or within a significant portion of their distribution in the foreseeable future;
2. Are undergoing a status review by the U.S. Fish and Wildlife Service to determine whether to list the species as a threatened or endangered species across all or a significant portion of its range under the Endangered Species Act;
3. Are undergoing significant current or predicted downward trends in habitat capability that would reduce their existing distribution;
4. Are undergoing significant current or predicted downward trends in population or density such that federally listed, proposed, candidate, or state listed status might become necessary;
5. Have typically small and widely dispersed populations;
6. Are inhabiting ecological refugia or specialized or unique habitats; or
7. Are state listed but might be better conserved through application of BLM sensitive species status. Such species should be managed to the level of protection required by State laws or under the BLM policy for candidate species, whichever would provide better opportunity for their conservation.

3.2.7.1 Areas of Assessment

DOE used two areas of assessment to describe the affected environment for biological resources: the greater study area and the construction right-of-way.

3.2.7.1.1 Construction Right-of-Way

The rail line construction right-of-way would be a nominal width of 300 meters (1,000 feet), which is 150 meters (500 feet) on either side of the rail alignment centerline. The footprint, which would be within the construction right-of-way, is the area that would involve clearing of vegetation, excavation, and filling for subgrade to support the rail line. This area would be directly affected, long term, by rail line construction activities. The footprint would fluctuate throughout the alignment due to topography, cut and fill requirements, and land use. The footprint could also vary based on land use and avoidance or minimization of impacts to other resources (for example, water or structures) but generally would be 300 meters or less. The area between the footprint and the outer edge of the construction right-of-way would be directly affected, short term, by construction-related activities such as construction staging, material laydown, and temporary access roads. DOE analyzed the area between the footprint and the outer edge of the construction right-of-way for short-term impacts even though the use of this area would be minimized and the area might not be disturbed. For purposes of this analysis, DOE has taken a conservative approach of potentially overstating the environmental impacts to biological resources. For facilities that would be outside the nominal width of the rail line construction right-of-way (such as quarries and other ***infrastructure***), the area DOE assessed as the affected environment is the maximum area or the footprint of the proposed facility.

3.2.7.1.2 Study Area

DOE identified a study area (16-kilometers [10-miles] wide, extending 8 kilometers [5 miles] on either side of the centerline of the rail alignment) for use in database and literature searches to ensure the identification of sensitive habitat areas near the Caliente rail alignment and transient or migratory wildlife, particularly special status species, that could pass through or along the construction right-of-way. Using the larger study area identifies special status species and/or habitat that could be present near the rail alignment to better describe the habitat value and species use within the construction right-of-way.

3.2.7.2 General Environmental Setting and Characteristics

This section describes the affected environment for biological resources that could be present or have the potential to occur within the construction right-of-way or the study area. DOE used the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), which the BLM currently uses in its conservation and management actions, to characterize the vegetation communities in the construction right-of-way and the study area.

As a starting point for classification, the 2004 Southwest Regional Gap Analysis Project divided the southwestern United States into general ***ecoregions*** (relatively discrete sets of ecosystems characterized by certain plant communities or assemblages) based on physical and biological similarities. Using satellite imagery and field data, the Project classified geographic areas or “mapping zones” within each ecoregion based on their land-cover types, and generated maps of these land-cover types. The project classified naturally vegetated types using the “ecological systems” and developed and described types based on dominant vegetation, physical characteristics of the land, hydrology, and climate in the area (DIRS 176369-Lowry et al. 2005, all; DIRS 173051-Comer et al. 2003, all). These mapping zones represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. As shown in Figure 3-83, the Caliente rail alignment would cross three mapping zones: the Pioche, the Mojave, and the Nellis. The land-cover types are grouped into land-cover classes. Eleven land-cover classes occur in this part of Nevada. To identify the land-cover types and classes within the construction right-of-way and the study area, digital maps of the land-cover types within the affected map zones were overlain (spatial analysis using the Geographic Information System) with the Caliente rail alignment construction right-of-way and operations support facilities.

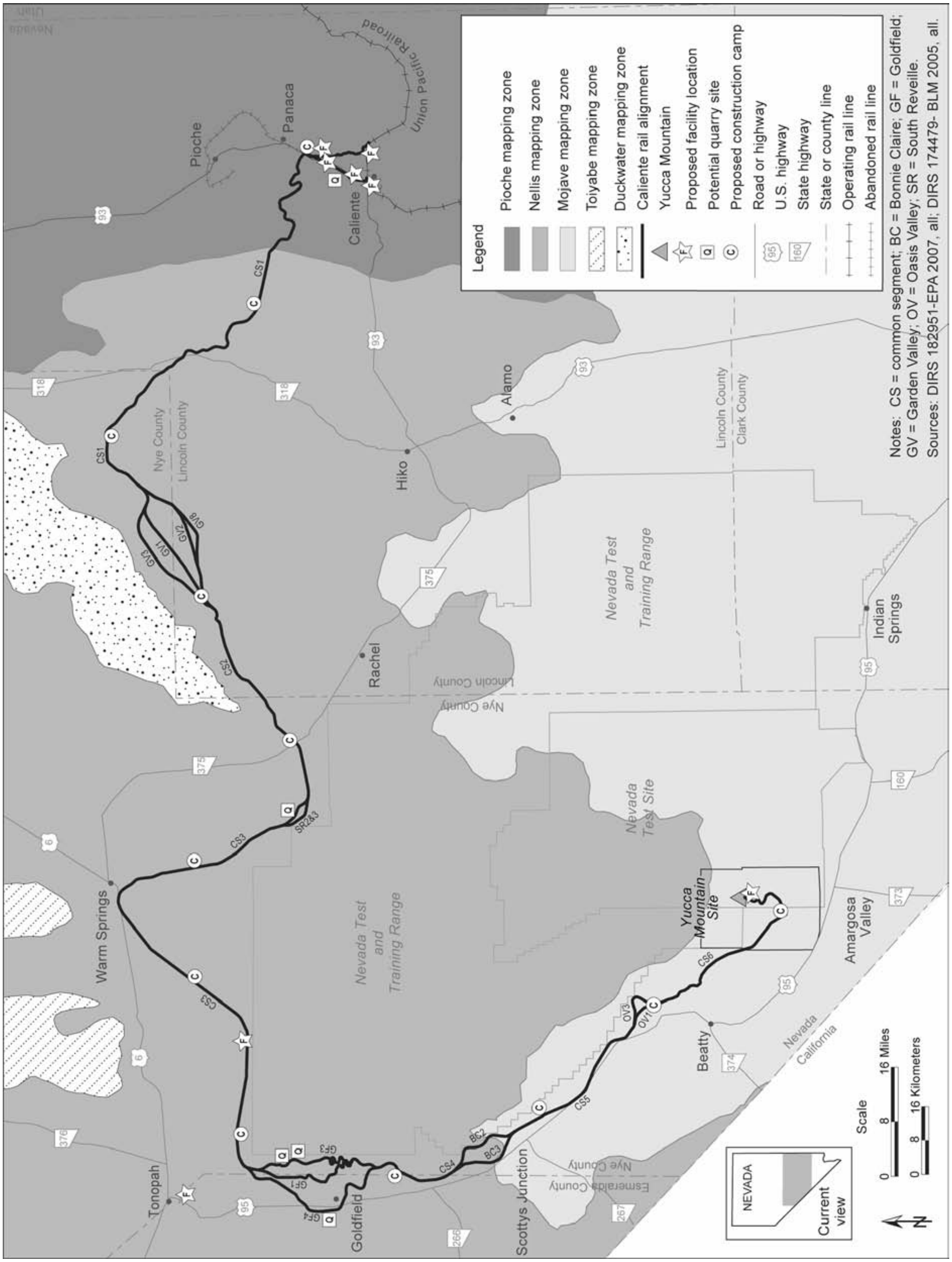


Figure 3-83. Mapping zones along the Caliente rail alignment.

The Caliente rail alignment construction right-of-way would cross nine of the eleven classes (DIRS 174324-NatureServe 2004). Table 3-46 lists classes and types and Figures 3-84 through 3-90 show the classes the rail alignment would cross.

To document additional site-specific information regarding vegetation and habitat, DOE performed literature and database searches, and consulted with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, the Nevada Department of Wildlife, the University of Nevada–Reno, and the Nevada Division of Forestry.

In addition to the review of existing information, DOE conducted field surveys and gathered data to further characterize the mapping zones and associated vegetation communities, and to further characterize the habitats in the study area that might support special status species. DOE chose field survey locations to provide representative survey coverage of the different types of vegetation along the Caliente rail alignment, specifically in the construction right-of-way, but also in the larger study area. The field survey data DOE collected helped further characterize the types of habitats in the construction right-of-way and identified by the Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Appendix H describes the field survey methodology. The additional surveys and data searches are outlined in each specific resource area below.

3.2.7.2.1 Vegetation

The Caliente rail alignment is situated within two large deserts: the Great Basin and the Mojave. The Great Basin Desert is considered a cold desert and has been referred to as the Basin and Range region due to its parallel north-south trending ranges, or mountains, and intervening basins, or valleys. This region covers most of central and northern Nevada, with its southern extent ending roughly in southern Lincoln, Esmeralda, and Nye Counties. The Mojave Desert is considered a hot desert and covers most of southern Nevada and much of southeastern California (DIRS 174412-Ryser 1985). Just as the two deserts are distinguished from one another climatically, the predominant vegetation and vegetation communities also define each desert.

The Great Basin Desert is generally characterized by big sagebrush (*Artemisia tridentata*), which is mostly absent from the Mojave Desert except at moderate to high elevations in the mountains. Alternatively, the Mojave Desert is dominated by creosote bush (*Larrea tridentata*), which is mostly absent from the Great Basin Desert. There is a broad transitional zone where these two deserts meet, which exhibits characteristics of both regions.

Based on the spatial analysis described above, the Caliente rail alignment would intersect 25 land-cover types, which are listed in Table 3-46. The most common plant communities within the study area are the Inter-Mountain Basins Mixed Salt Desert Scrub and the Inter-Mountain Basins Big Sagebrush Shrubland. Appendix H, Table H-1, describes plant communities. The acreages in the table are representative of the total acreages in the mapping zones (the Pioche, the Mojave, and the Nellis) that intersect the Caliente rail alignment.

Undisturbed areas of winterfat, or whitesage (*Krascheninnikovia lanata*), are present, but uncommon, within the construction right-of-way. While they have no official protected status with any federal or state agency, the BLM has identified these vegetation communities as important and their conservation or protection should be considered during development of any projects.

Table 3-46. Land-cover classes and types in the mapping zones.

Class and type	Total amount of classes and land-cover types within the Pioche, the Mojave, and the Nellis mapping zones (square kilometers)[a]
Barren Lands	
Inter-Mountain Basins Playa	1,100
Inter-Mountain Basins Wash	1.6
Inter-Mountain Basins Cliff and Canyon	420
North American Warm Desert Playa	520
North American Warm Desert Bedrock Cliff and Outcrop	1,820
Evergreen Forest	
Great Basin Pinyon-Juniper Woodland	1,000
Scrub/Shrub	
Inter-Mountain Basins Mixed Salt Desert Scrub	26,000
Inter-Mountain Basins Big Sagebrush Shrubland	8,000
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	19,000
Great Basin Xeric Mixed Sagebrush Shrubland	7,600
Mojave Mid-Elevation Mixed Desert Scrub	11,000
Sonora-Mojave Mixed Salt Desert Scrub	1,500
Grassland/Herbaceous	
Inter-Mountain Basins Semi-Desert Shrub Steppe	4,900
Inter-Mountain Basins Semi-Desert Grassland	100
Inter-Mountain Basins Montane Sagebrush Steppe	530
Woody Wetland	
Inter-Mountain Basins Greasewood Flat	1,440
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	140
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	30.8
Emergent Herbaceous Wetland	
North American Arid West Emergent Marsh	47.2
Altered or Disturbed	
Invasive Annual Grassland	51
Invasive Annual and Biennial Forbland	29
Developed and Agriculture	
Developed, Open Space - Low Intensity	430
Agriculture	430
Developed, Medium - High Intensity	84
Other	
Barren Lands, Non-specific	30

a. To convert square kilometers to acres, multiply by 247.10.

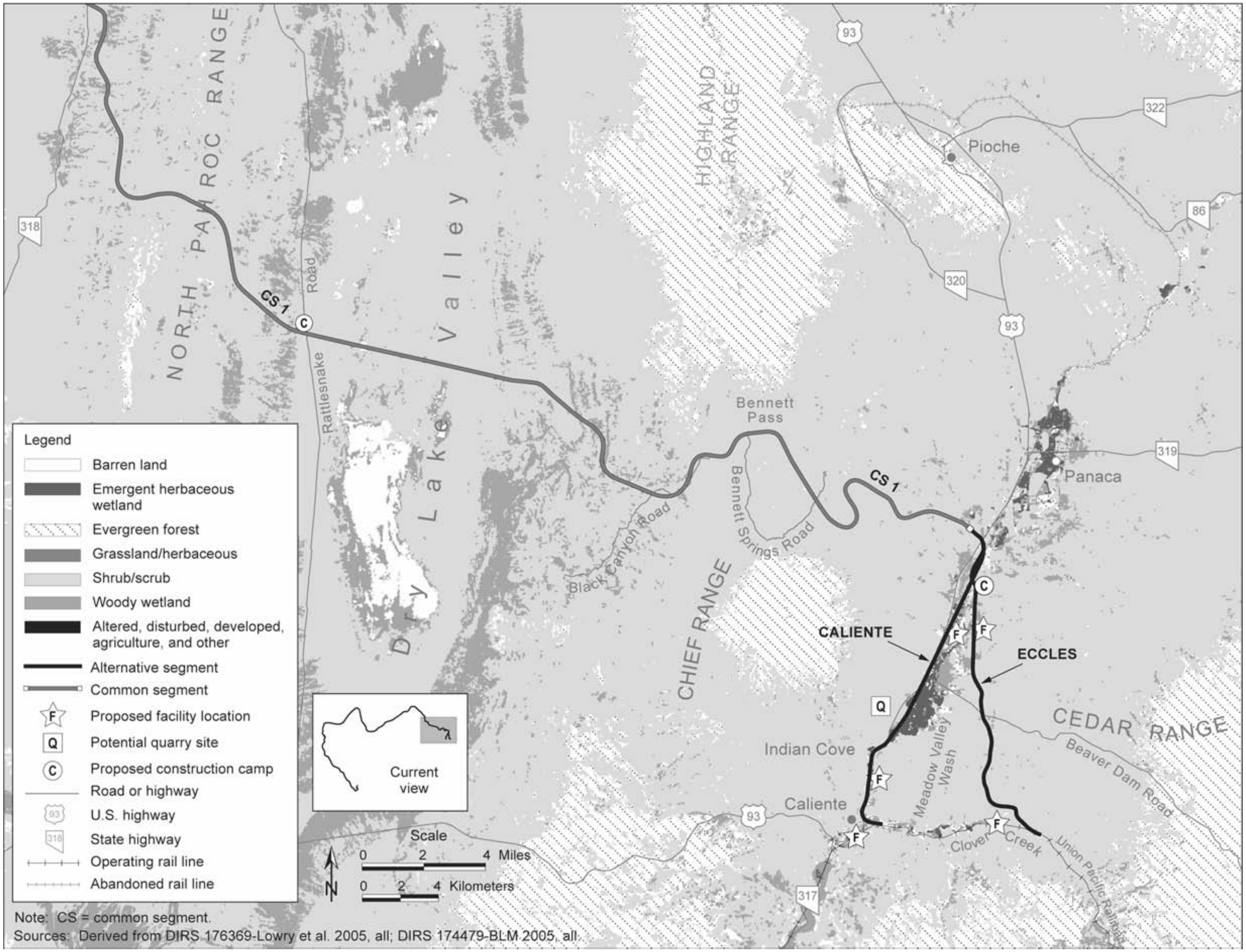


Figure 3-84. Land-cover classes the Caliente rail alignment would cross within map area 1.

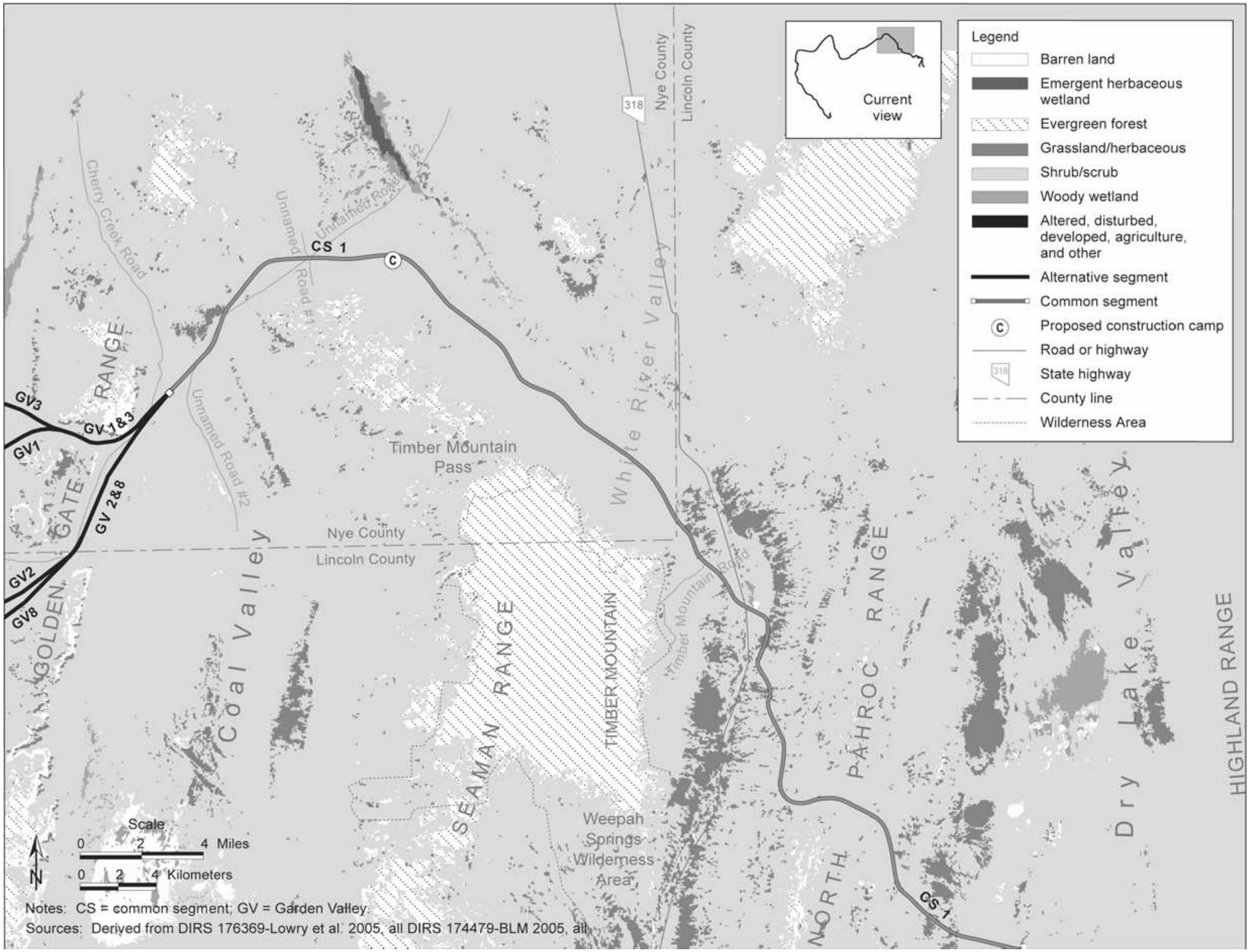


Figure 3-85. Land-cover classes the Caliente rail alignment would cross within map area 2.

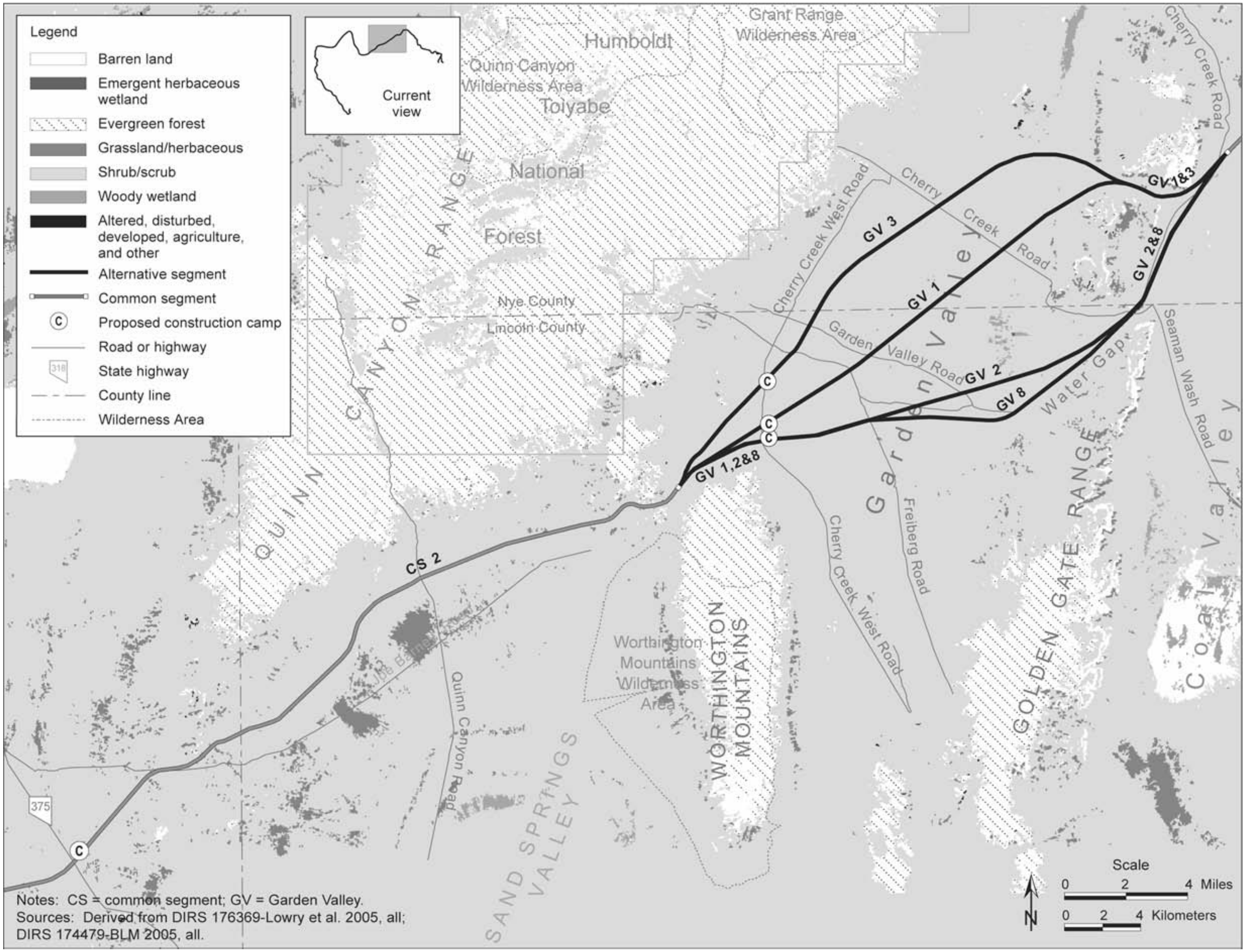


Figure 3-86. Land-cover classes the Caliente rail alignment would cross within map area 3.

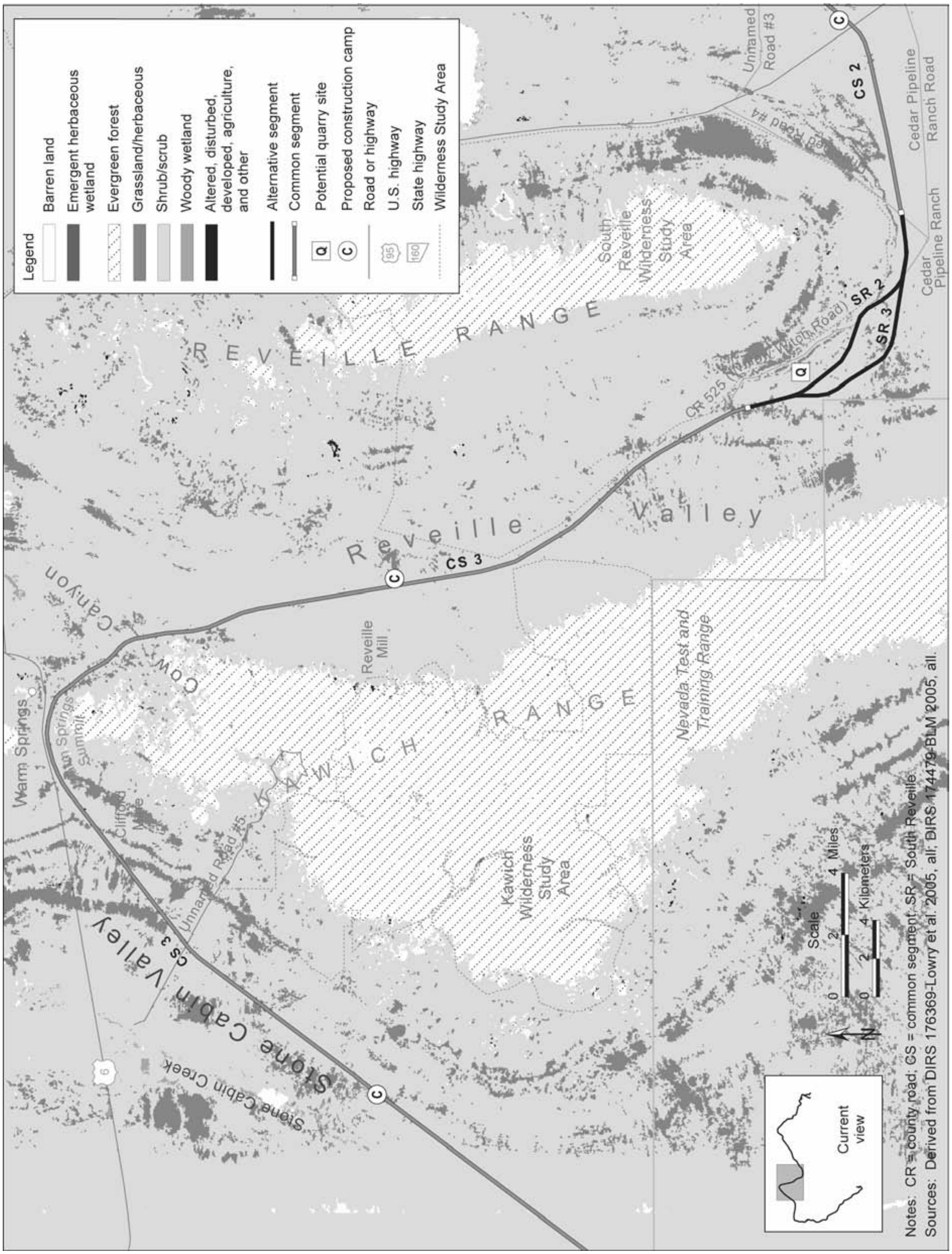


Figure 3-87. Land-cover classes the Caliente rail alignment would cross within map area 4.

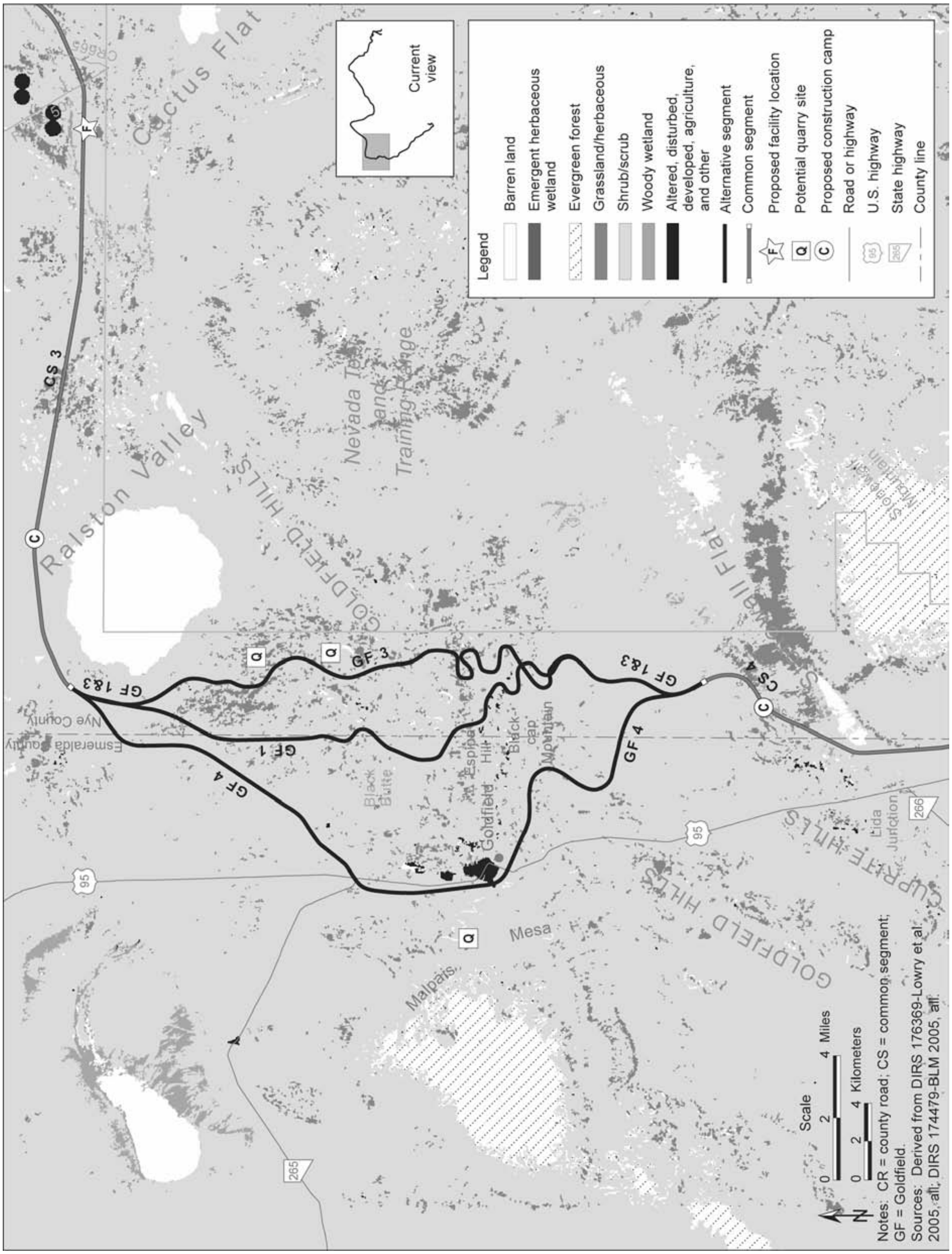


Figure 3-88. Land-cover classes the Caliente rail alignment would cross within map area 5.

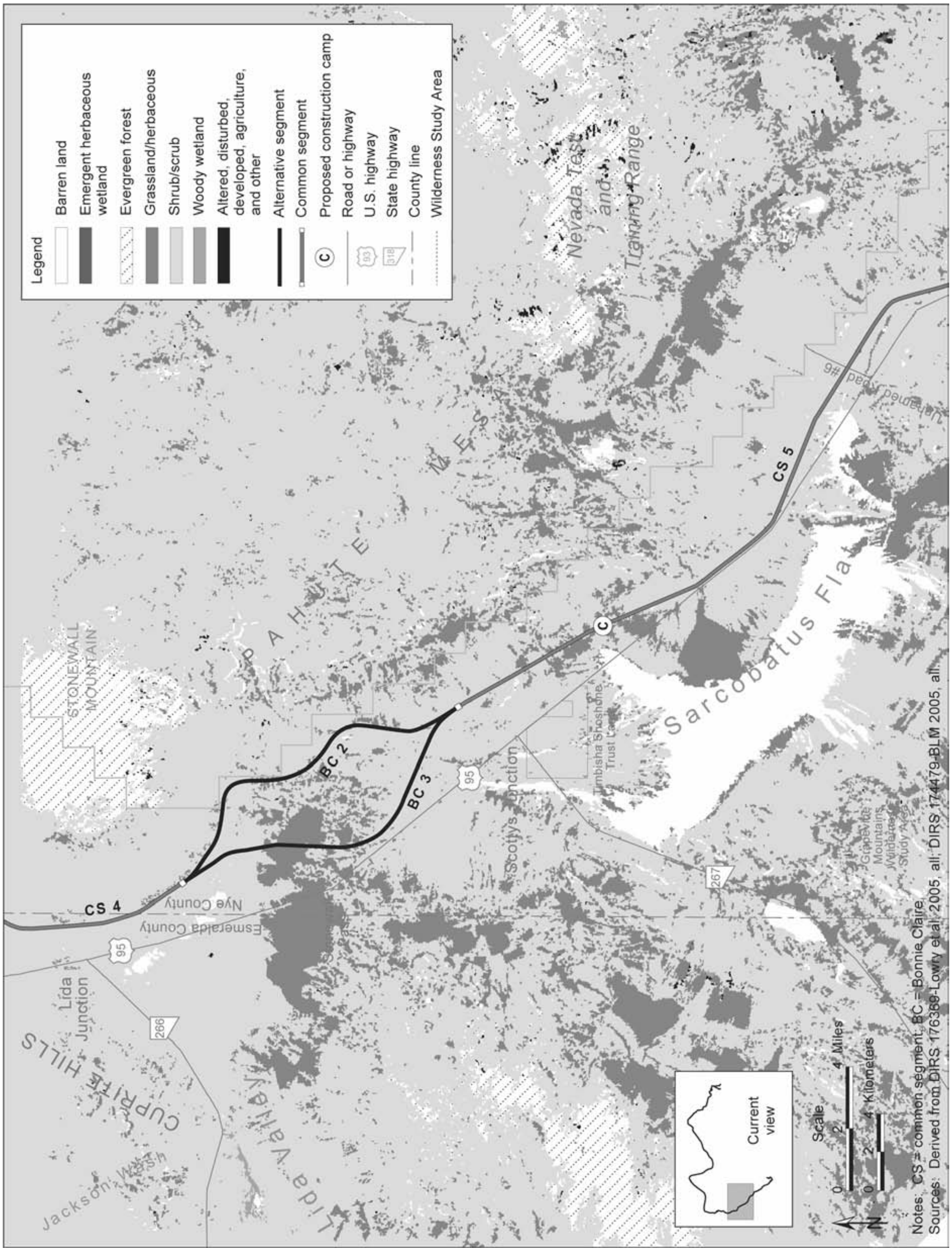


Figure 3-89. Land-cover classes the Caliente rail alignment would cross within map area 6.

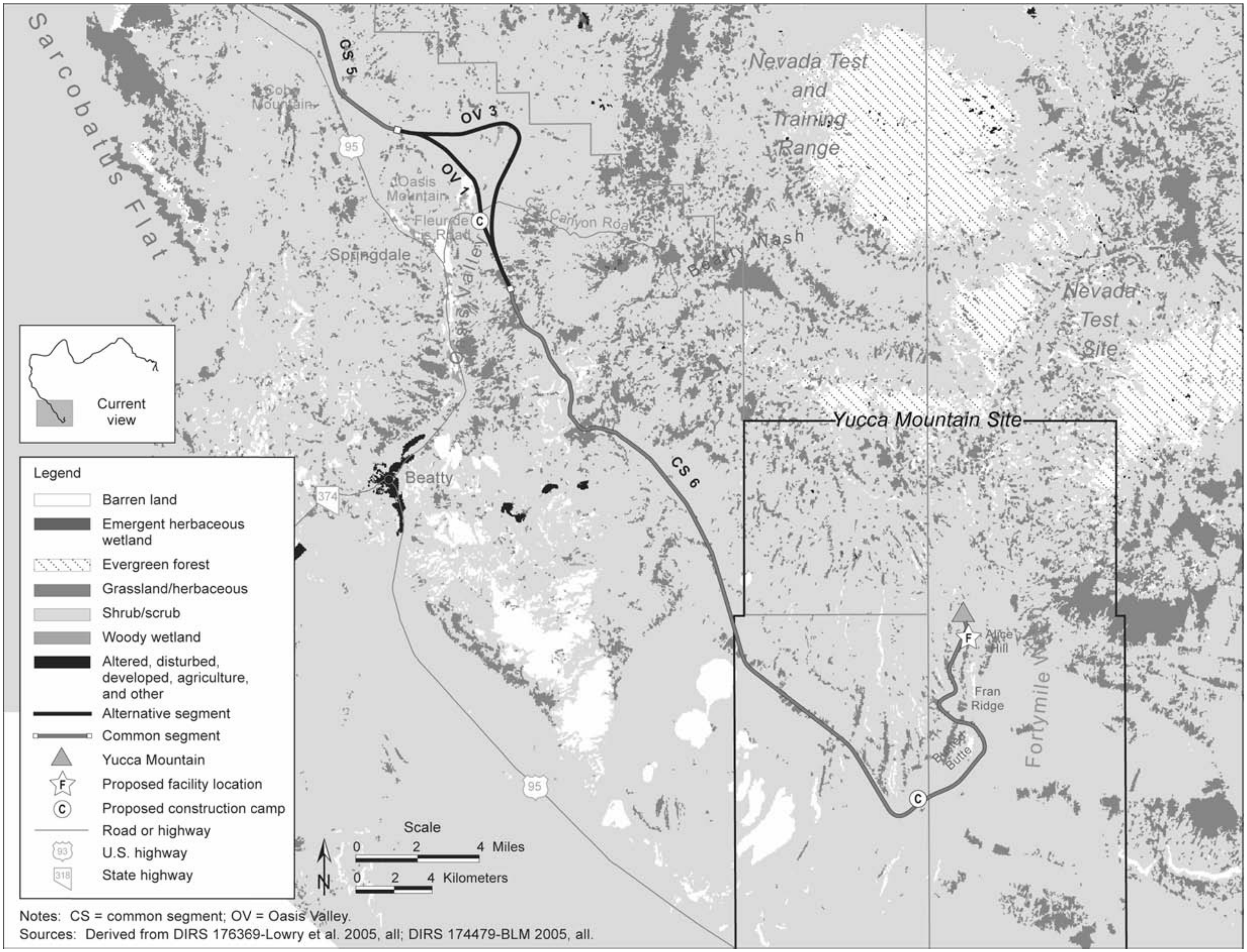


Figure 3-90. Land-cover classes the Caliente rail alignment would cross within map area 7.

In addition to shrubs and grasses, biological soil crusts are an important component to both the Mohave and Great Basin ecosystems. Biological crusts are comprised of multiple species of lichen, moss, cyanobacteria and algae which live on top of the soil surface, binding with soil particles and forming a cohesive mat or crust on the surface of arid landscapes (DIRS 181866-Belnap 2006, p. 1). Cyanobacteria is the dominant component of crusts in the Mojave Desert, while soil lichen and moss species tend to be limited. Biological crusts (if present) could play an important role in maintaining the health of some of the desert vegetation communities listed in Table 3-46, including but not limited to facilitating water infiltration, retaining soil moisture, and reducing soil loss from wind and water erosion (DIRS 181957-Kaltenecker and Wicklow-Howard 1994, p. 1-8). Crusts are highly sensitive to surface disturbance and are easily destroyed. Biological crusts likely occur within the region of influence in some areas where there has been no surface disturbance. Biological crusts are potentially present in areas where construction would occur, but because of insufficient data regarding the location and extent of biological crusts in the region of influence, Section 4.2.7 does not discuss impacts to biological crusts.

Nonnative plant species: A species found in an area where it has not historically been found.

Native plant species: With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13112, *Invasive Species*).

Invasive plant species: An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, *Invasive Species*).

Noxious weeds: The BLM defines a noxious weed as: "A plant that interferes with management objectives for a given area of land at a given point in time." (DIRS 177037-BLM 1996, p. 3) The State of Nevada defines noxious weeds as: "Any species of plant which is, or liable to be, detrimental or destructive and difficult to control or eradicate" (Nevada Revised Statute 555.005).

Weeds can be native or nonnative, invasive or non-invasive, and noxious or not noxious. Invasive species include not only noxious weeds, but also other nonnative plants. The BLM considers plants invasive if they have been introduced into an environment where they did not evolve. As a result, invasive species usually have no natural enemies to limit their spread and can produce significant detrimental changes.

3.2.7.2.1.1 Noxious Weed and Invasive Species. The Great Basin-Mojave Desert region is threatened by a number of nonnative, invasive plant species that have displaced ***native plant species***. Invasive plant species, such as red brome (*Bromus rubens*), tamarisk (*Tamarix ramosissima*), and cheatgrass (*Bromus tectorum*), have the ability to out-compete individual species of native range plants, which results in extensive monocultures of the introduced species. ***Invasive species*** usually have little to no nutritional value for livestock and wildlife; some invasive species are toxic or physically injurious to animals, can increase the frequency of wildfires, and degrade wildlife habitat by reducing the diversity of native vegetation (DIRS 155925-Nevada Weed Action Committee 2000, p. 5).

Some plant species are considered ***noxious weeds***, an official designation used by federal and state authorities to identify species with a high likelihood of being very destructive or difficult to control or eradicate. Chapter 555.010 of the Nevada Administrative Code lists species designated as noxious. Chapter 555 of the Nevada Revised Statutes directs that designated noxious weeds are to be controlled on both public and private land, and provides for enforcement measures should the landowner or occupier fail to take corrective action. While many noxious species are invasive, invasiveness is not required for a species to be designated noxious. Some species managed as noxious weeds are not considered truly invasive because they cannot effectively out-compete healthy communities of native vegetation.

3.2.7.2.1.2 Wetlands and Riparian Habitats. Riparian habitats are transition areas from wetland or stream habitat to upland habitat. Wetlands are areas that are saturated by water for a sufficient amount of time to support vegetation that is adapted to saturated soil conditions. While wetland and riparian habitats in Nevada cover a very small percentage of the total area of the state, they support a comparatively high number and large diversity of species, many of which are locally ***endemic***. Wetland and riparian habitats have been reduced in the region over the years due in part to water removal and the presence of invasive species, such as tamarisk (DIRS 174518-BLM 2005, p. 3.5-9). Appendix F contains information on wetlands within the project area and Sections 3.2.5 and 4.2.5 discuss impacts in relation to Section 404 of the Clean Water Act and wetland fill permitting. This section discusses wetlands and riparian habitats that support terrestrial and aquatic species.

To maintain consistency within this section, DOE assessed the amount and types of wetland and riparian habitats utilizing the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Section 3.2.5, Surface-Water Resources, utilizes National Wetlands Inventory maps (DIRS 176976-MO0605GISNWIDQ.000) and the results of the wetland delineations conducted during the field surveys in 2005 (DIRS 174040-PBS&J 2005, pp. 15 and 16) and 2006 (DIRS 180914-PBS&J 2006, pp. 11 and 12) to calculate the area of the wetlands. Therefore, the area totals differ between Sections 3.2.5 and 3.2.7 because Section 3.2.7 analyzes wetland and riparian habitat and Section 3.2.5 analyzes only the wetland areas.

According to the Southwest Regional Gap Analysis Project, there are three types of wetland or riparian habitats along the Caliente rail alignment and at locations of the proposed railroad construction and operations support facilities: North American Warm Desert Lower Montane Riparian Woodland and Shrubland; Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland; and North American Arid West Emergent Marsh (Figures 3-91 to 3-94 and Table 3-46).

The North American Warm Desert Lower Montane Riparian Woodland and Shrubland is found along perennial and seasonally intermittent streams. Generally located in middle to low elevations and found in canyons and valleys, vegetation in this land-cover type depends on seasonal flooding and removal of sediment that occurs during these flood events. The vegetation is a mix of tree and shrub species including Fremont cottonwood (*Populus fremontii*) and willows, including sandbar willow (*Salix exigua*) and seep willows (*Baccharis salicifolia*) (DIRS 174324-NatureServe 2004. pp. 140 to 142).

The Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland land cover occurs in the mountains of the Great Basin from middle to high elevations. This habitat requires flooding, and the scouring and subsequent deposition of soils that occurs during flood events, for maintenance and germination of vegetation. Vegetation typically associated with this type of riparian habitat includes Fremont cottonwood, willows, rushes (*Juncus* spp.), and sedges (*Carex* spp.) (DIRS 174324-NatureServe 2004, pp. 149 and 150).

The North American Arid West Emergent Marsh type occurs throughout the arid regions of the western United States. This land cover occurs along slow-moving streams, has soils that are able to accumulate organic material, and contains vegetation that is adapted to frequently or continually saturated soil conditions. Vegetation commonly found in marsh areas includes bulrushes (*Scirpus* spp.), cattails (*Typha* spp.), and rushes (DIRS 174324-NatureServe 2004, pp. 154 to 156).

3.2.7.2.2 Wildlife

As with the vegetation communities and wetland habitats, DOE gathered data on wildlife communities to identify existing information regarding the occurrence and distribution of wildlife, including mammals, birds, reptiles, and aquatic species, within the construction right-of-way.

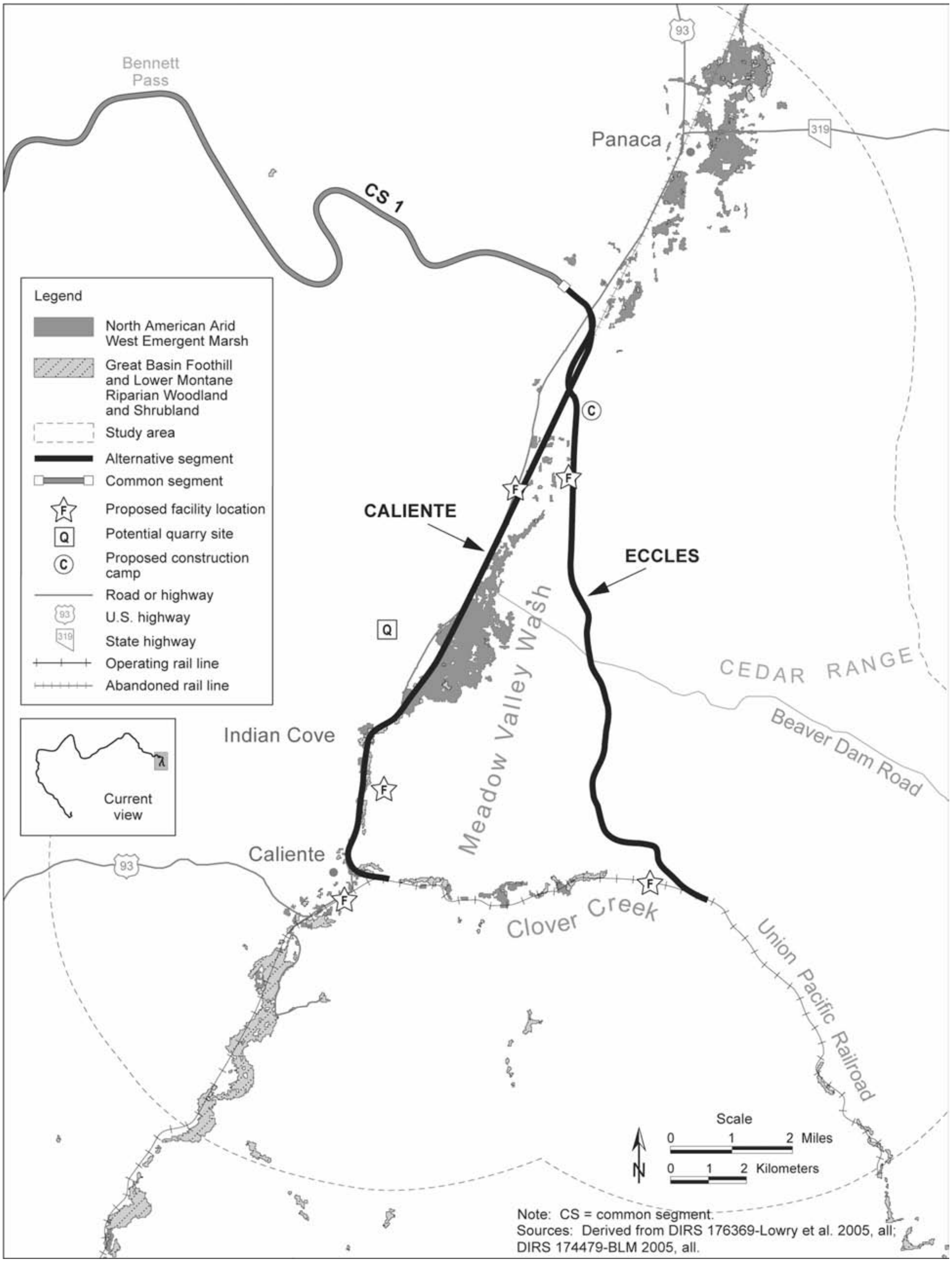


Figure 3-91. Wetland/riparian habitat within the study area near the Caliente and Eccles alternative segments.

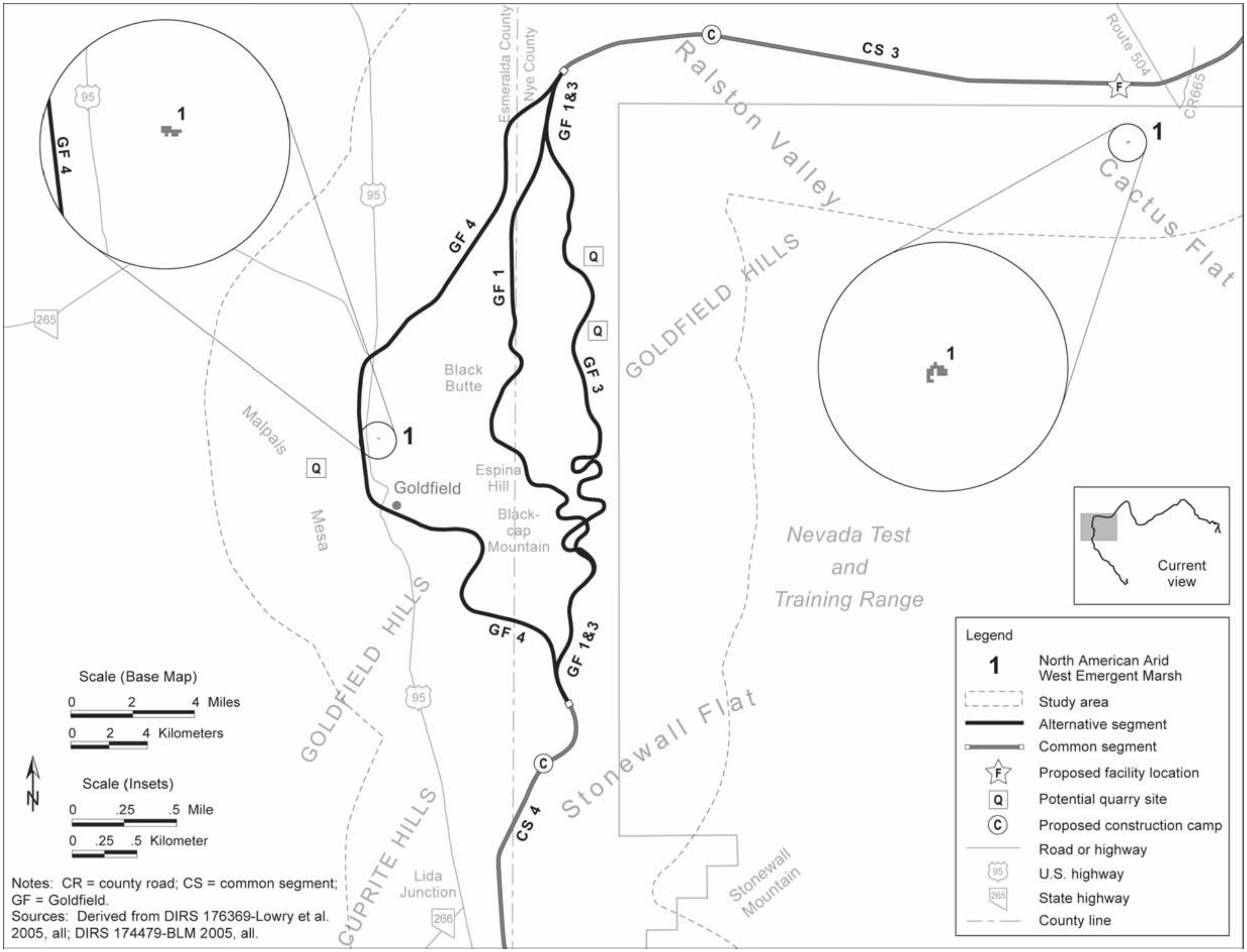


Figure 3-92. Wetland/riparian habitat within the study area adjacent to the Goldfield alternative segments.

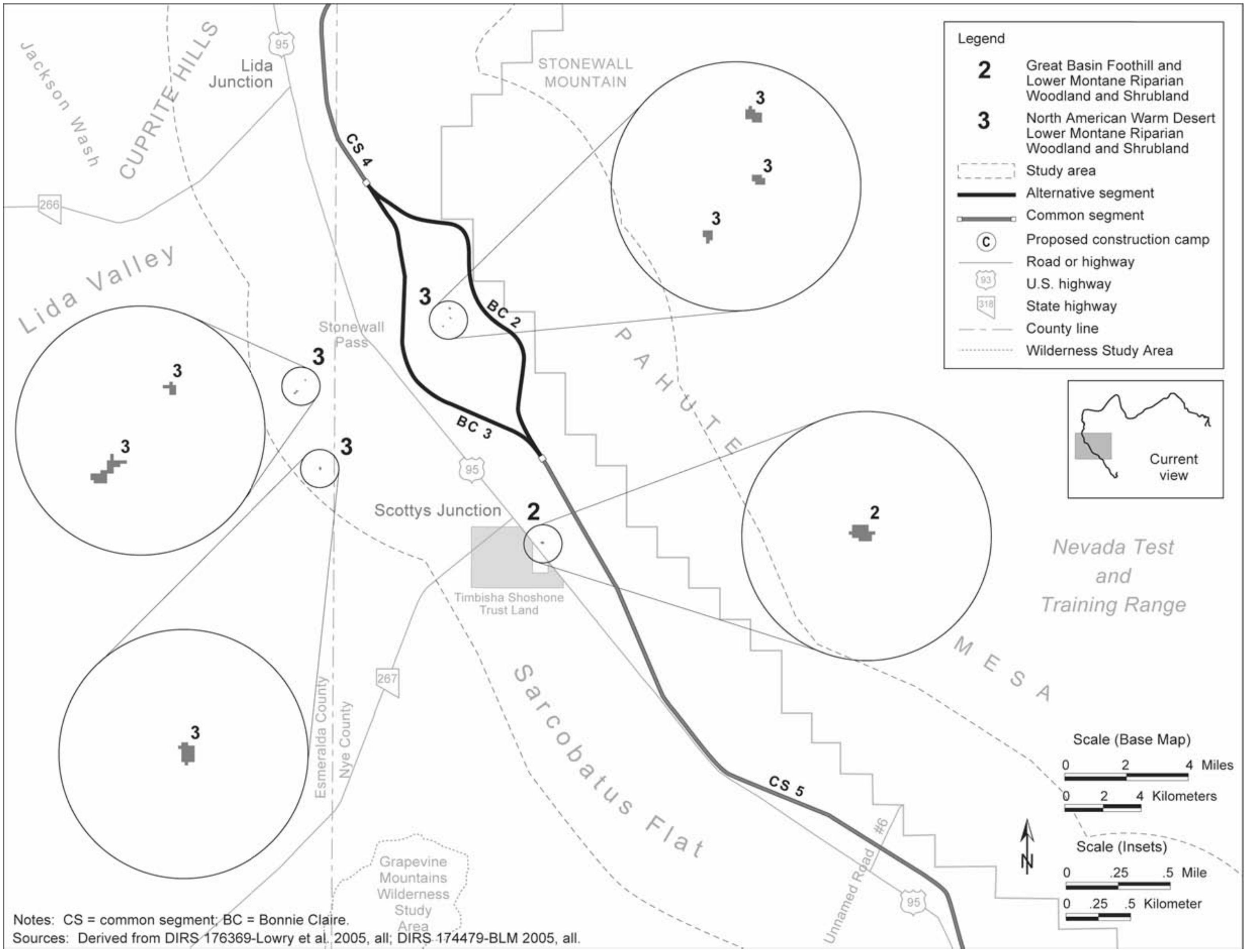


Figure 3-93. Wetland/riparian habitat within the study area near the Bonnie Claire alternative segments.

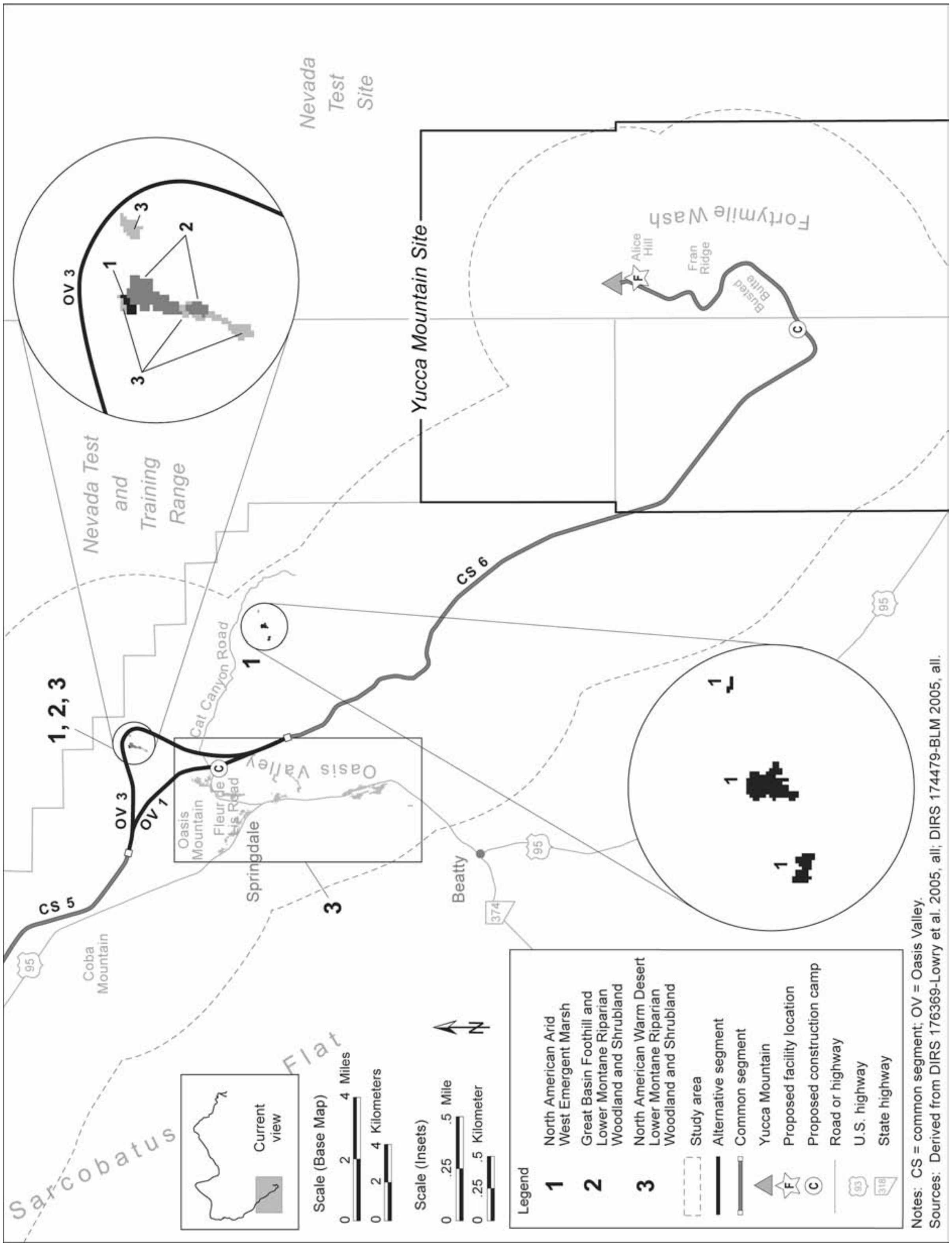


Figure 3-94. Wetland/riparian habitat within the study area near the Oasis Valley alternative segments.

These investigations incorporated literature and database searches and consultations with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, and the Nevada Department of Wildlife. DOE also obtained information regarding Nevada game species from these agencies. Concurrent with other field surveys, the Department gathered information on field observations to identify the presence of wildlife within the construction right-of-way.

Wildlife abundance and diversity is related to habitat or land-cover types and quality. DOE mapped the wildlife and species synonymous with the habitat or land-cover types to the construction right-of-way. Appendix H contains a map detailing field survey locations.

3.2.7.2.3 Special Status Species

Special status species are plants, fish, and wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. DOE contacted the U.S. Fish and Wildlife Service to obtain a list of species protected under the federal Endangered Species Act that are known to exist or could exist within the construction right-of-way or within the study area (DIRS 174439-Williams 2005, all). The Department assessed the potential for federally listed species to occur within the construction right-of-way by reviewing agency listings of known, or potentially occurring, listed species, and through a review of potential habitat for those species along the Caliente rail alignment. The Department also obtained location records for special status species from a statewide database managed by the Nevada Natural Heritage Program that contains records of incidental observations of rare or protected plants, fish, and wildlife species (DIRS 182061 2005, all). The special status species DOE selected for further consideration are one or a combination of the following:

- Special status species documented as occurring within the study area
- Special status species identified as potentially occurring in the study area by personnel affiliated with appropriate resource management agencies, including the BLM (DIRS 172900 BLM 2003, all), the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry
- Special status species identified as potentially occurring in the study area because field personnel identified potentially suitable habitat during the field surveys

DOE used a Geographic Information System database to map the documented occurrences of special status plants and wildlife species within the study area in relation to the Southwest Regional Gap Analysis Project types. The Department then used these maps to identify and match areas of potential habitat and the presence of the documented special status species within those habitats. Through field surveys, the Department further evaluated areas that appeared to contain viable habitat for a special status species. Appendix H provides details on the survey methodology for special status species.

3.2.7.2.4 State of Nevada Game Species

Table 3-47 lists the game species identified in the Nevada Administrative Code Sections 503.020, 503.045, 503.060 that potentially occur in the study area. Game species identified in these sections of the Nevada Administrative Code that are absent from the study area are listed in Appendix H, Table H-5, and are not considered further in this Rail Alignment EIS. The greater sage-grouse *(Centerocercus urophasianus)* and pygmy rabbit *(Sylvilagus idahoensis)* are game species that are also BLM-listed sensitive and State of Nevada protected. The bighorn sheep is a BLM-listed sensitive species managed by the Nevada Department of Wildlife as a big game mammal.

Table 3-47. Nevada game species present or potentially present in the biological resources study area – Caliente rail alignment.[a]

Common name	Scientific name	Occurrence within the study area
Game mammals		
Pronghorn antelope	*Antilocapra americana*	Present
Mule deer	*Odocoileus hemionus*	Present
Mountain lion	*Felis concolor*	Present
Cottontail rabbit	*Sylvilagus* spp.	Present
Pygmy rabbit	*Sylvilagus idahoensis*	Present
Black-tailed jackrabbit	*Lepus californicus*	Present
Bighorn sheep	*Ovis canadensis*	Present
Elk	*Cervus elaphus*	Present
Upland and migratory game birds		
Greater sage-grouse	*Centrocercus urophasianus*	Potentially present
Chukar	*Alectoris chukar*	Present
Ring-necked pheasant	*Phasianus colchicus*	Present
Gambel's quail	*Callipepla gambelii*	Present
Wild turkey	*Meleagris gallopavo*	Present
American crow	*Corvus brachyrhynchos*	Present
Ducks, geese, and swans	Family *Anatidae*	Present only in wetland/marsh areas
Wild doves and pigeons	Family *Columbidae*	Present
Cranes	Family *Gruidae*	Present only in wetland/marsh areas
Rails, coots, and gallinules	Family *Rallidae*	Present only in wetland/marsh areas
Woodcocks and snipes	Family *Scolopacidae*	Present only in wetland/marsh areas

a. Source: Nevada Administrative Code Sections 503.020, 503.045, and 503.060.

DOE conducted surveys along the Caliente rail alignment to further characterize the presence or absence of game species. Observations included identification of tracks and fecal pellets, and direct observation of animals within the rail alignment study area. Results do not imply population level or habitat quality, only the presence or absence of game species and their approximate level of use.

3.2.7.2.5 Wild Horses and Burros

The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros that the herd management area is managed for, and it is established to avoid the ecological degradation of the herd management area. DOE reviewed the Tonopah Resource Management Plan (DIRS 173224-BLM 1997, all), the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, all), and herd management plans for the Ely and Battle Mountain BLM Districts to obtain current information on herd management areas. The Department contacted the BLM to obtain Geographic Information System data on management areas and to obtain data regarding the use of the herd management areas by wild horses and burros.

Concurrent with other field investigations, DOE performed observations for wild horses and burros, or signs of their presence. Section 3.2.2, Land Use and Ownership, describes the grazing allotment planning process.

3.2.7.3 Affected Environment along Alternative Segments and Common Segments

This section describes biological resources in the Caliente rail alignment construction right-of-way and study area. To avoid unnecessary repetition, this section discusses biological resources by resource type (vegetation, wildlife, special status species, migratory birds, State of Nevada game species, and wild horses and burros) rather than by alternative segment or common segment.

3.2.7.3.1 Vegetation

There are 25 different land-cover types within the construction right-of-way and multiple options for the proposed Caliente railroad construction and operations support facilities. Tables 3-48 through 3-50 list land-cover types along the rail alignment and the areas of proposed operations support facilities. The percentages disclosed are the percent of land-cover types that could be affected and these percentages relate to the total acreages in the Pioche, the Mojave, and the Nellis mapping zones (see Table 3-46). The land-cover types listed and the percentages that could be affected are based on the nominal width of the rail line construction right-of-way for the alternative segments and common segments and the footprint of each proposed operations support facility. Table 3-51 lists the land-cover types present in the areas of the potential quarry sites.

3.2.7.3.1.1 Noxious Weeds and Invasive Species. Cheatgrass is found along most of the Caliente rail alignment where it fills open space between shrubs. Red brome is also common, although it is generally confined to areas along the rail alignment that would cross the Mojave Desert region. These observations were made during the 2005 field surveys.

The BLM and the Nevada Department of Agriculture maintain databases identifying the locations of documented occurrences of noxious weeds and invasive species (DIRS 174479-BLM 2003, all). The databases identify the following noxious weeds and invasive species in the Meadow Valley Wash near the Caliente alternative segment:

- Dalmatian toadflax (*Linaria dalmatica*)
- Hoary cress (*Cardaria draba*)
- Spotted knapweed (*Centaurea maculosa*)
- Tall whitetop (*Lepidium latifolium*)
- Russian knapweed (*Acroptilon repens*)

These databases also identify tall whitetop along the Eccles alternative segment and Caliente common segment 1, and Scotch thistle (*Onopordum acanthium*) along the Eccles alternative segment.

3.2.7.3.1.2 Wetlands and Riparian Habitat. Before conducting field surveys, DOE reviewed pertinent maps, the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), and available state wetland and land-use inventories to identify the locations of possible wetland and riparian habitat within the rail line construction right-of-way and the study area.

Table 3-48. Land-cover types and percentages within the construction right-of-way by common segment.[a]

Land-cover type	Area covered by common segment[b,c] (percent)					
	CS1	CS2	CS3	CS4	CS5	CS6
Barren Lands, Non-specific	0	0.04	0	0	0	0
Great Basin Pinyon-Juniper Woodland	< 0.01	0.11	0	0	0.1	0
Great Basin Xeric Mixed Sagebrush Shrubland	13.25	0.60	0.75	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	45.95	20.59	20.46	0.64	0.05	0
Inter-Mountain Basins Greasewood Flat	0.19	0.08	0.46	0.35	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	33.59	77.37	71.35	95.36	0	0
Inter-Mountain Basins Playa	0.28	0	0.33	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0.24	0.07	1.57	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	4.3	1.14	5.05	3.65	7.55	13.59
Invasive Annual and Biennial Forbland	0	0	0.03	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	2.17	0	0	0	12.46	23.92
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0	0	0.39
North American Warm Desert Playa	0	0	0	0	<0.01	0.13
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	< 0.01	0	0	0	26.47	61.38
Sonora-Mojave Mixed Salt Desert Scrub	< 0.01	0	0	0	53.37	0.59
Totals[d]	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004, all.
b. CS = common segment.
c. < = less than.
d. Totals might differ from sums of values due to rounding.

Table 3-49. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 1 of 2).

	Area covered by alternative segment (percent)														
	Interface with Union Pacific Mainline alternative segments		Garden Valley				South Reveille		Goldfield			Bonnie Claire		Oasis Valley	
Land-cover type	Caliente	Eccles	GV1	GV2	GV3	GV8	SR2	SR3	GF1	GF3	GF4	BC2	BC3	OV1	OV3
Agriculture	1.84	1.21	0	0	0	0	0	0	0	0	0	0	0	0	0
Barren Lands, Non-specific	0	0.38	0	0	0	0	0	0	0	0	0.03	0	0	0	0
Developed, Medium-High Intensity	0	0	0	0	0	0	0	0	0	0	0.06	0	0	0	0
Developed, Open Space - Low Intensity	0.85	0	0	0	0	0	0	0	0	0	0.21	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	5.55	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	15.57	1.14	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	16.4	35.04	0.08	0.01	0.04	0.33	2.88	1.25	0.99	6.33	1.35	0.11	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	22.99	35.56	29.5	20	60	19.1	18.44	17.4	10.3	15.44	9.57	5.04	0.8	0	0
Inter-Mountain Basins Cliff and Canyon	0	0	0.02	0.06	0.02	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	10.43	6.02	0.04	0.02	0.09	0.02	0	0	1.49	1.37	1.33	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	6.01	19.82	70.19	79.9	40.8	80.45	68.92	71.49	83.9	69.91	85.63	33.59	30.27	0	0
Inter-Mountain Basins Montane Sagebrush Steppe	6.53	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3-49. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 2 of 2).

	Area covered by alternative segment (percent)														
	Interface with Union Pacific Mainline alternative segments		Garden Valley				South Reveille		Goldfield			Bonnie Claire		Oasis Valley	
Land-cover type	Caliente	Eccles	GV1	GV2	GV3	GV8	SR2	SR3	GF1	GF3	GF4	BC2	BC3	OV1	OV3
Inter-Mountain Basins Playa	0	0	0	0	0	0	0	0	0	0	0	0	0.51	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0.16	0	0	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0.13	0.67	0.17	0	0.13	0.1	9.56	9.86	3.12	6.95	1.81	10.66	16.53	4.88	3.13
Inter-Mountain Basins Wash	2.87	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Annual Grassland	0	0	0	0	0	0	0	0	0.1	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	0.09	0	0	31.44	23.43	3.61	0.45
North American Arid West Emergent Marsh	10.82	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.43
North American Warm Desert Playa	0	0	0	0	0	0	0	0	0	0	0	0	0	5.33	1.07
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	13.88	27.01	77.56	72.68
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	5.29	1.84	8.63	22.24
Totals[b]	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. Totals might differ from sums of values due to rounding.

Table 3-50. Land-cover types and percentages within facility footprints by facility[a] (page 1 of 2).

	Area covered by facility[b] (percent)							
	Interchange Yard		Staging Yard					
Land-cover type	Caliente	Eccles	Caliente-Upland	Caliente-Indian Cove	Eccles-North	Maintenance-of-Way Trackside Facility	Maintenance-of-Way Headquarters	Rail Equipment Maintenance Yard
Developed, Open Space - Low Intensity	0.27	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	1.6	5.17	0	26.74	0	0	0	0
Great Basin Pinyon-Juniper Woodland	12	8.8	0.28	6.69	1.67	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	29.87	19.37	1.82	29.61	8.24	0	7.27	0
Inter-Mountain Basins Big Sagebrush Shrubland	6.13	54.68	3.11	4.57	9.21	0	0	0
Inter-Mountain Basins Greasewood Flat	0	0	64.1	0	41.85	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	38.67	10.59	4.63	0	38.82	93.16	92.73	0
Inter-Mountain Basins Montane Sagebrush Steppe	0	1.39	0	0.06	0	0	0	0

Table 3-50. Land-cover types and percentages within facility footprints by facility[a] (page 2 of 2).

Land-cover type	Area covered by facility[b] (percent)							
	Interchange Yard		Staging Yard					
	Caliente	Eccles	Caliente-Upland	Caliente-Indian Cove	Eccles-North	Maintenance-of-Way Trackside Facility	Maintenance-of-Way Headquarters	Rail Equipment Maintenance Yard
Inter-Mountain Basins Playa	0	0	1.28	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	6.69	0	0.5	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0	6.34	0	15.04
Inter-Mountain Basins Wash	0	0	20.99	15.62	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	8.04
North American Arid West Emergent Marsh	11.47	< 0.01	3.83	10.02	0.19	0	0	0
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	74.94
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	1.98
Totals[b]	100	100	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. < = less than.
c. Totals might differ from sums of values due to rounding.

Table 3-51. Types and percentages of land cover within the footprints of potential quarry sites[a] (page 1 of 2).

Land-cover type	Area covered (percent)
Quarry CA-8B	
Great Basin Foothill and Lower Montane Riparian Woodland & Shrubland	1.27
Barren Lands, Non-Specific	0.76
Great Basin Pinyon-Juniper Woodland	1.42
Great Basin Xeric Mixed Sagebrush Shrubland	67.35
Inter-Mountain Basins Mixed Salt Desert Scrub	0.09
Inter-Mountain Basins Montane Sagebrush Steppe	0.21
Inter-Mountain Basins Semi-Desert Shrub Steppe	2.12
Inter-Mountain Basins Big Sagebrush Shrubland	21.86
North American Arid West Emergent Marsh	4.91
Total[b]	100
Quarry NN-9A	
Great Basin Xeric Mixed Sagebrush Shrubland	8.07
Inter-Mountain Basins Big Sagebrush Shrubland	27.96
Inter-Mountain Basins Mixed Salt Desert Scrub	50.95
Inter-Mountain Basins Semi-Desert Shrub Steppe	13.02
Total	100
Quarry NN-9B	
Great Basin Xeric Mixed Sagebrush Shrubland	22.62
Inter-Mountain Basins Big Sagebrush Shrubland	13.11
Inter-Mountain Basins Mixed Salt Desert Scrub	59.73
Inter-Mountain Basins Semi-Desert Shrub Steppe	4.54
Total	100
Quarry NS-3A	
Great Basin Xeric Mixed Sagebrush Shrubland	14.35
Inter-Mountain Basins Big Sagebrush Shrubland	13.02
Inter-Mountain Basins Mixed Salt Desert Scrub	47.00
Inter-Mountain Basins Semi-Desert Shrub Steppe	25.66
Total	100
Quarry ES-7	
Great Basin Xeric Mixed Sagebrush Shrubland	32.46
Inter-Mountain Basins Big Sagebrush Shrubland	47.50
Inter-Mountain Basins Mixed Salt Desert Scrub	18.86
Inter-Mountain Basins Semi-Desert Shrub Steppe	1.17
Total	100

Table 3-51. Types and percentages of land cover within the footprints of potential quarry sites[a] (page 2 of 2).

Land-cover type	Area covered (percent)
Quarry NS-3B	
Great Basin Xeric Mixed Sagebrush Shrubland	2.61
Inter-Mountain Basins Big Sagebrush Shrubland	26.68
Inter-Mountain Basins Mixed Salt Desert Scrub	60.81
Inter-Mountain Basins Semi-Desert Shrub Steppe	9.9
Total	100

a. Source: DIRS 174324-NatureServe 2004, all.
b. Total might differ from sum of values due to rounding.

DOE identified wetland and riparian habitat along the following portions of the Caliente rail alignment using a combination of fieldwork and the 2004 Southwest Regional Gap Analysis Project (see Figures 3-91 through 3-94):

- Caliente alternative segment
- Eccles alternative segment
- Caliente common segment 1
- Goldfield alternative segments
- Bonnie Claire alternative segments
- Oasis Valley alternative segment

This section discusses only portions of the Caliente rail alignment in which there are wetland and/or riparian habitats. Section 3.2.5, Surface-Water Resources, provides information on springs and their locations and specific information for function and value of wetlands for Section 404 permitting. This section discusses wetlands and riparian areas in relation to the vegetation and habitat that is supplied for terrestrial and aquatic species. Table 3-52 details the identified wetland and riparian types found in the construction right-of-way and the study area, along alternative segments and common segments of the Caliente rail alignment.

Plant species that are considered indicators of wetland conditions that were found along the Caliente alternative segment include bulrushes, sedges, Fremont cottonwood, willows (including sandbar willow), broadleaf cattail (*Typha latifolia*), Baltic rush (*Juncus balticus*), common reed (*Phragmites australis*), tamarisk, and Russian olive (*Eleagnus angustifolia*) (DIRS 174040-PBS&J 2005, p. 17).

The wetlands along the Eccles alternative segment at the Meadow Valley Wash were classified as emergent, emergent/rock bottom, and scrub-shrub/rock bottom wetlands (DIRS 174040-PBS&J 2005, p. 16).

In the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east), Caliente common segment 1 would pass near an approximately 0.01-square kilometer (3-acre) wetland. This wetland is adjacent to a single, developed unnamed spring, approximately 440 meters (1,450 feet) outside the rail line construction right-of-way near Black Rock Spring (DIRS 174040-PBS&J 2005, p. 18 and Figure 5). The unnamed spring was likely developed to provide a stock watering area. The wetland area is classified as emergent/rock bottom/unconsolidated bottom and emergent wetlands. The Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all) lists the riparian habitat in this area as Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland.

Table 3-52. Wetland and riparian land-cover types within the Caliente rail alignment construction right-of-way and study area.[a]

Segment/land-cover type	Amount in construction right-of-way (square kilometers)[b]	Amount in study area (square kilometers)
Caliente alternative segment		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.07	4.5
North American Arid West Emergent Marsh	0.14	9.76
Eccles alternative segment		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	2.04
North American Arid West Emergent Marsh	0.05	9.61
Caliente common segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.57
North American Arid West Emergent Marsh	0	7.59
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0.01
Goldfield alternative segment 4		
North American Arid West Emergent Marsh	0	0.01
Bonnie Claire alternative segment 2		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.03
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0.03
Bonnie Claire alternative segment 3		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.02
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0.07
Oasis Valley alternative segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.08
North American Arid West Emergent Marsh	0	0.13
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	2.02
Oasis Valley alternative segment 3		
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0.02	2.02
North American Arid West Emergent Marsh	0	0.23
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.08

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.10.

Oasis Valley alternative segment 3 contains a small (approximately 0.02 square kilometer [5 acres]) wetland area that would be within the construction right-of-way. This wetland area contains willow and inland saltgrass (*Distichlis spicata*) (DIRS 174040-PBS&J 2005, Figure 4T).

See Section 3.2.5, Surface-Water Resources, for more specific information on wetlands.

3.2.7.3.2 Wildlife

> A **wildlife guzzler** is a water development for wildlife that relies on rainfall or snowmelt to recharge it, rather than springs or streams. Usually used where there are no other sources of water for wildlife.

This section describes the wildlife and wildlife communities potentially present in the Caliente rail alignment construction right-of-way. Figure 3-95 details the manmade wildlife water sources, also called ***wildlife guzzlers***, within the study area. There are three wildlife guzzlers within the study area: Scofield #3, and two guzzlers, both named Garden Valley (Figure 3-95 Scofield #3 is approximately 7.6 kilometers (4.7 miles) north of Garden Valley alternative segment 3. The first Garden Valley guzzler is approximately 1.8 kilometers (1.1 miles) south of Garden Valley alternative segment 8. The second Garden Valley guzzler is approximately 2 kilometers (1.2 miles) south of Garden Valley alternative segment 8. Section 3.2.5, Surface-Water Resources, provides information about and locations of other sources of water available to wildlife.

The following sections describe the most common species of mammals, birds, reptiles, amphibians, and fish potentially found within the Caliente rail alignment greater study area and potentially within the construction right-of -way. Section 3.2.7.3.3 provides information on federally listed threatened and endangered species, and federally and state-listed sensitive or protected species. Section 3.2.7.3.4 discusses migratory birds, Section 3.2.7.3.5 discusses Nevada game species, and Section 3.2.7.3.6 discusses wild horses and burros.

3.2.7.3.2.1 Mammals. Mammals are known to exist within the study area along the entire length of the Caliente rail alignment. The types of mammals found within the study area would depend on the vegetation communities. Mammals that could occur within the greater study area and the construction right-of-way of the Caliente rail alignment include:

- Mountain lion (*Felis concolor*)
- Bighorn sheep (*Ovis Canadensis*)
- Kit fox (*Vulpes macrotis*)
- Coyote (*Canis latrans*)
- Bobcat (*Lynx rufus*)
- Badger (*Taxidea taxus*)
- Cottontail rabbit (*Sylvilagus* spp.)
- Various rodents
- Elk (*Cervus elaphus)*
- Pronghorn antelope (*Antilocapra americana*)
- Grey fox (*Urocyon cinereoargenteus*)
- Mule deer (*Odocoileus hemionus*)
- Black-tailed jackrabbit (*Lepus californicus*)
- Ringtail (*Bassariscus astutus*)
- Various bats
- Various ground squirrel species

Mule deer, elk, pronghorn antelope, and bighorn sheep are Nevada game species and are discussed in Section 3.2.7.3.5.

Twenty-three species of bats have been observed in Nevada (DIRS 174474-NDOW 2002, p. 7-8). Bats, including resident, migrant, and transient species, are found throughout Nevada and in every type of habitat. Bats occupy a variety of habitats within the construction right-of-way, including mine shafts, caves, talus slopes with cracks and crevices, cliff faces, man-made structures, and pinyon-juniper and Joshua tree (*Yucca brevifolia*) forests. Bats often use different day and night roosting habitats, different nursery and non-breeding habitats, and different winter and summer habitats. Appendix H includes a list of bat species potentially found within the project area. Many of the bats along the rail alignment are special status species and are discussed further in Section 3.2.7.3.3.

3.2.7.3.2.2 Birds. A variety of bird species are commonly observed in central and southern Nevada, including year-round residents, summer residents, migratory species breeding in southern Nevada, winter residents that breed to the north, and seasonal migrants passing through central and southern Nevada en route to breeding ranges to the north and winter ranges to the south. Several federal laws and state statutes protect various groups of birds. Chapter 6 of this Rail Alignment EIS details these protections.

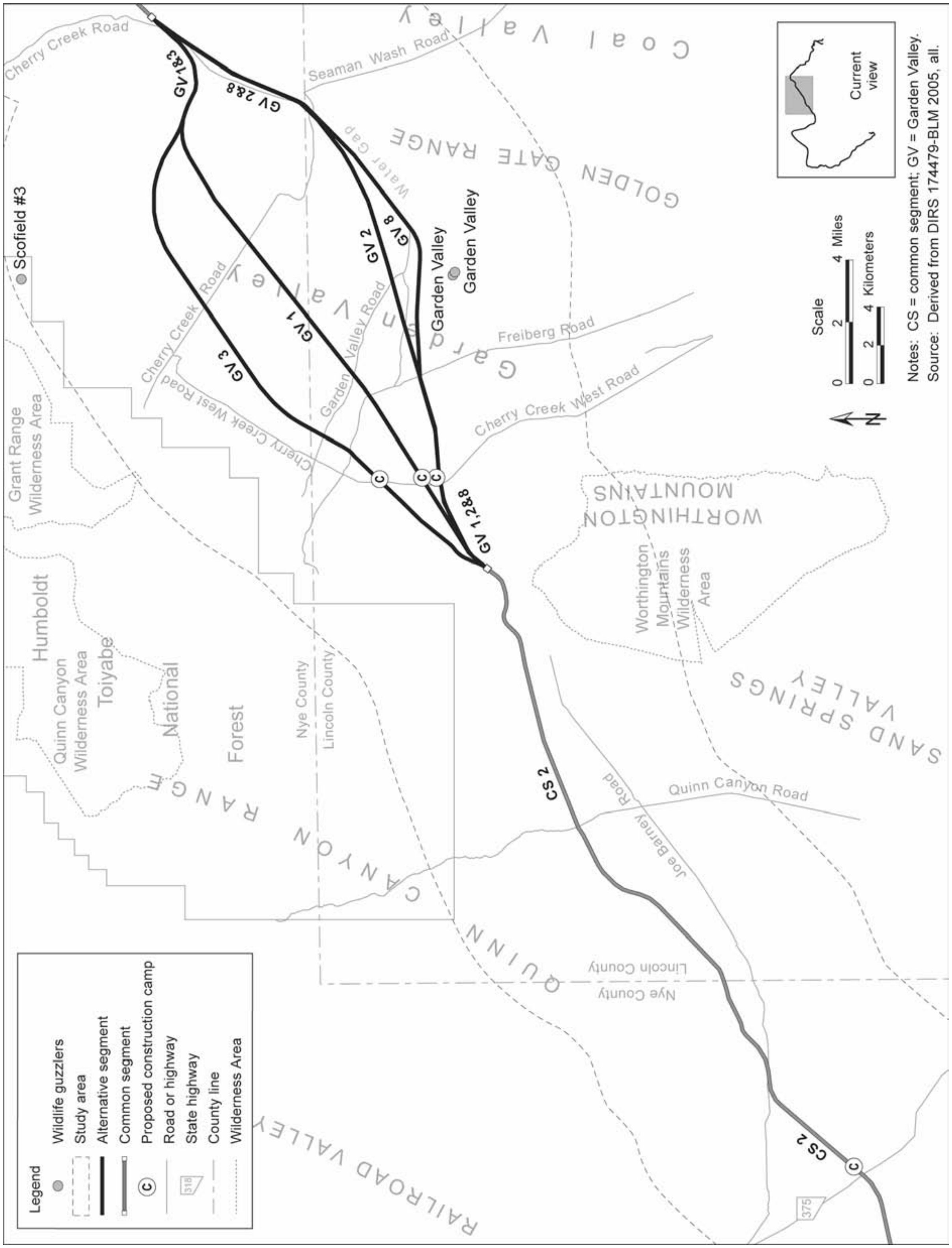


Figure 3-95. Wildlife guzzlers located along the Caliente rail alignment.

The Great Basin region of Nevada is an important migration route for waterfowl and other species of birds traveling between southern wintering areas and northern breeding territories; however, suitable habitat for waterfowl and shorebirds is extremely limited in the region and along the Caliente rail alignment. Portions of Meadow Valley Wash are considered to be waterfowl habitat (DIRS 101504-BLM 1979, pp. 2-35 and 2-36) and migrating birds might temporarily utilize any exposed surface-water areas. Waterfowl and shorebirds were observed during the 2005 field surveys in a few locations where there was standing surface water that supported aquatic vegetation.

Common species of resident and migrating birds observed along the Caliente rail alignment include:

- Common raven (*Corvus corax*)
- Horned lark (*Eremophila alpestris*)
- American pipit (*Anthus rubescens*)
- European starling (*Sturnus vulgaris)*
- American crow (*Corvus brachyrhynchos*)
- MacGillivray's warbler (*Oporonis tolmiei*)
- Loggerhead shrike (*Lanius ludovicianus*)
- Yellow warbler (*Dendroica petechia*)

Two upland game bird species are expected to occur within the Caliente rail alignment construction right-of-way: chukar (*Alectoris chukar*) and Gambel's quail (*Callipepla gambelii*). Two species of upland game birds, chukar and mourning dove, were observed during surveys conducted along the rail alignment. Chukars were recorded in cliff and talus habitat in the Beatty Wash area. Mourning doves are common and were observed at multiple locations along the rail alignment. The greater sage-grouse is an upland game bird that has historically occurred in low abundance near portions of the rail alignment and it could occupy suitable habitat along the northern sections of the rail alignment. The greater sage-grouse is a BLM-listed special status species and receives additional protection from the State of Nevada; it is discussed in more detail in Section 3.2.7.3.3.

Populations of raptors are typically low in numbers, and their occurrence in the rail line construction right-of-way would be very low due to the lack of roosting, nesting, and foraging potential along the alignment. Raptors observed during field surveys included prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), great-horned owl (*Bubo virginianus*), turkey vulture (*Cathartes aura*), and golden eagle (*Aquila chrysaetos)*. In addition, ferruginous hawks (*Buteo regalis*) have been reported to occupy, and in some cases nest in, areas with trees close to the construction right-of-way (DIRS 174519-Bennet 2005, Plate 5).

Populations of bird species that rely on sagebrush habitat in Nevada are declining because cattle grazing and the proliferation of nonnative weeds have degraded the native sagebrush habitat (DIRS 174518-BLM 2005, pp. 222-223). Sagebrush-dependent species that might occupy habitat along the proposed rail alignment could include sage thrasher (*Oreoscoptes montanus)*, sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and vesper sparrow (*Pooecetes gramineus*). The Caliente rail alignment would cross sagebrush habitat in Bennett Pass, Pahroc Pass, and the western and northern portions of Garden Valley, portions of western Sand Spring Valley, southeastern Railroad Valley, and Warm Springs Pass.

3.2.7.3.2.3 Reptiles. A variety of species of lizards and snakes are present throughout the southern Great Basin Desert and northern Mojave Desert and along the Caliente rail alignment. Appendix H, Table H-6, lists the reptiles that have the potential to occur along the Caliente alignment. The desert tortoise (*Gopherus agassizii*) is found within the proposed rail line construction right-of-way at its southern end, from the Beatty Wash area to Yucca Mountain.

This special status species is discussed in Section 3.2.7.3.3.1. The most common lizard species observed during the 2005 field surveys were:

- Western fence lizard (*Sceloporus occidentalis*)
- Western whiptail lizard (*Cnemidophorus tigris*)
- Long-nosed leopard lizard (*Gambelia wislezenii*)
- Side-blotched lizard (*Uta stansburiana*)
- Sagebrush lizard (*Sceloporus graciosus*)
- Desert horned lizard (*Phrynosoma platyrhinos*)

Other lizard species that were observed, but did not appear to be common, were:

- Zebra-tailed lizard (*Callisaurus draconoides*)
- Desert spiny lizard (*Sceloporus magister*)
- Desert iguana (*Dipsosaurus dorsalis*)

Great Basin collared lizards (*Crotaphytus bicinctores*) and desert night lizards (*Xantusia vigilis*) were not observed during field surveys, but probably occur in the study area and potentially in the construction right-of-way. Chuckwalla (*Sauromalus ater*) commonly occurs in land-cover types similar to those in the southern portion of common segment 6, although none were observed during field surveys. This species is found in rocky outcrops and is rarely seen above ground.

Two species of snakes were observed during field surveys performed in February, March, and May 2005: the coachwhip snake (*Masticophis flagellum*) and the gopher snake (*Pituophis catenifer*). Various other species of snakes are likely to occur in the study area and potentially in the construction right-of-way, but were not directly observed during field surveys.

3.2.7.3.2.4 Aquatic Species. Aquatic species are species that require wet environments for at least part of their life cycle. The only native fish species found within the Caliente rail alignment greater study area are special status species and include:

- Railroad Valley springfish (*Crenichthys nevadae*)
- Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6 [unnamed])
- Meadow Valley Wash speckled dace (*Rhinichthys osculus* ssp. 11 [unnamed])
- Meadow Valley Wash desert sucker (*Catostomus clarki* ssp. [unnamed])

Nine more species of amphibians can be found in the southern Great Basin Desert and northern Mojave Desert that are not present in the Caliente rail alignment study area or construction right-of-way and are listed in Appendix H. Potential amphibian habitat correlates with the riparian and wetland habitat found along the rail alignment. The only amphibian observed during field surveys was a possible Woodhouse's toad (*Bufo woodhousii*) at an unnamed spring approximately 760 meters (2,500 feet) downgradient of Caliente common segment 1 on Pahroc Pass, which would be outside of the construction right-of-way. A tadpole in the spring outflow and a brief vocalization are the only recorded evidence; there were no direct observations of adult individuals. The Amargosa toad (*Bufo nelsoni*) occurs only in Oasis Valley north of Beatty. The southwestern toad (*Bufo microscaphus*) has been reported to occur (DIRS 174048-Bennett and Thebeau 2005, all), and is assumed still to exist, at the confluence of Clover Creek and Meadow Valley Wash, although none were observed during field surveys. Nonnative bullfrogs (*Rana catesbeiana*) are also present in some waterways and water bodies in the Caliente rail alignment greater study area.

3.2.7.3.3 Special Status Species

Special status species are plants or wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. The following sections describe two categories of special status species, including threatened or endangered species and BLM special status (designated sensitive) and State of Nevada protected species. Table 3-53 lists special status species, their BLM, state, and federal status, and their likely occurrence in the greater study area and potentially within the construction right-of-way. Figures 3-96 through 3-98 show documented locations of special status species in the study area from the Nevada Natural Heritage Program database. Not all special status species listed in Table 3-53 appear on the figures because DOE obtained the additional information in the table from personnel affiliated with appropriate resource management agencies, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry, and obtained the specific locations of the special status species from a review of the Natural Heritage Program database (DIRS 182061-NNHP 2005, all). The review of the Nevada Natural Heritage Program database for the study area revealed 24 special status species that have been documented as occurring within the study area.

3.2.7.3.3.1 Threatened and Endangered Species. Table 3-53 identifies six federally listed plant and wildlife species, or candidates for listing, with the potential to occur along the Caliente rail alignment, including one plant, one fish, one reptile, and three bird species. However, in 2007 the U.S. Fish and Wildlife Service delisted the bald eagle and the golden eagle. These two species are protected under the Bald and Golden Eagle Protection Act, but are no longer federally listed (See Section 3.2.7.3.3.2). There are no federally listed mammal species along the Caliente rail alignment.

Plants The threatened Ute ladies'-tresses orchid has the potential to occur in the area of the Caliente alternative segment. However, the alternative segment is within the southernmost extent of potential Ute ladies'-tresses habitat. A petition to delist the Ute ladies'-tresses was filed with the U.S. Fish and Wildlife Service in 2004. In its 90-day finding on this petition, the U.S. Fish and Wildlife Service stated that the petition presented substantial new information on the orchid, and that the Service was initiating a 5-year status review to determine if delisting of this species is warranted (50 CFR 17). Until this review is completed and the Service issues the 12-month finding, the Ute ladies'-tresses orchid will continue to be addressed as a ***threatened species***.

An historic observation of the Ute ladies'-tresses orchid was documented in 1936 approximately 8 kilometers (5 miles) north of the Caliente and Eccles alternative segments near Panaca Spring (Meadow Valley Wash watershed). Until recently, this species was believed to no longer exist in Nevada (*Endangered and Threatened Wildlife and Plants; Final Rule to List the Plant Spiranthes Diluvialis (Ute Ladies'-Tresses) as a Threatened Species* [57 *FR* 2048, January 17, 1992]). However, in July 2005, the population at Panaca Spring was rediscovered and included 80 to 100 individual plants (DIRS 176365-Fertig et al. 2005, p. 12). The Ute ladies'-tresses orchid is associated with moist soil conditions, which in the southwest can include perennial streams or washes, floodplains or spring-fed stream channels, or wetlands. There is no designated critical habitat for this species within the study area (DIRS 174439-Williams 2005). However, there is a potential for the Ute ladies'-tresses orchid to occur within Meadow Valley Wash between Panaca and Caliente, along the proposed Caliente alternative segment (DIRS 181606-Rautenstrauch 2007, all).

Fish The endangered Railroad Valley springfish was reportedly introduced into Warm Springs near the Warm Springs summit, north of U.S. Highway 6. The Nevada Natural Heritage Program documented the occurrence approximately 3.3 kilometers (2 miles) northeast of Caliente common segment 3 (see Figure 3-93). A survey of the springs in 1994 indicated that the springfish was no longer present in this area, and the Draft Ely District Resource Management Plan indicates that the introduction failed (DIRS 174518-BLM 2005, p. 3.7-5). This fish is typically found in warm spring pools, outflow streams, and adjacent marshes.

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 1 of 4).

Common name	Species name	Status			Portion of the Caliente rail alignment study area where species could be found
		BLM[b]	State[c]	FWS[d]	
Plants					
Eastwood milkweed	*Asclepias eastwoodiana*	N		xC2	Goldfield alternative segments 1, 3, and 4; Caliente common segment 4
Needle Mountains milkvetch	*Astragalus eurylobus*	N		xC2	Caliente and Eccles alternative segments; Caliente common segment 1
Black woollypod	*Astragalus funereus*	N		xC2	Common segment 6; Oasis Valley alternative segments 1 and 3
Long-calyx eggvetch	*Astragalus oophorus var. lonchocalyx*	N			Caliente common segment 1
White River catseye	*Cryptantha welshii*	N		xC2	Caliente and Eccles alternative segments; Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8
Rock purpusia	*Ivesia arizonica var. saxosa*	N			Common segment 6
Pioche blazingstar	*Mentzelia argillicola*	N			Caliente and Eccles alternative segments; Caliente common segment 1
Tiehm blazingstar	*Mentzelia tiehmii*	N			Caliente common segment 1
Nevada dune beardtongue	*Penstemon arenarius*	N		xC2	Caliente common segment 3; common segment 5
Bashful beardtongue	*Penstemon pudicus*	N			Caliente common segment 3; South Reveille alternative segments 2 and 3
Williams combleaf	*Ployctenium williamsiae*		CE		Caliente common segment 3
Tonopah fishhook cactus	*Sclerocactus nyensis*	N	CY		Caliente common segment 3
Schlesser pincusion	*Sclerocactus schlesseri*	N	CY	xC2	Caliente common segment 1
Ute ladies'-tresses	*Spiranthes diluvialis*		CE	LT	Caliente alternative segment
Wassuk beardtongue	*Penstemon rubicundus*				Goldfield alternative segments 1, 3, and 4; Oasis Valley alternative segments 1 and 3; common segments 5 and 6
Dune sunflower	*Helianthus deserticola*				Goldfield alternative segments 1, 3, and 4; common segments 5 and 6; Oasis Valley alternative segments 1 and 3

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 2 of 4).

Common name	Species name	Status			Portion of the Caliente rail alignment study area where species could be found
		BLM[b]	State[c]	FWS[d]	
Invertebrates					
Oasis Valley pyrg	*Pyrgulopsis micrococcus*	N		xC2	Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Fish					
Meadow Valley Wash desert sucker	*Catostomus clarki*	N	S	xC2	Caliente and Eccles alternative segments
Railroad Valley springfish	*Crenichthys nevadae*		T	LT	Caliente common segment 3
Meadow Valley speckled dace	*Rhinichthys osculus* ssp. 11[e]	N	P		Caliente and Eccles alternative segments
Oasis Valley speckled dace	*Rhinichthys osculus* ssp. 6[e]	N	P		Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Amphibians and reptiles					
Southwestern toad	*Bufo microscaphus*	N			Caliente and Eccles alternative segments; common segment 6
Amargosa toad	*Bufo nelsoni*	N	P		Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	N	T	LT	Common segment 6
Chuckwalla	*Sauromalus ater*	N		xC2	Common segment 6
Birds					
Western burrowing owl	*Athenes cunicularia*	N		xC2	All
Greater sage-grouse	*Centrocercus urophasianus*	N	G		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8
Western yellow-billed cuckoo	*Coccyzus americanus*		S	C	Caliente alternative segment
Southwestern willow flycatcher	*Empidonax traillii extimus*		E	LE	Caliente alternative segment; Oasis Valley alternative segments 1 and 3
Ferruginous hawk	*Buteo regalis*	N		xC2	Caliente and Eccles alternative segments; Caliente common segments 1, 2, and 5
Swainson's hawk	*Buteo swainsoni*	N		--	Oasis Valley; common segment 6

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 3 of 4).

Common name	Species name	Status			Portion of the Caliente rail alignment where species could be found
		BLM[b]	State[c]	FWS[d]	
Birds (continued)					
Peregrine falcon	*Falco peregrinus*	N	E	NL	Caliente alternative segment; Oasis Valley; common segment 6
Bald eagle	*Haliaeetus leucocephalus*		E	NL	Caliente alternative segment
Loggerhead shrike	*Lanius ludovicianus*	N	S	xC2	All
Sage thrasher	*Oreoscotes montanus*	N	S		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Oasis Valley
Phainopepla	*Phainopepla nitens*	N		--	Oasis Valley; common segment 6
Brewer's sparrow	*Spizella breweri*	N	S		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Oasis Valley; common segment 6
Western least bittern	*Ixobrychus exilis hesperis*	N	P	xC2	Common segment 5
White-faced ibis	*Plegasis chihi*	N	P	xC2	Oasis Valley; common segment 6
Mammals					
Pygmy rabbit	*Brachylagus idahoensis*	N	G	xC2	Caliente common segment 1; Garden Valley alternative segments 1, 2, 3, and 8
Pale kangaroo mouse	*Microdipidops pallidus*		P		Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Goldfield alternative segments 1, 3, and 4
Dark kangaroo mouse	*Microdipodops megacephalus albiventer*	N	P	xC2	Caliente common segments 1, 2, and 3; Garden Valley alternative segments 1, 2, 3, and 8; South Reveille alternative segments 2 and 3; Goldfield alternative segments 1, 3, and 4

Table 3-53. Special status species potentially within the Caliente rail alignment greater study area[a] (page 4 of 4).

Common name	Species name	Status BLM[b]	State[c]	FWS[d]	Portion of the Caliente rail alignment where species could be found
Mammals (continued)					
Desert bighorn sheep	*Ovis canadensis*	N	G		Caliente common segment 1; Bonnie Claire alternative segment 2; common segment 5; common segment 6
Pallid bat	*Antrozous pallidus*		P		All segments
Townsend's big-eared bat	*Corynorhinus townsendii*	N	S		Goldfield alternative segment 4; Oasis Valley alternative segments 1 and 3; common segment 6
Big brown bat	*Eptesicus fuscus*	N			All segments
Greater western mastiff bat	*Eumops perotis*	N	S	xC2	All segments
Spotted bat	*Euderma maculatum*		T	xC2	Caliente and Eccles alternative segments; Caliente common segment 1; Goldfield alternative segment 4
Allen's lappet-browed bat	*Idionycteris phyllotis*	N	P	xC2	All segments
Western red bat	*Lasiurus blossivillii*	N	S		All segments
Hoary bat	*Lasiurus cinereus*	N			All segments
Silver-haired bat	*Lasionycteris noctivagans*	N			All segments
California leaf-nosed bat	*Macrotus californicus*	N	S	xC2	All segments
California myotis	*Myotis californicus*	N			All segments
Small-footed myotis	*Myotis ciliolabrum*	N		xC2	All segments
Long-eared myotis	*Myotis evotis*	N			All segments
Little brown myotis	*Myotis lucifugus*	N			All segments
Fringed myotis	*Myotis thysanodes*	N	P	xC2	Common segment 6
Cave myotis	*Myotis velifer*	N		xC2	All segments
Long-legged myotis	*Myotis volans*	N			All segments
Yuma myotis	*Myotis yumanensis*	N			All segments
Western pipistrelle	*Pipistrellus hesperus*	N			All segments
Brazilian free-tailed bat	*Tadarida brasilliansis*	N	P		All segments

a. Source: DIRS 182061-NNHP 2005, all.
b. BLM = U.S. Bureau of Land Management. Status definitions: N = designated sensitive by the BLM state office.
c. State = State of Nevada Protected Species (under NAC 503). Status definitions: G = game; P = protected; T = threatened; E = endangered; S = sensitive; CE = critically endangered plant; CY = state-protected cactus and yucca.
d. FWS = U.S. Fish and Wildlife Service. Status definitions: LE = listed endangered; LT = listed threatened; C = candidate; xC2= former Category 2 Candidate, now "species of concern;" NL = not listed (removed from list).
e. Numbers refer to unnamed subspecies.

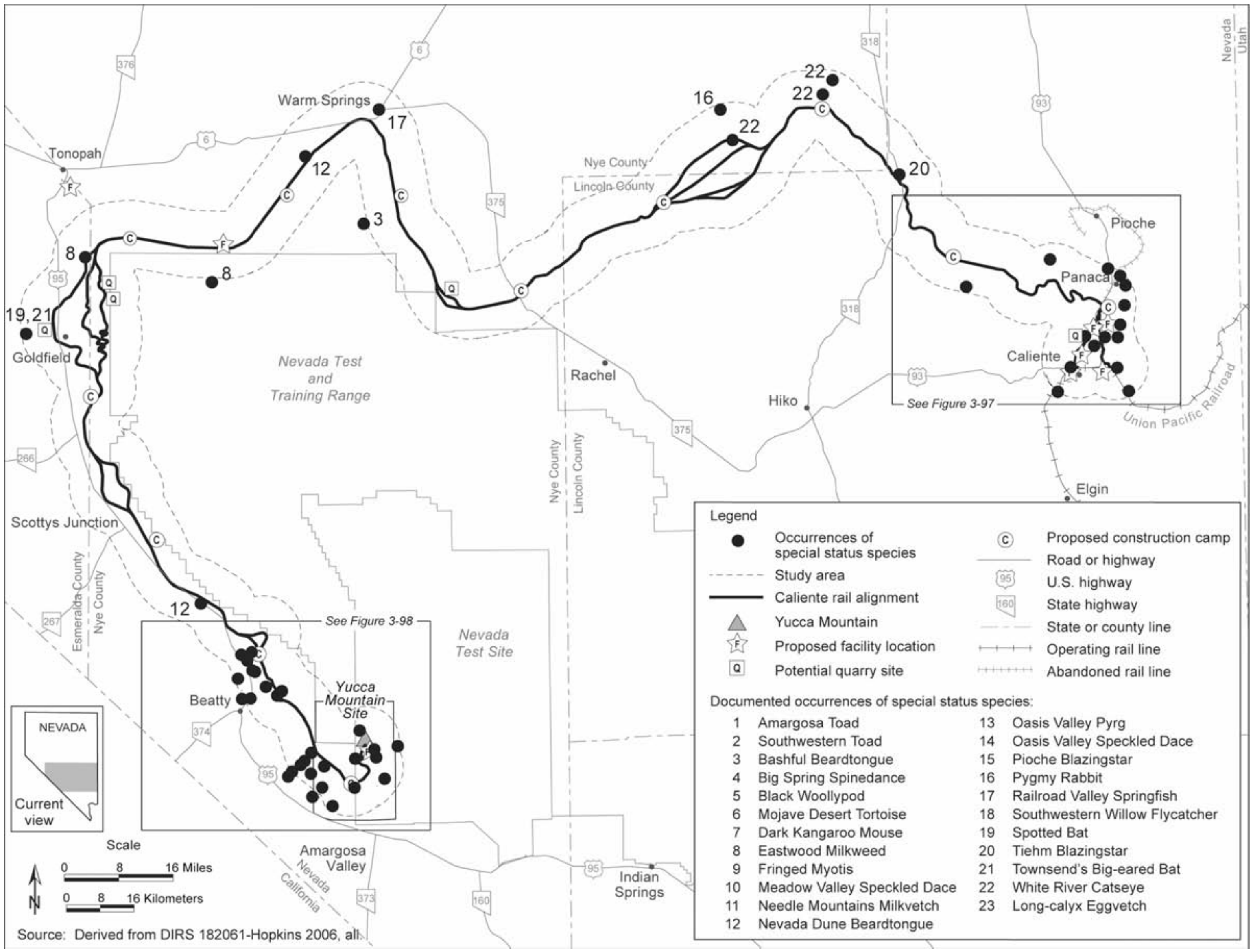


Figure 3-96. Occurrences of special status species documented in the Nevada Natural Heritage Program database along the Caliente rail alignment.

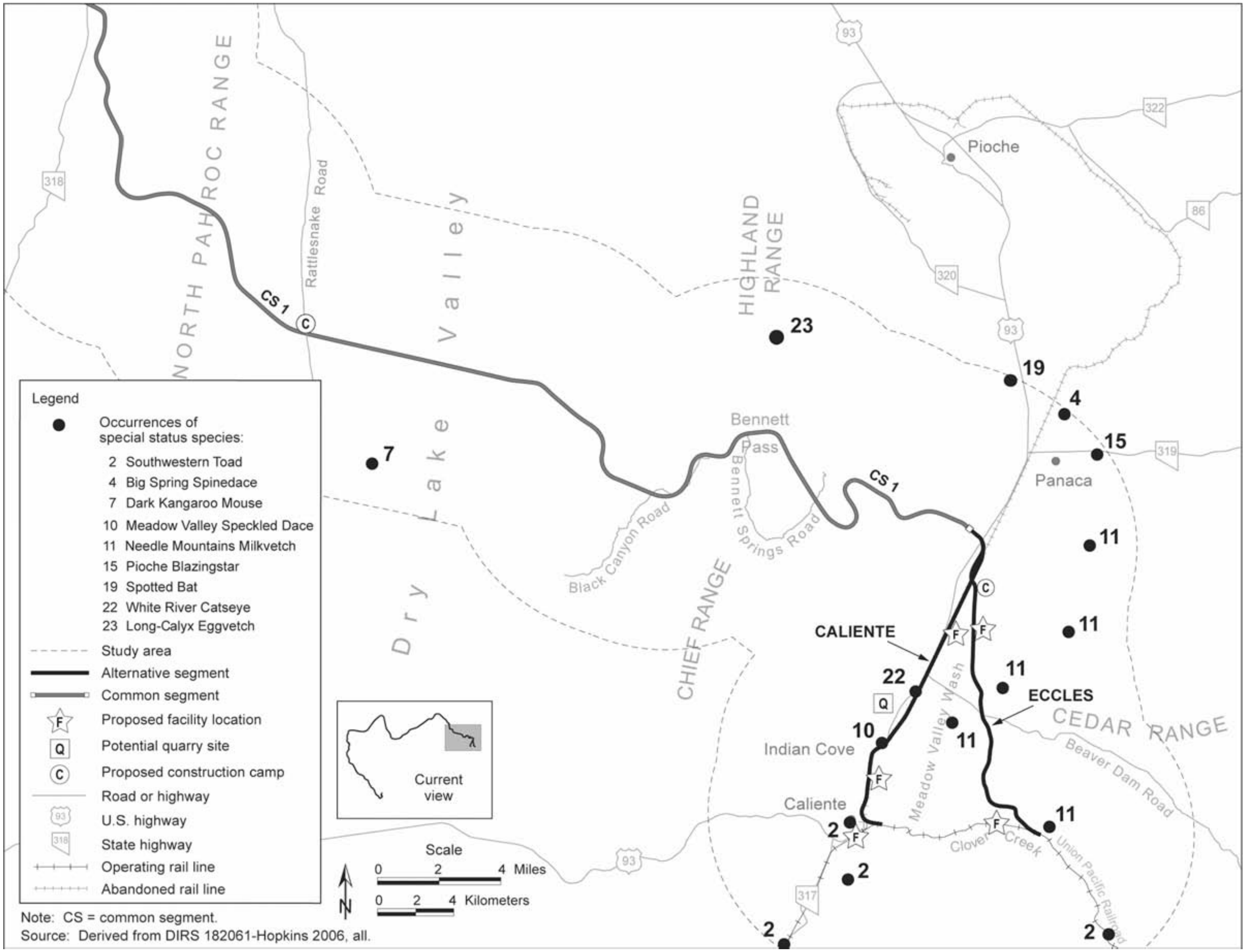
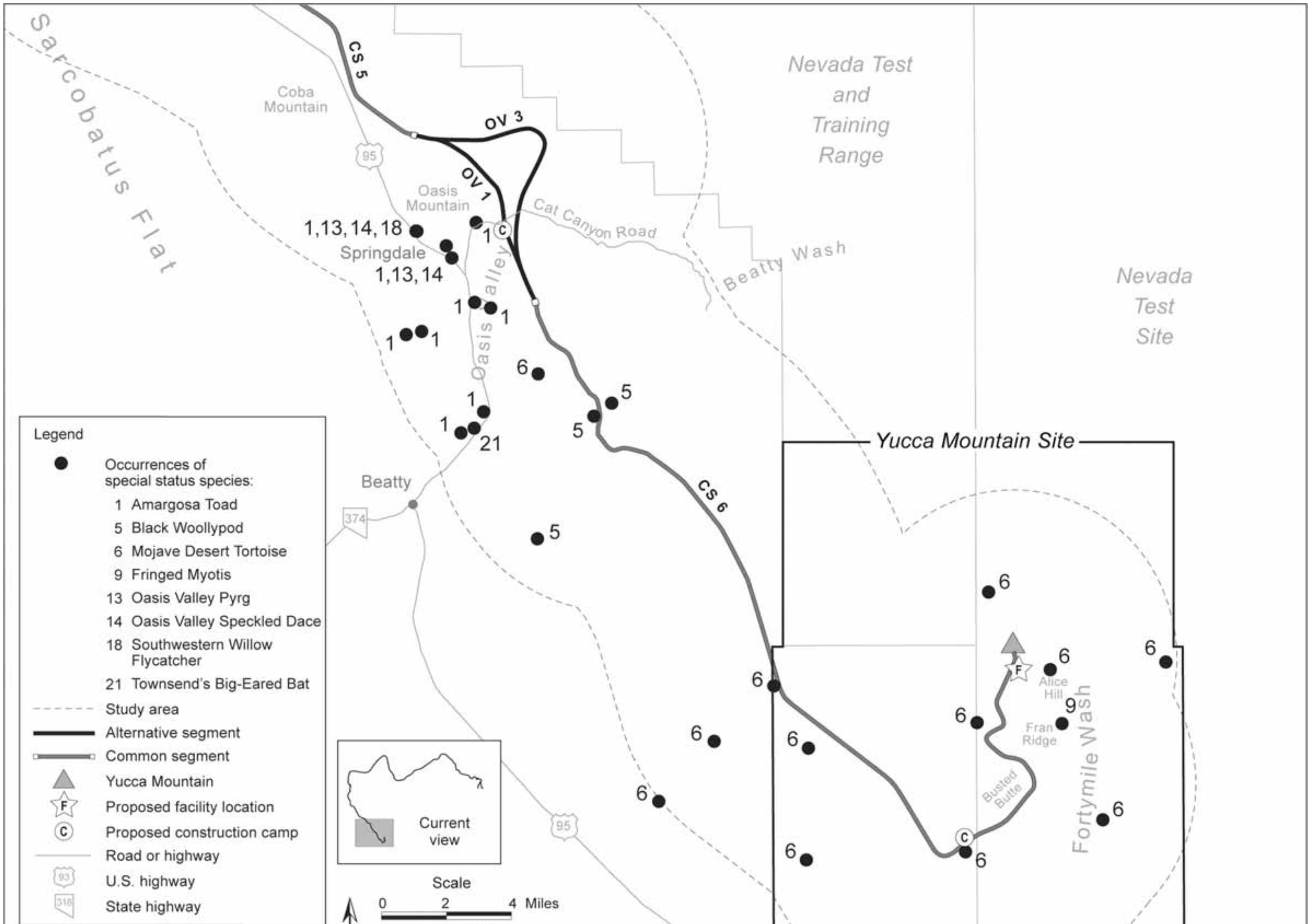


Figure 3-97. Occurrences of special status species documented in the Nevada Natural Heritage Program database adjacent to the Caliente and Eccles alternative segments.



Notes: CS = common segment;
OV = Oasis Valley.
Source: Derived from DIRS 182061-Hopkins 2006, all.

Figure 3-98. Occurrences of special status species documented in the Nevada Natural Heritage Program database adjacent to the Oasis Valley alternative segments and the Yucca Mountain Site.

Amphibians and Reptiles The desert tortoise, which is listed as threatened under the Endangered Species Act and by the State of Nevada (Mojave Desert population only), is found along the southern end of the Caliente rail alignment from approximately Beatty Wash to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 57 to 72). The desert tortoise's range in this portion of Nevada extends approximately 16 kilometers (10 miles) north of Beatty near Springdale (DIRS 176649-FWS 2003, p. 7). About 48 kilometers (30 miles) of the rail alignment would be within potentially suitable desert tortoise habitat, including common segment 6 and the Rail Equipment Maintenance Yard (Figure 3-99). Mojave Desert tortoises are generally confined to warm, creosote bush and shadscale (*Atriplex confertifolia*) scrub habitats with well-drained sandy ***loam*** soils. These soils are composed of sand or sandy gravel that permit the tortoises to burrow and nest (DIRS 102475-Brussard et al. 1994, p. 15). The area through which common segment 6 would pass and the location of the Rail Equipment Maintenance Yard are not designated as critical habitat for the desert tortoise. This area is primarily considered low-density for the desert tortoise, with the population of tortoises at a low level in relation to other areas within the range of this species in Nevada.

Birds Until recently, the yellow-billed cuckoo, which is a federal ***candidate species*** under the Endangered Species Act, had been considered to no longer exist in Nevada; however, recent U.S. Fish and Wildlife Service survey data indicated that at least one nesting pair has been observed along the Meadow Valley Wash area in southeastern Nevada approximately 27 kilometers (17 miles) south of the City of Caliente (DIRS 173227-Micone and Tomlinson 2000; DIRS 173228-Gallagher et al. 2001, p. 10; DIRS 173229-Furtek et al. 2002, p. 13-21; DIRS 173230-Furtek et al. 2003, p. 18-23; DIRS 173231-Furtek and Tomlinson 2003, p. 16-22). Yellow-billed cuckoos nest in tall cottonwood trees and willow riparian woodlands in the West and require patches of an average of 0.17 square kilometers (42 acres) of dense riparian habitat with at least 0.03 square kilometers (7 acres) of it closed canopy (DIRS 175505-Laymon and Halterman 1987, pp. 19 to 25). There is no suitable breeding habitat for yellow-billed cuckoos within the Caliente rail alignment construction right-of-way (DIRS 182308-Rautenstrauch 2006, all). There is an area of marginally suitable migratory or non-nesting yellow-billed cuckoo habitat approximately 320 meters (1,050 feet) long on the northern border of the City of Caliente. This habitat is between U.S. Highway 95 and the Caliente rail alignment and outside the construction right-of-way. There is also a stand of riparian vegetation west of the Eccles Interchange Yard location along Clover Creek; although suitable for migratory or non-nesting yellow-billed cuckoos, this area is outside the Caliente rail alignment construction right-of-way. This area of riparian vegetation would not be disturbed during the construction of the Eccles Interchange Yard. The lack of confirmed records for this species throughout Nevada and the lack of sufficient breeding habitat within the Caliente rail alignment construction right-of-way suggest that it is highly unlikely that the yellow-billed cuckoo would occur within the project area.

The southwestern willow flycatcher, listed as endangered under the Endangered Species Act, is potentially present in Nevada from May through September and breeds in dense riparian habitat. This species' preferred habitat is typically dominated by willows, cottonwood, or invasive tamarisk. The southwestern willow flycatcher has been observed in dense stands of riparian vegetation in Meadow Valley Wash in Lincoln County. Potential habitat exists along Meadow Valley Wash; however, substantial flood events and recent construction efforts in the area have greatly reduced the amount of potential flycatcher habitat in this area. The closest recorded occurrence of this species within Meadow Valley Wash was approximately 12 kilometers (7.5 miles) from the beginning of the Caliente alternative segment, south of the City of Caliente (DIRS 182061-NNHP 2005, all). There is no suitable breeding habitat for southwestern willow flycatchers within the construction right-of-way (DIRS 182308-Rautenstrauch 2006, all). There is an area of marginally suitable migratory or non-nesting habitat for southwestern willow flycatchers approximately 320 meters (1,050 feet) long on the northern border of the City of Caliente to the confluence of Meadow Valley Wash and Antelope Canyon Wash.

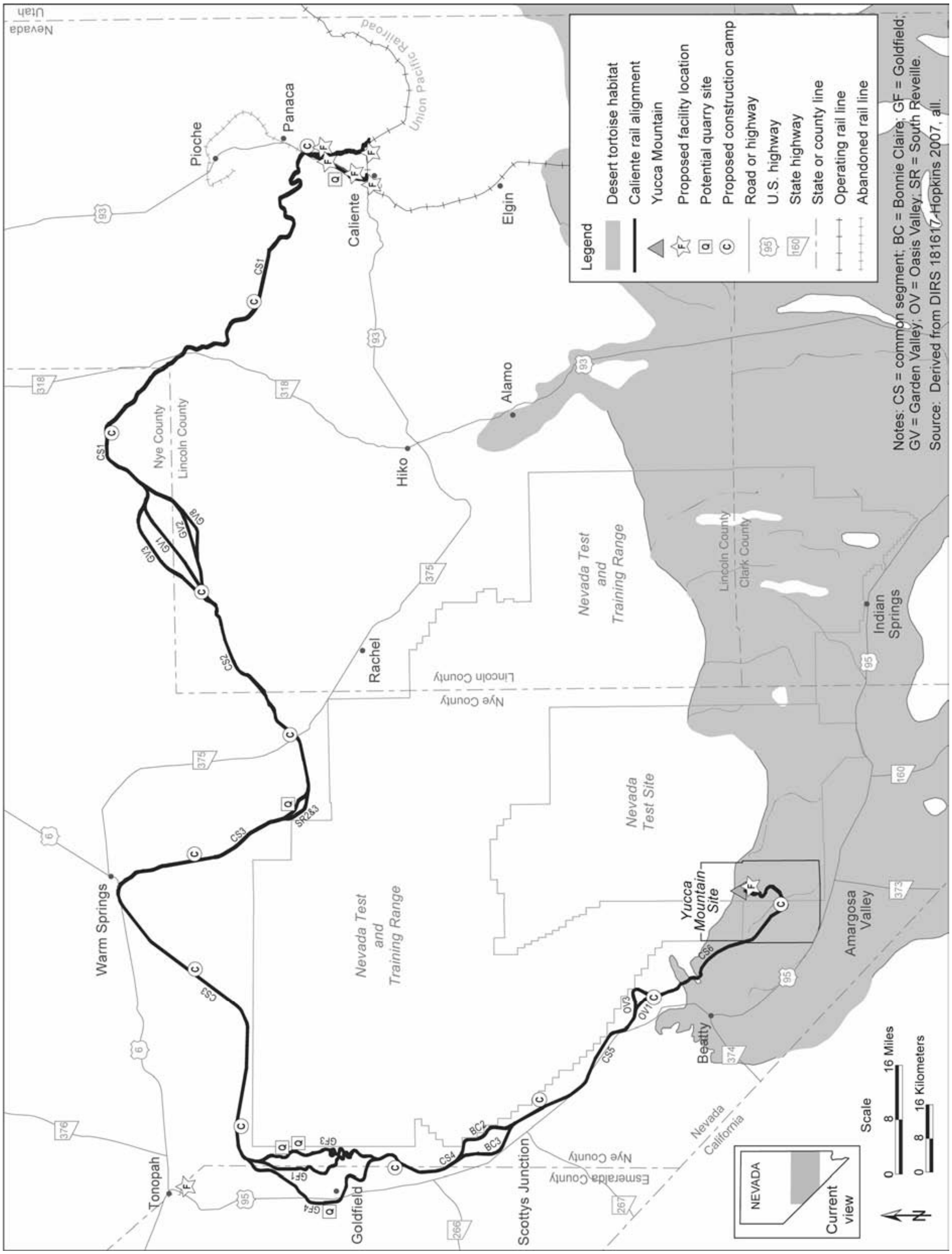


Figure 3-99. Estimated northern extent of potential desert tortoise habitat in relation to the Caliente rail alignment.

There are scattered occurrences of willows and cottonwoods within this stretch of riparian habitat and within the construction right-of-way but adjacent to the old rail roadbed where the new rail line would be constructed. There is a small amount, about 20 to 30 meters (66 to 98 feet), of riparian habitat to the north and west of the Antelope Canyon Wash bridge crossing. This area is between U.S. Highway 95 and the proposed construction right-of-way along the Caliente alternative segment. There is also a stand of riparian vegetation west of the proposed location of the Eccles Interchange Yard along Clover Creek, outside the construction right-of-way, which could be suitable for migrating and non-nesting southwestern willow flycatchers. This area of riparian vegetation would not be disturbed during construction of the Eccles Interchange Yard. Southwestern willow flycatchers have also been documented approximately 19 kilometers (12 miles) north of Beatty, near Oasis Valley (DIRS 182061-NNHP 2005, all). This recorded occurrence was approximately 4.4 kilometers (2.7 miles) southwest of Oasis Valley alternative segment 1 and well outside the Caliente rail alignment construction right-of-way.

3.2.7.3.3.2 BLM Special Status and State of Nevada Protected Species. The BLM State Office and the State of Nevada have identified a number of species as requiring conservation and protection. The BLM State Office designates species as sensitive and the State of Nevada designates species protected. Many of the species designated as sensitive by the BLM are also designated as protected by the State of Nevada. Additionally, a few BLM-designated sensitive species and State of Nevada-designated protected species are also listed as threatened, endangered, proposed, or candidate under the Endangered Species Act. Table 3-53 lists BLM-designated sensitive and State of Nevada-designated protected species and provides information on their status and known or potential locations along the Caliente rail alignment. These species are described below by plant and animal categories.

Plants DOE performed field surveys in May 2005 to confirm the presence of BLM-designated sensitive species and to identify potential habitat for such species along the Caliente rail alignment. Appendix H contains detailed survey information. In addition to location records for BLM-designated sensitive species obtained from the Nevada Natural Heritage Program (DIRS 182061-NNHP 2005, all), these species were passively observed during field surveys in other locations with habitat characteristics of the species. Because the field surveys did not cover the entire construction right-of-way, and there is both seasonality to the presence or absence of visible signs of plants and annual variability among plant species, the fact that a BLM-designated sensitive species was not documented at a specific location does not indicate a definitive absence of the species.

The Eastwood milkweed has been documented 140 meters (460 feet) west of Goldfield alternative segment 4, near Mud Lake. Surveys in May 2005 in this location documented an individual Eastwood milkweed plant within the construction right-of-way of Goldfield alternative segment 4. Typical habitat for this species consists of sandy soils in mixed desert shrub or salt desert scrub, including blackbrush (*Coleogyne ramosissima*) and sagebrush from 1,130 to 2,000 meters (3,700 to 6,500 feet) elevation (DIRS 176456-Welsh et al. 1993).

Needle Mountains milkvetch has been recorded in large populations within approximately 0.8 kilometer (0.5 mile) of the Eccles alternative segment (DIRS 182061-NNHP 2005, all). Field surveys identified this species in the gravelly, eroded sandstone badlands between the areas east of Bennett Pass to where the Caliente or Eccles alternative segment would join Caliente common segment 1, and continuing south along the Eccles alternative segment to the dirt road between U.S. Highway 93 and Beaver Dam State Park and outside the construction right-of-way. This species typically occurs in deep, sandy, gravelly, or clay soils and is frequently found in or along drainages. Although this species appears to be locally common, its distribution is patchy, and habitat outside this area is rare.

The black woollypod has been observed approximately 6 kilometers (4 miles) east of U.S. Highway 95 near Beatty Wash. Field surveys along common segment 6 in Beatty Wash confirmed the presence of this species in the study area but outside the construction right-of-way. This plant is common locally on very steep, gravelly slopes of light-colored volcanic tuff in the area where there is little competition from other species. Habitat for this species is characterized by open, talus, or gravelly slopes on alluvium soils composed of volcanic tuff around 975 to 2,340 meters (3,200 to 7,700 feet) elevation (DIRS 181872-NNHP 2001, all).

Long-calyx eggvetch has been recorded in the vicinity of the Highland Range, approximately 4.5 kilometers (2.8 miles) north of Bennett Pass, just west of Panaca within the study area but outside the construction right-of-way. There is very little information on the habitat of this species in Nevada. Typical habitat includes pinyon-juniper associations and other mixed-shrub communities (DIRS 176456-Welsh et al. 1993), which occur at elevations of 1,770 and 2,300 meters (5,800 and 7,550 feet) throughout the Great Basin.

White River catseye is known to occur in gravelly, eroded sandstone badlands between the areas east of Bennett Pass to where the Caliente or Eccles alternative segment would join Caliente common segment 1, and continuing south along the Eccles alternative segment to the dirt road between U.S. Highway 93 and Beaver Dam State Park. It has also been recorded in the Meadow Valley watershed near the Caliente alternative segment; however, the location description puts the species in a wet meadow, which is not typical habitat for the species. No White River catseye were observed in the construction right-of-way during field surveys; however, this species has been documented approximately 200 meters (660 feet) south of Garden Valley alternative segment 3.

Rock purpusia has been documented approximately 13 kilometers (8 miles) from common segment 6 within the study area but outside the construction right-of-way. No systematic surveys have been completed for this species; therefore, there is no habitat and range information. Studies at the Nevada Test Site show this species tends to occur in cliff crevices and boulders on volcanic and possibly carbonate rocks in the upper mixed-shrub, sagebrush, and pinyon-juniper zones (DIRS 180962-NatureServe Explorer 2007, all).

Pioche blazingstar is a newly described species that has been documented approximately 7.5 kilometers (4.7 miles) north of Bennett Pass, less than 1.6 kilometers (1 mile) east of Panaca. This species appears to be restricted to barren clay knolls and slopes between Panaca and the Patterson Wash area of southern Lake Valley and is known from only five reported occurrences in this area of Nevada (DIRS 181846-NatureServe 2007, all).

Tiehm blazingstar has been documented in the White River Valley, west of the White River approximately 1.6 kilometers (1 mile) from Caliente common segment 1. Field surveys conducted in May 2005 did not detect the presence of this species at the location described by the Nevada Natural Heritage Program (DIRS 182061-NNHP 2005, all). Additionally, no occurrences were documented along the Caliente rail alignment construction right-of-way in the White River Valley, although it is possible that the plant would not have matured enough to be identified. Other occurrences of this species were recorded approximately 40 kilometers (25 miles) to the north, near Sunnyside, in an area dotted with knolls of white, chalky soil, the type of habitat typically associated with this species. The area in White River Valley consists of a series of gravelly mesas separated by steep washes and lacks the white chalky soil found to the north.

A population of the Nevada dune beardtongue was documented during field surveys along the Caliente rail alignment within the Sarcobatus Flats area outside the construction right-of-way. This species is common locally in a sandy area along common segment 5 on both sides of a bisecting secondary road, but appears restricted to this area of deep, sandy soil. Typical habitat for this species consists of deep, loose sandy soils of valley bottoms, often in alkaline areas, sometimes on road banks and other previously disturbed areas with associated vegetation including shadscale, four-winged saltbush (*Atriplex canescens*), and rabbitbrush (*Chrysothamnus nauseosus* spp.) (DIRS 180960-NatureServe Explorer 2007, all).

Bashful beardtongue, also known as the Kawich Range beardtongue, has been documented along the Caliente rail alignment where it would pass through the Kawich Range at Warm Springs Summit. This species has a narrow distribution and is known from only five sites within the Kawich Range. Typical habitat for this species includes coarse rocky slopes in pinyon-juniper or mountain mahogany woodlands and sagebrush communities around 2,300 to 2,700 meters (7,500 to 8,900 feet) elevation (DIRS 181882-NNHP 2001, all).

Williams combleaf has been found within the Kawich Range approximately 10 kilometers (6 miles) south of the study area along Caliente common segment 3 but outside the construction right-of-way. This species has a small range in Nevada and is found in relatively barren sandy to sandy-clay soils associated with high elevation non-alkaline seasonal lakes in sagebrush, pinyon-juniper zones around 1,700 to 2,700 meters (5,700 to 8,900 feet) (DIRS 181881-NNHP 2001, all).

The Tonopah fishhook cactus has been recorded near the Caliente rail alignment in Reveille Valley. Only general locations of this species are included in the Nevada Natural Heritage Program database (DIRS 182061-Hopkins 2005) because of the risk of illegal collection. Field surveys consisting of two 1.6-kilometer (1-mile) transects perpendicular to the rail alignment in Reveille Valley did not locate any Tonopah fishhook cacti within the construction right-of-way. This species is typically found in dry, rocky soils or outcrops, or under shrubs in the upper salt desert and lower sagebrush zones (DIRS 181880-NNHP 2001, all).

A population of the Schlesser's pincushion was recorded 640 meters (2,100 feet) north of the Caliente rail alignment near the city of Panaca. The habitat for this species is typified by open, gravelly or sandy-clay soils, with dense shrubs or grass canopies dominated by shadscale shrubs (DIRS 181879-NNHP 2001, all). Surveys along the rail alignment nearest the recorded occurrence, east of Bennett Pass to where the Caliente or Eccles alternative segment would join Caliente common segment 1, found no Schlesser's pincushion.

As defined in Section 3.2.7.3.3, special status species are species that are afforded some level of protection or special management under federal or state laws or regulations. As such, all cacti and yucca are considered special status because they are protected by the State of Nevada and the BLM. All cacti, yucca, and Christmas trees have special consideration under Nevada Revised Statutes Section 527.050 and are protected from unauthorized removal. Removal or possession of any cactus, yucca, or Christmas tree for commercial purposes on any state, county, or privately owned land is regulated by the State Forester Fire Warden. Removal of such species from private lands would require a permit requisition from the State Forester Fire Warden. DOE would salvage minimal amounts of cacti and yucca within the construction right-of-way in accordance with this law and the requirements of applicable land management agencies during the construction phase. Stipulations for salvage are outlined in BLM Manual 6840, *Special Status Species Management* (DIRS 172901-BLM 2001, all).

Invertebrates The Oasis Valley pyrg, a snail, is known to occur in the Amargosa River drainage in Oasis Valley. Specifically, this snail has been observed in an unnamed spring near Fleur de Lis Spring 12 kilometers (7.5 miles) north-northeast of Beatty (DIRS 104593-CRWMS M&O 1999, p. K-6) and potentially inhabits other springs in the Amargosa River drainage. This snail inhabits small springs and stream outflows where it is typically found on stone, travertine, watercress, and plant debris (DIRS 175029-NatureServe Explorer 2007, all). There is no recorded occurrence of this snail in the construction right-of-way.

Fish The Meadow Valley Wash desert sucker is also found in Meadow Valley Wash (DIRS 104593-CRWMS M&O 1999, pp. E-2 and E-4) and in the White River drainage. This subspecies is typically found in small- to moderate-sized streams, often with pools and riffles or shallow areas, with mainly gravel-rubble, sandy silt substrates (DIRS 180964-NatureServe Explorer 2007, all).

The Meadow Valley Wash speckled dace has been historically observed in Meadow Valley Wash approximately 60 meters (200 feet) northwest of the Caliente rail alignment (DIRS 182061-NNHP 2005, all; DIRS 104593-CRWMS M&O 1999, pp. 3-23, E-2, and E-4). This subspecies has a very limited range and is only known within this watershed. Specific distribution of this fish varies within Meadow Valley Wash due to water availability within the wash.

The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near the towns of Springdale and Beatty, less than 1.6 kilometers (1 mile) from Oasis Valley alternative segment 1. This subspecies has a very limited range and is only known from the watershed in Oasis Valley. Specific distribution of this fish varies with available water (DIRS 181847- NatureServe 2007).

Amphibians and Reptiles The Amargosa toad is found in or near riparian habitats associated with the Amargosa River drainage (Oasis Valley) and at Fleur de Lis Spring, Crystal Spring, Indian Spring, and other springs and seeps near the towns of Springdale and Beatty (DIRS 174414-Stebbins 2003, pp. 209 and 210; DIRS 104593-CRWMS M&O 1999, p. 3-20). Vegetation bordering this toad’s habitat includes cottonwood trees, cattails, and sedges. Adult toads hide and rest under bushes and in rodent burrows, and generally hibernate from November to March. In the late summer and fall, adult toads have been documented as traveling more than 183 meters (600 feet) from water sources. If moist soil is available, open water might not be necessary for the adult toad to survive (DIRS 176795-BLM [n.d.]).

The southwestern toad (also known as Arizona toad) has been documented in locations in Meadow Valley Wash near the City of Caliente, and also within Clover Creek (DIRS 174048-Bennett and Thebeau 2005). Specifically, this toad has been documented approximately 0.8 kilometer (0.5 mile) south of the Caliente alternative segment and approximately 4.8 kilometers (3 miles) south of the Eccles alternative segment in Clover Creek outside the construction right-of-way. This species can be found in cottonwood-willow associations, creeks, pools, irrigation ditches, flooded fields, and reservoirs. This toad normally breeds in low- to moderate-gradient streams and is not dependent on rainfall (DIRS 174414-Stebbins 2003, pp. 213 and 214; DIRS 175487-NatureServe Explorer 2007). There were no southwestern toads found within the Caliente rail alignment study area during the 2005 field surveys. However, the potential presence of this species cannot be discounted, because the survey of potentially suitable toad habitat was limited to areas that were accessible and along the construction right-of-way. Thus, the survey excluded large areas of potentially suitable habitat on private property to which DOE had no access.

Chuckwalla has been documented in the southeastern foothills of Yucca Mountain, adjacent to common segment 6 but outside the construction right-of-way. This area represents the chuckwalla’s northern-most range in southern Nevada. This large lizard is typically found among talus slopes, large rocky outcrops and boulders, which provide cover and basking sites (DIRS 174414-Stebbins 2003, pp. 269 and 270).

Birds Western burrowing owls are known to occur throughout the Mojave and Great Basin Deserts (DIRS 176455-Dickinson ed. 1999, p. 256). DOE identified one burrowing owl burrow, which appeared to be active, within the Caliente rail alignment study area in the vicinity of Yucca Mountain. Typical burrowing owl habitat is characterized by well-drained, level-to-gently sloping areas in arid or semi-arid environments. This species has been known to overwinter throughout Nevada; however, they are predominantly encountered during their breeding season from mid-March through September (DIRS 176361-Klute et al. 2003, p. 1-12).

The greater sage-grouse is a BLM-designated sensitive bird species that is also listed as a game species by the State of Nevada. Greater sage-grouse are found exclusively in sagebrush habitat. Although sage-grouse are sagebrush obligate species, they require a variety of habitats within the landscape throughout the year, including various conditions and communities of sagebrush, meadow, and riparian habitats. The Caliente rail alignment would cross the extreme southern portion of the range of the greater sage-grouse. Big sagebrush and other sagebrush species provide nesting, brood, fall/winter cover, and forage throughout the year for the greater sage-grouse. Suitable winter habitat for the greater sage-grouse consists of big sagebrush stands comprised of 10 to 30 percent horizontal sagebrush cover and a diversity of sagebrush heights that are generally tall enough to emerge through any accumulated snow, and ridges or canyons where sagebrush is exposed. Nesting habitat is characterized by big sagebrush communities that have 15 to 38 percent canopy cover and 10 to 15 percent grass. Nesting habitat is usually close to leks (communal courtship and breeding sites in open areas surrounded by sagebrush cover). Nesting and early brood rearing in Nevada usually occurs during April through June in habitat with nearby sagebrush cover and an abundance of grass and forbs to provide nutrition for chicks. After about 6 weeks, hens move chicks to summer habitat for the remaining brood rearing. Summer habitat for this species is characterized by mixed sagebrush with wet meadows and riparian habitat (DIRS 173575-NDOW 2004, Appendix E, p. 2-3). The 2004 Conservation Assessment for *The Greater Sage-Grouse Management Plan for Nevada and Eastern California* shows the largest populations of sage-grouse to inhabit most of Elko county and portions of Washoe, White Pine, Humboldt, Lincoln, and Nye counties (of these, the proposed Caliente rail alignment would pass through Lincoln and Nye Counties). Documented lek sites in Nye County are concentrated in the north-central portion of the county, outside the study area. However, there is suitable winter, year-round, and nesting habitat along Caliente common segment 3 outside of the construction right-of-way. There is suitable winter habitat within the construction right-of-way of all Garden Valley alternative segments and within the northern portion of Caliente common segment 1 and a portion of the Caliente common segment 3 construction right-of-way (Figure 3-100). There are documented lek sites within the construction right-of-way of Garden Valley alternative segment 3 (DIRS 173575 NDOW 2004, p. 12). No greater sage-grouse or sage-grouse leks were observed in the construction right-of-way during the field surveys of the Caliente rail alignment in the spring of 2005. Appendix H provides additional information on the greater sage-grouse surveys.

Bald eagles almost exclusively occupy habitat associated with large bodies of water during the breeding season, but occasionally use upland areas for food and roost sites. They usually nest in tall trees and feed opportunistically on fish, waterfowl and seabirds, various mammals, and carrion. In the winter, bald eagles preferentially roost in large, shelter-providing trees (DIRS 180967-NatureServe Explorer [n.d.], all). There is no nesting habitat for the bald eagle within the Caliente rail alignment study area. The marsh habitat in Indian Cove and Meadow Valley Wash provides potential foraging habitat for migrating eagles. However, the waterbodies are small and not used by enough fish and waterfowl to support wintering eagles. Any use of the study area by bald eagles would be transitory.

Ferruginous hawks have been reported to occupy and, in some cases, nest in areas adjacent to the Caliente rail alignment (DIRS 174519-Bennett 2005). The ferruginous hawk is a relatively rare breeding species in the study area. This species prefers to nest in trees; however, in Nevada tall trees are scarce, so the species is often found in pinyon-juniper associations or occasionally on shrubs or rocks on the ground. No ferruginous hawks or nests were observed during the 2005 field surveys, although they have been previously reported in the area.

Peregrine falcons are found in a wide variety of habitats during the breeding season, from tundra, moorlands, steppe, and seacoasts to mountains, open-forested regions, and human population centers. They typically nest on rocky cliffs.

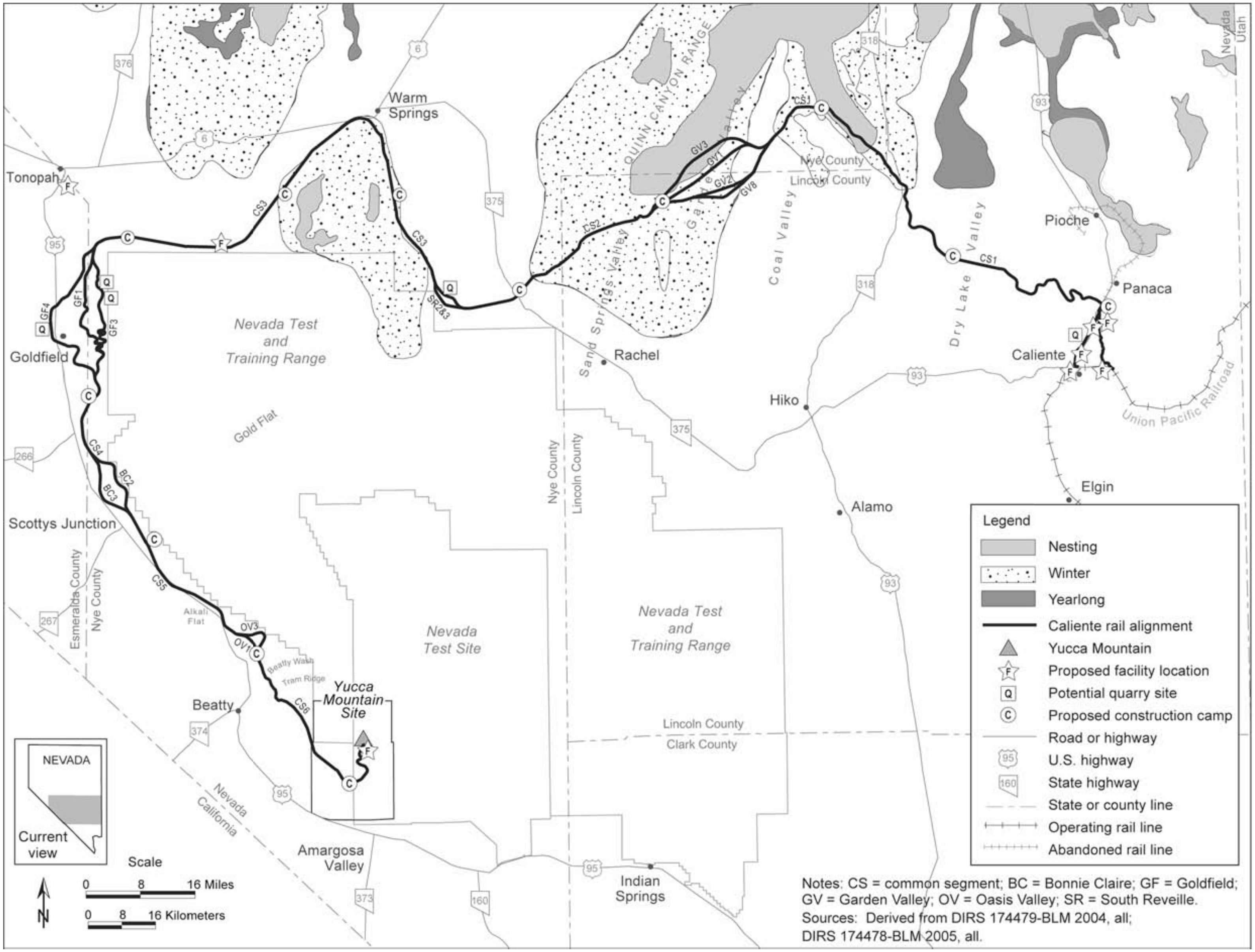


Figure 3-100. Potential greater sage-grouse habitat along the Caliente rail alignment.

Outside the breeding season, the falcons occur in areas where prey (primarily birds) concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports (DIRS 180966-NatureServe Explorer 2007, all). There is potential nesting habitat for peregrine falcons on cliffs within the Clover Creek area and near the City of Caliente.

Loggerhead shrikes have been documented along the Caliente rail alignment where suitable habitat is present. Habitat used by this species during the breeding season includes open country with scattered trees and shrubs, savanna, desert scrub (southwestern United States) and, occasionally, open woodlands (DIRS 180963-NatureServe Explorer 2007, all). They typically nest in thick brush, shrubs, or small trees in open areas. Potentially suitable habitat for loggerhead shrikes occurs along all segments of the Caliente alignment.

Sage thrashers are known to occur in sagebrush habitat within the Caliente rail alignment construction right-of-way. During Field surveys in May 2005, an individual was sighted near Pahroc Pass within the common segment 1 study area in the Highland Range. Habitat for this bird species is associated with large stands of sagebrush habitat, which can be found in areas where the rail alignment would cross mountain ranges, including the Highland, Reveille, and Kawich Ranges. There is potential sagebrush habitat near Bennett Pass, Pahroc Pass, the western and southern portions of Garden Valley, western Sand Spring Valley, southeastern Railroad Valley, and at Warm Springs Summit.

Brewer’s sparrows are strongly associated with sagebrush over most of their range, in areas with scattered shrubs and short grass (DIRS 180959-NatureServe Explorer 2007, all). Sagebrush habitat can be found in areas where the rail alignment would cross mountain ranges, including the Highland, Reveille, and Kawich Ranges. There is potential sagebrush habitat near Bennett Pass, Pahroc Pass, the western and southern portions of Garden Valley, western Sand Spring Valley, southeastern Railroad Valley, and at Warm Springs Summit. Brewer’s sparrows are likely to occur in sagebrush habitat within the Caliente rail alignment construction right-of-way.

Mammals The State of Nevada classifies desert bighorn sheep as a game species. As further discussed in Section 3.2.7.3.5, the State of Nevada manages the desert bighorn sheep as a game species throughout the state.

The pygmy rabbit (*Brachylagus idahoensis*), a small sagebrush-dependent rabbit, has been documented 7.5 kilometers (4.6 miles) northwest of Garden Valley alternative segment 3 (DIRS 174519-Bennett 2005, Plate 3). This species is well-distributed throughout the Great Basin; however, overall the populations tend to be locally clustered in areas of high-density sagebrush, which they use for both cover and food. DOE field surveys did not indicate the presence of pygmy rabbit habitat within the Caliente rail alignment construction right-of-way.

The dark kangaroo mouse and the closely related pale kangaroo mouse are known to occur in appropriate habitat from the Dry Lake Valley to Goldfield (DIRS 174519-Bennett 2005). Habitat for these two mouse species is characterized by alkali (salt) sinks and desert scrub dominated by shadscale or big sagebrush. These rodents usually prefer soft sand accumulated at bases of shrubs for burrow sites (DIRS 176370-O’Farrell and Blaustein 1974, p. 1-2; DIRS 176372-O’Farrell and Blaustein 1974, p. 1).

There are 23 species of bats in Nevada. In general, bats are highly mobile; all of the 23 species could at some time of the year fly over or, if appropriate habitat exists, roost and forage near the Caliente rail alignment. Twenty-one of the 23 species of bats in Nevada are BLM-designated sensitive (DIRS 172900-BLM 2003, p. 2) and nine are State of Nevada protected.

Of these bat species, seven have a strong probability of utilizing habitat along the rail alignment (DIRS 181865 Bradley et al. 2006), as follows:

- Pallid bat
- Townsend's big-eared bat
- Big brown bat
- California myotis bat
- Small-footed myotis bat
- Western pipistrelle bat
- Brazilian free-tailed bat

All of these bat species are commonly found throughout the Mojave and southern Great Basin Deserts. These species are known to roost in cliff faces, caves, rocky outcrops, and man-made structures where available. Bats are also known to forage over natural or artificial water sources.

3.2.7.3.4 Migratory Birds

More than 300 species of birds are commonly observed in southern Nevada, including year-round residents, seasonal migrants that breed in southern Nevada, winter residents that breed in the north, and seasonal migrants that pass through southern Nevada while traveling in spring and fall between breeding ranges to the north and winter ranges to the south. All of the migratory birds found along the Caliente rail alignment are protected under the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq*.) and Executive Order 13186.

3.2.7.3.5 State of Nevada Game Species

The Caliente rail alignment would cross several areas designated as game habitat (DIRS 173224-BLM 1997, Maps 9-13; DIRS 174518-BLM 2005, Maps 3.6-1 through 3.6-4). As shown in Table 3-53, three game species that occur, or have the potential to occur, within or near the construction right-of-way are cross-listed as BLM-designated sensitive, are state protected, or both. The game species that are also BLM-designated sensitive include greater sage-grouse, pygmy rabbit, and desert bighorn sheep. Section 3.2.7.3.3.2 provides information on the greater sage-grouse and pygmy rabbit. The Nevada Department of Wildlife actively manages the desert bighorn sheep as a big game animal. Its distribution is shown on Figure 3-98. Other game species that could be affected by the proposed railroad construction and operation include mule deer, pronghorn antelope, elk, and mountain lion. Figures 3-101 to 3-104 indicate the general habitat locations for desert bighorn sheep, mule deer, pronghorn antelope, and elk. Mountain lions occur throughout the State of Nevada in canyon, mountain, and forested areas; therefore, no distribution map is included for this species. Sections 3.2.7.3.5.1 through 3.2.7.3.5.5 summarize game species information.

3.2.7.3.5.1 Desert Bighorn Sheep. Desert bighorn sheep are found predominantly in lower foothills and grasslands of mountain ranges, often where terrain is rough, rocky and steep, and broken up by canyons and washes. Desert bighorn sheep require access to freestanding water, especially during the summer, and distribution of water holes significantly influences patterns of home-range movement (DIRS 176363-Shackleton 1985, p. 4). Any natural or artificial water sources within this species' range could be subject to desert bighorn sheep use. Caliente common segment 1 would cross year-round desert bighorn sheep habitat near the Pahroc Range, and common segment 6 would cross a ***movement corridor***, or an area of high use at certain times of the year, in the Beatty Wash area (Figure 3-101). The Caliente rail alignment would not cross any crucial habitat for this species.

3.2.7.3.5.2 Mule Deer. Mule deer are fairly common in southern Nevada and throughout the western United States, and are found in a variety of habitats from coniferous forests at high elevations to desert shrub, chaparral, and grasslands at lower elevations (DIRS 176454-Whitaker 1992, p. 652). Mule deer are often associated with early transitional vegetation, especially near agricultural lands. Mule deer are found throughout the area the Caliente rail alignment would cross, but would most likely be encountered in the segments from Warm Springs Summit (Kawich Range) eastward. The eastern portion of Caliente common segment 1 would pass through year-round mule deer habitat. The western portion of Caliente common segment 1, Garden Valley alternative segments, much of Caliente common segment 2, and Caliente common segment 3 at the Warm Springs summit would cross mule deer winter habitat. Figure 3-102 details habitat for mule deer. The rail alignment would not cross any mule deer crucial habitat.

3.2.7.3.5.3 Pronghorn Antelope. Most of the Caliente rail alignment would cross year-round pronghorn antelope habitat from Dry Lake Valley west to Goldfield (Figure 3-103). Pronghorn antelope are generally found at lower elevations in open desert grasslands, salt desert scrub, or bunchgrass-sagebrush vegetation in the valleys and foothills throughout the western United States. This species also occurs in dense sagebrush communities at higher elevations during the breeding season (DIRS 176454-Whitaker 1992, pp. 662 and 663). NDOW has not identified any areas along the Caliente rail alignment as pronghorn antelope augmentation areas.

3.2.7.3.5.4 Elk. Elk are known to have summer, winter, and year-round ranges along portions of the Caliente rail alignment from Garden Valley and the Quinn Canyon Mountain Range eastward. Elk habitat is usually composed of moderate- to low-density conifer woodlands and open mountain grasslands (Figure 3-104). This species is migratory, moving to lower elevations with dense wooded slopes during the winter (DIRS 176454-Whitaker 1992, pp. 647 to 650).

3.2.7.3.5.5 Mountain Lion. Mountain lions occur throughout the State of Nevada in low numbers in canyon, mountainous, and forested areas (DIRS 103439-Hall 1995, pp. 269 to 271). They are known to occur within the study area and might move along the Caliente rail alignment construction right-of-way. This species is shy, solitary, secretive, and active mostly at night (DIRS 103439-Hall 1995, pp. 269 to 271).

3.2.7.3.6 Wild Horses and Burros

Wild horses are generally presumed to descend from horses that were released by, or escaped from, settlers of western North America, possibly dating as far back as Spanish settlers in the 1600s. The size, color, and confirmation of the horses depend on the type of stock or breed from which the wild horses descended (DIRS 174518-BLM 2005, p. 3.8-1).

Generally, burros live in the lower elevations year-round, while wild horses reside in the higher elevations in summer and migrate to the lower elevations in winter. Both wild horses and burros will travel as far as 16 kilometers (10 miles) away from permanent water sources. Their diets vary–burros prefer shrubs, horses tend to prefer grasses (DIRS 103079-BLM 1998, p. 3-48).

Wild horse herd areas were originally identified by federal agencies in 1971, with passage of Public Law 92-195, the Wild Free-Roaming Horses and Burros Act. The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros the BLM has determined the herd management area can support, and it is established to avoid the ecological degradation of the herd management area and any riparian areas within each herd management area (DIRS 176364-State of Nevada [n.d.], all).

The Caliente rail alignment would cross approximately 13 designated wild horse and burro herd management areas (Figure 3-105). Appendix H provides detailed information on the individual herd management areas. Table 3-54 identifies each Caliente rail alignment alternative segment and common segment that would cross or lie within herd management areas and describes the location, size, and management level of each herd management area.

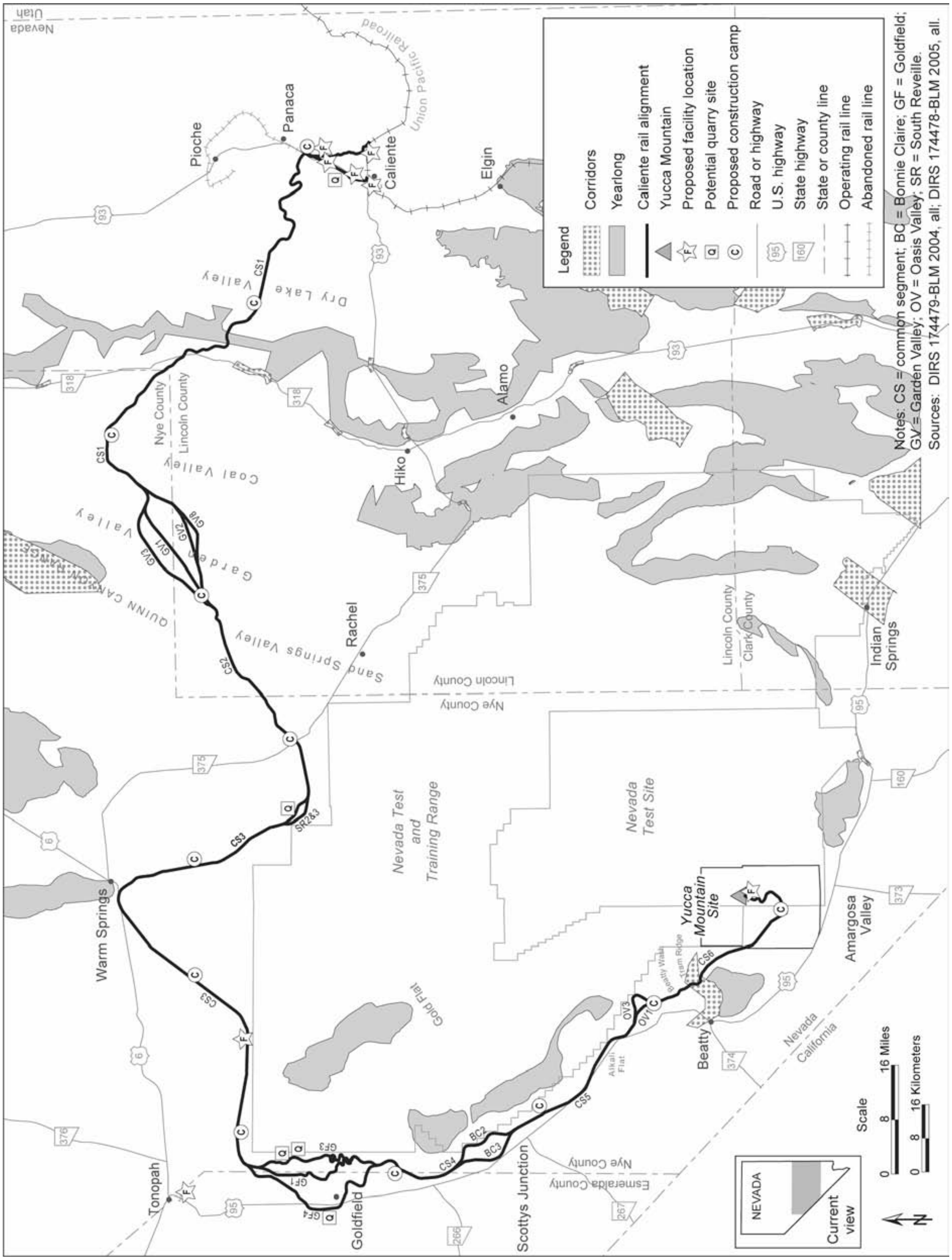


Figure 3-101. Desert bighorn sheep habitat along the Caliente rail alignment.

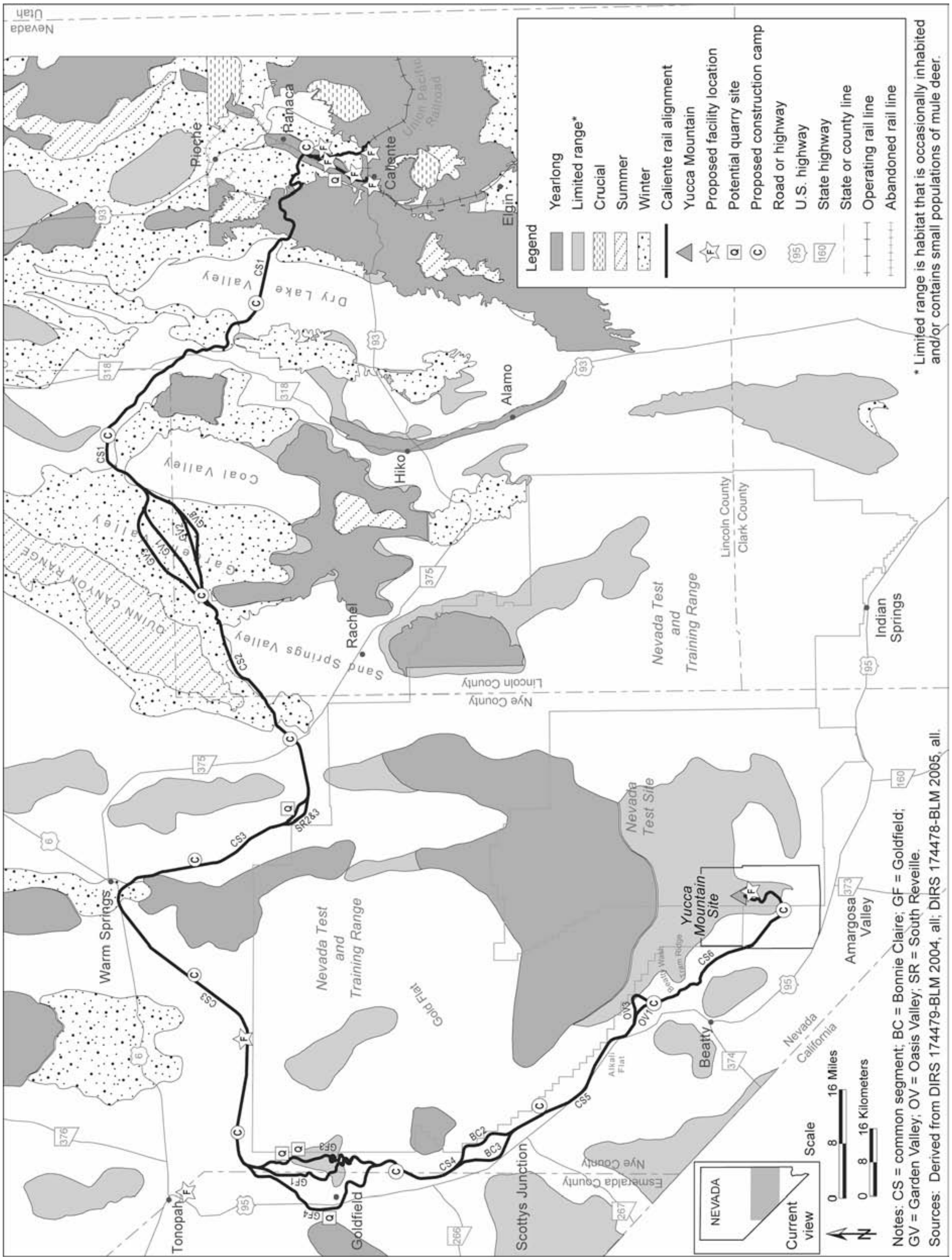


Figure 3-102. Mule deer habitat along the Caliente rail alignment.

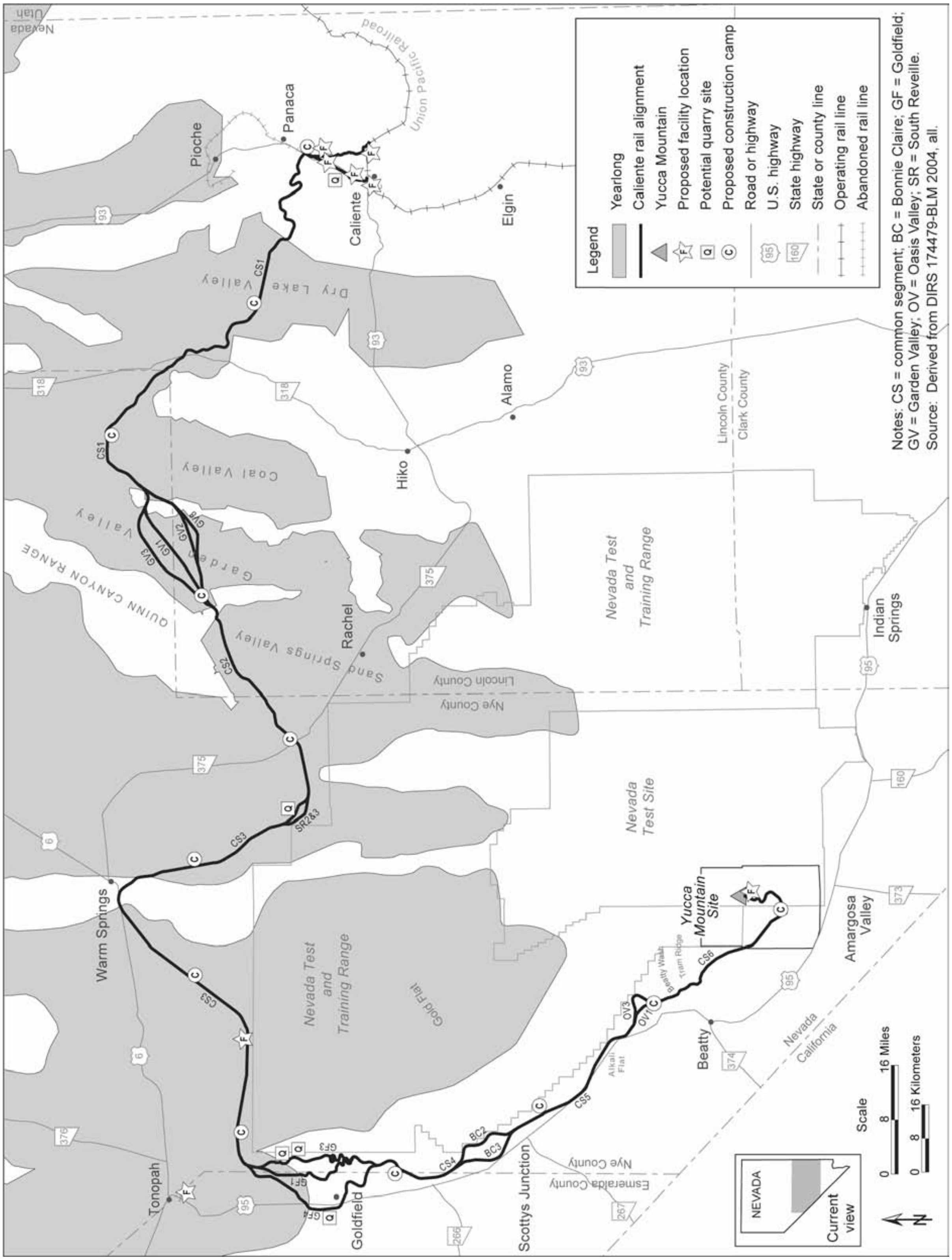


Figure 3.-103. Pronghorn antelope habitat along the Caliente rail alignment.

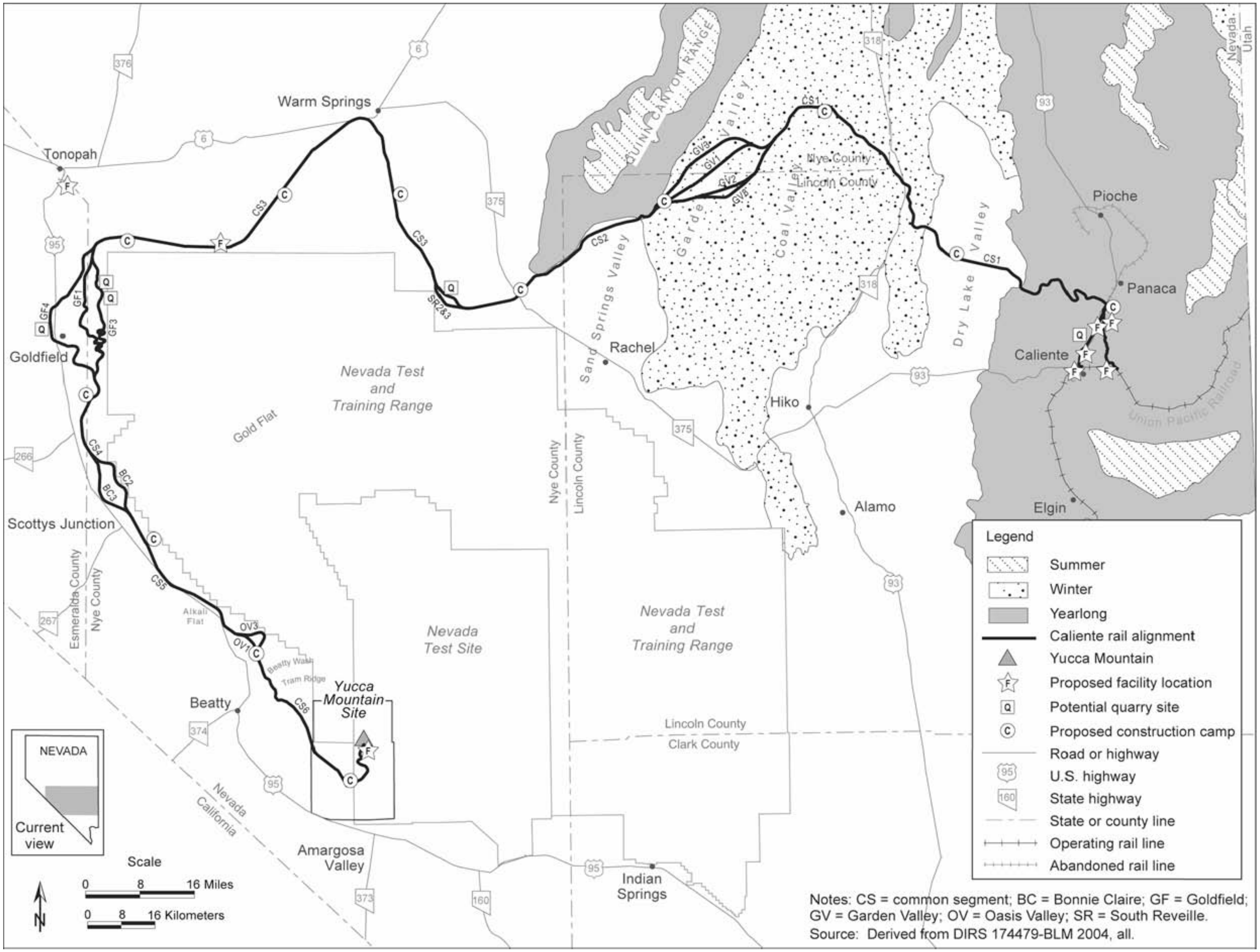


Figure 3-104. Elk habitat along the Caliente rail alignment.

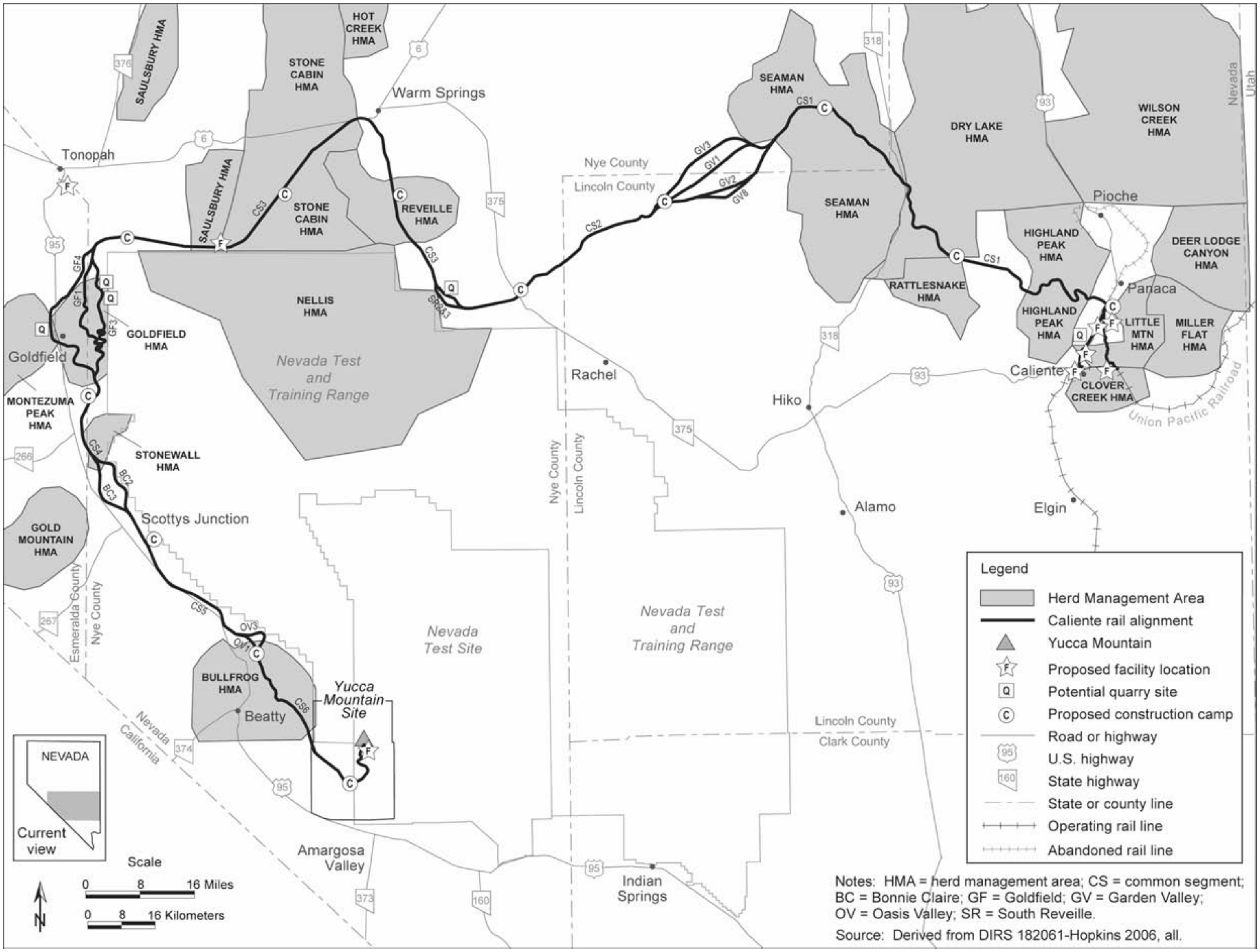


Figure 3-105. Herd management areas along the Caliente rail alignment.

Table 3-54. Herd management areas the Caliente rail alignment would cross.[a]

Herd management area	Location[b]	Area (square kilometers)[c]	Appropriate management level	Alternative segment or common segment that would cross area
Miller Flat	Lincoln County, northeast of Caliente	360	9 to 15 horses	Caliente and Eccles alternative segments
Little Mountain	Lincoln County, northeast of Caliente	210	9 to 15 horses	Caliente and Eccles alternative segments
Highland Peak	West of Panaca	550	20 to 33 horses	Caliente common segment 1
Rattlesnake	27 kilometers west of Caliente	290	1 horse	Caliente common segment 1
Dry Lake	West of Pioche	2,000	94 horses	Caliente common segment 1
Seaman	56 kilometers south of Lund	1,500	159 horses	Caliente common segment 1; Garden Valley alternative segments 1, 2, and 3
Reveille	80 kilometers east of Tonopah and 19 kilometers south of Warm Springs	510	138 horses	Caliente common segment 3
Stone Cabin	45 kilometers east of Tonopah	1,600	364 horses	Caliente common segment 3
Saulsbury	26 kilometers east of Tonopah	570	40 horses	Caliente common segment 3
Goldfield	East of Goldfield	260	125 horses 50 burros	Goldfield alternative segments 1, 2, and 3
Montezuma Peak	West of Goldfield	310	146 horses 10 burros	Goldfield alternative segment 4
Stonewall	West of Lida Junction and south of Goldfield	100	50 horses 25 burros	Caliente common segment 4; Bonnie Claire alternative segments 2 and 3
Bullfrog	Surrounds Beatty	520	12 horses 185 burros	Oasis Valley alternative segments 1 and 3; common segment 6

a. Sources: DIRS 174047-Bennett 2005; DIRS 174046-Bennett 2005; DIRS 174479-BLM 2003; DIRS 174478-BLM 2005; DIRS 174329-BLM [n.d.]; DIRS 174333-BLM [n.d.]; DIRS 174332-BLM [n.d.]; DIRS 174330-BLM [n.d.]; DIRS 173064-BLM 2007; DIRS 173063-BLM [n.d.]; DIRS 173062-BLM [n.d.]; DIRS 173061-BLM [n.d.]; DIRS 173060-BLM [n.d.]; DIRS 173059-BLM [n.d.]; DIRS 173057-BLM 2005; DIRS 174518-BLM 2005.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert square kilometers to acres, multiply by 247.10.

3.2.8 NOISE AND VIBRATION

This section describes existing noise and vibration in the Caliente rail alignment region of influence. Section 3.2.8.1 describes the region of influence; Section 3.2.8.2 describes general regional characteristics for noise and vibration; and Section 3.2.8.3 describes the existing environment for noise and vibration in more detail for Caliente rail alignment alternative segments and common segments.

Noise is considered a source of pollution because it can be a human health hazard. Noise effects on people range from hearing impairment at very high noise levels to annoyance at moderate to high noise levels. Sound waves are characterized by frequency and measured in ***hertz***; sound pressure is expressed as ***decibels*** (dB). Appendix I, Noise and Vibration Assessment Methodology, provides more information on the fundamentals of analyzing noise.

With the exception of prohibiting nuisance noise, neither the State of Nevada nor local governments have established numerical noise standards. Nevertheless, many federal agencies use the ***day-night average noise level*** (DNL) as a guideline for land-use compatibility and to assess the impacts of noise on humans.

Day-night average noise level (DNL): The energy average of A-weighted decibels (dBA) sound level over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the day.

A-weighted decibels (dBA): A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

For the operation of trains during proposed railroad construction and operations, DOE analyzed noise impacts under established STB criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by DNL of 3 ***A-weighted decibels*** (dBA) or more.
- An increase to a noise level of 65 DNL or greater.

If the estimated noise level increase at a location exceeds either of these criteria, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, recent noise evaluations indicate that both criteria components must be met to cause an adverse impact from noise (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more to cause an adverse impact.

There are three potential ground-borne vibration (vibration propagating through the ground) impacts of general concern: annoyance to humans, damage to buildings, and interference with vibration-sensitive activities. To evaluate potential impacts of vibration from construction and operations activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded human annoyance criterion for infrequent events 80 VdB (vibration velocity in decibels) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inches per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be an impact from vibration (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

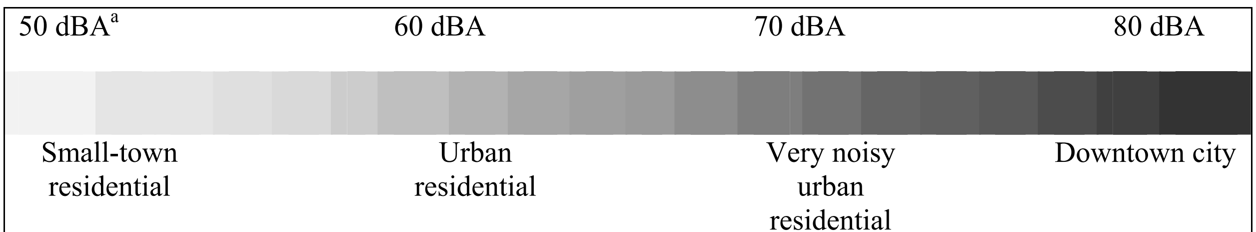
3.2.8.1 Region of Influence for Noise and Vibration

> **Ambient noise:** The sum of all noise (manmade and natural) at a specific location over a specific time is called ambient noise.

The region of influence for noise and vibration for construction and operation of a railroad along the Caliente rail alignment includes the construction right-of-way and extends out to variable distances, depending on several analytical factors (ambient noise level, train speed, number of trains per day, and number of railcars). Similarly, the region of influence for the railroad construction and operations support facilities depends on the magnitude of noise that would be generated and ambient noise levels, which would affect how far away the noise might be heard. In areas with low ambient noise conditions along the proposed rail alignment, project-related noise might be heard farther away. Therefore, the region of influence varies along the rail alignment. In addition, DOE has reviewed recent aerial photographs along the entire rail alignment to identify the locations of receptors in the region of influence that might be affected by noise, vibration, or both.

3.2.8.2 General Regional Characteristics for Noise and Vibration

The Caliente rail alignment is primarily in a quiet desert environment where natural phenomena such as wind, rain, and wildlife account for most of the ambient noise. Manmade noise in some areas of the region of influence is caused by vehicles traveling along public highways and an occasional low-flying military jet. At present, there is no train activity in the region of influence except in the City of Caliente. Historically, there was train activity in Goldfield, Nevada. Baseline sound conditions vary somewhat along the rail alignment and are site-specific. Most of the region of influence for the Caliente rail alignment is typical of other desert environments in which the DNL values range from 22 decibels on a calm day to 38 decibels on a windy day (DIRS 102224-Brattstrom and Bondello 1983, p. 170). Areas within the region of influence are sparsely populated and, in general, ambient noise levels are low. The noise level at a specific location depends on nearby and distant sources of noise. Noise levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation noise (Figure 3-106).



a. dBA = A-weighted decibels.
b. Source: DIRS 101821-EPA 1974, p. 23.

Figure 3-106. Typical DNLs for residential areas.[b]

Ground-borne vibration occurs as a result of both natural phenomena (such as seismic activity) and manmade activities (such as construction and transportation activities). Human activities that can create perceptible levels of ground-borne vibration are important when sensitive sites, structures, or activities could be affected. Background vibration exists as a component of the overall effects of ground-borne vibration, higher in areas with more human activity, lower in areas more distant from human activities. Vibration levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation vibration. Background levels of ground-borne vibration along the Caliente rail alignment are low.

3.2.8.3 Existing Environments for Noise and Vibration at Three Measurement Locations along the Caliente Rail Alignment

DOE evaluated existing noise and vibration conditions along the Caliente rail alignment and compiled the detected ranges of noise and vibration levels at different locations under different conditions. Most of the region of influence for the rail alignment is sparsely populated and, in general, ambient noise levels are low and there are no detectable vibrations. DOE measured ambient noise and vibration levels at three locations along the proposed rail alignment: in Caliente, in Garden Valley near *City* (a large complex of abstract sculptural and architectural forms made from earth, rock, and concrete), and in Goldfield. DOE selected these locations for ambient noise and vibration measurements because they are representative of the few populated areas or Special Recreational Management Areas within the region of influence. The ambient noise measurements at these representative locations along the rail alignment ranged from 47 to 62 DNL and ambient vibration levels ranged from 25 to 44 VdB. Table 3-55 summarizes the measured ambient noise levels in Caliente, Garden Valley, and Goldfield. Table 3-56 summarizes the measured ambient vibration levels in Caliente, Garden Valley, and Goldfield.

Table 3-55. Ambient noise measurements along the Caliente rail alignment.

Location	DNL dBA[a]
Caliente	53[b]
Garden Valley	62[c]
Goldfield	47[d]

a. DNL dBA = day-night average noise level in A-weighted decibels.
b. DNL measurements were taken on January 11, 2005 (with a result of 54 DNL), and February 9, 2005 (with a result of 53 DNL). To be conservative, DOE selected the lowest value because the relative difference between project noise levels and ambient noise levels could influence the potential impact.
c. DNL measurements were taken in Garden Valley on February 9, 2005.
d. DNL measurements were taken in Goldfield on January 12, 2005.

Table 3-56. Ambient vibration measurements along the Caliente rail alignment.

Location	VdB[a]
Caliente	44[b]
Garden Valley	29[c]
Goldfield	25[d]

a. VdB = vibration velocity in decibels with respect to 1 micro-inch per second.
b. Vibration measurements were taken in Caliente on January 11, 2005.
c. Vibration measurements were taken in Garden Valley on February 9, 2005.
d. Vibration measurements were taken in Goldfield on January 12, 2005.

3.2.8.3.1 Caliente

DOE took noise measurements for 24-hour periods in Caliente, Nevada, on January 11, 2005, and on February 9, 2005. The measurements were repeated on February 9 because there was a major flood in the area during the January 11 measurements, which could have affected measurement results. Train activity was halted during that period, and there was substantial helicopter activity associated with flood-relief efforts. However, the DNL did not vary much between the two sets of measurements. On January 11 the noise level was 54 DNL; on February 9 it was 53 DNL (see Table 3-55). Measured DNL noise levels at Caliente are consistent with the "small-town residential" category shown on Figure 3-106.

Hourly ***equivalent sound levels*** ranged from 32 to 62 dBA. Noise sources consisted of vehicular traffic on U.S. Highway 93, train horns, noise from nearby residential areas, and aircraft overflights. Figure 3-107 shows measured noise levels taken at the Agua Caliente Trailer Park over a 24-hour period. Figure 3-108 shows the location where DOE took the ambient noise measurements in Caliente.

Equivalent sound level (Leq): A single value of sound level for any desired duration (such as 1 hour), which includes all of the time-varying sound energy in the measurement period. Leq correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant.

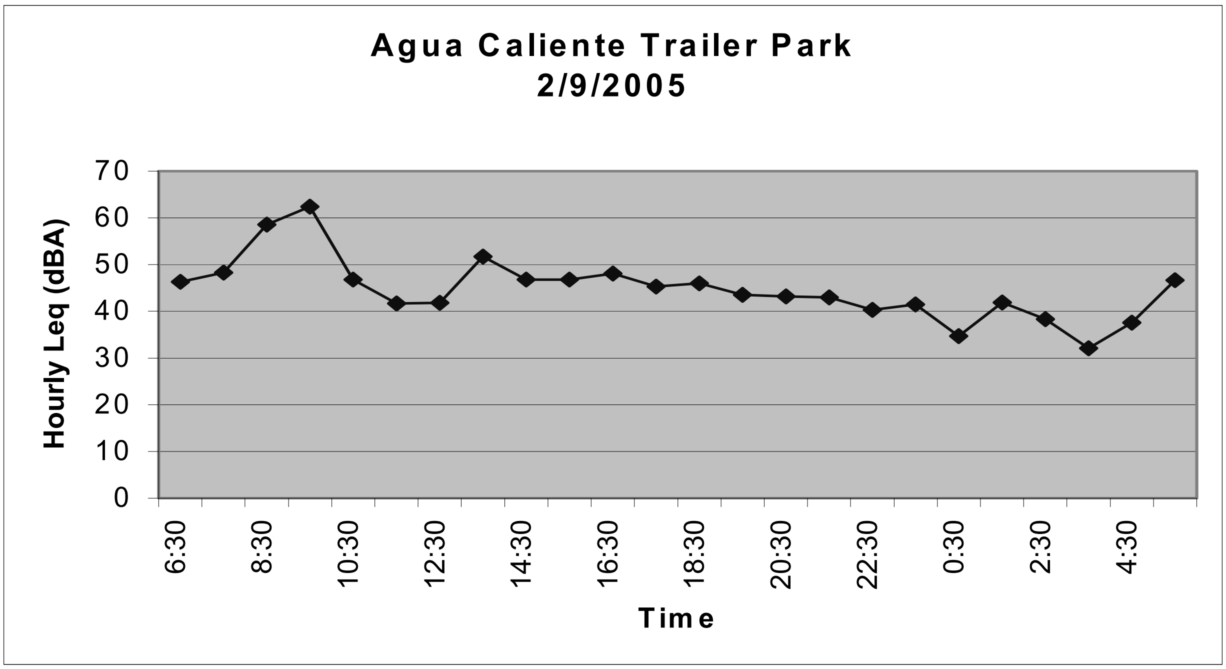


Figure 3-107. Measured noise levels over a 24-hour period in Caliente, Nevada.

Figure 3-109 shows modeled noise levels (65 DNL contour) for Union Pacific Railroad train activity in Caliente based on an average of 25 trains per day consisting of 2 locomotives and 60 railcars, and an operating speed of 64 kilometers (40 miles) per hour. The jagged shape and islands within the contour are caused by the shielding effects of buildings close to the grade crossing at South Spring Street.

DOE also took ambient ground-borne vibration measurements at the Agua Caliente Trailer Park on January 11, 2005. The vibration measurement was 44 VdB (see Table 3-56). Measured ambient vibration levels were low because of low population density and the resulting lack of vibration-producing activity. Ambient vibration levels of this magnitude are lower than human perception levels.

3.2.8.3.2 Garden Valley

DOE took noise measurements for 24 hours on February 9, 2005, near *City* in Garden Valley. Hourly equivalent sound level values ranged from 15 to 65 dBA, as shown on Figure 3-110. Figure 3-111 shows where DOE took the ambient noise measurements in Garden Valley. Two sonic booms from nearby U.S. Air Force jet activity or some other very loud-noise source occurred during the measurements,

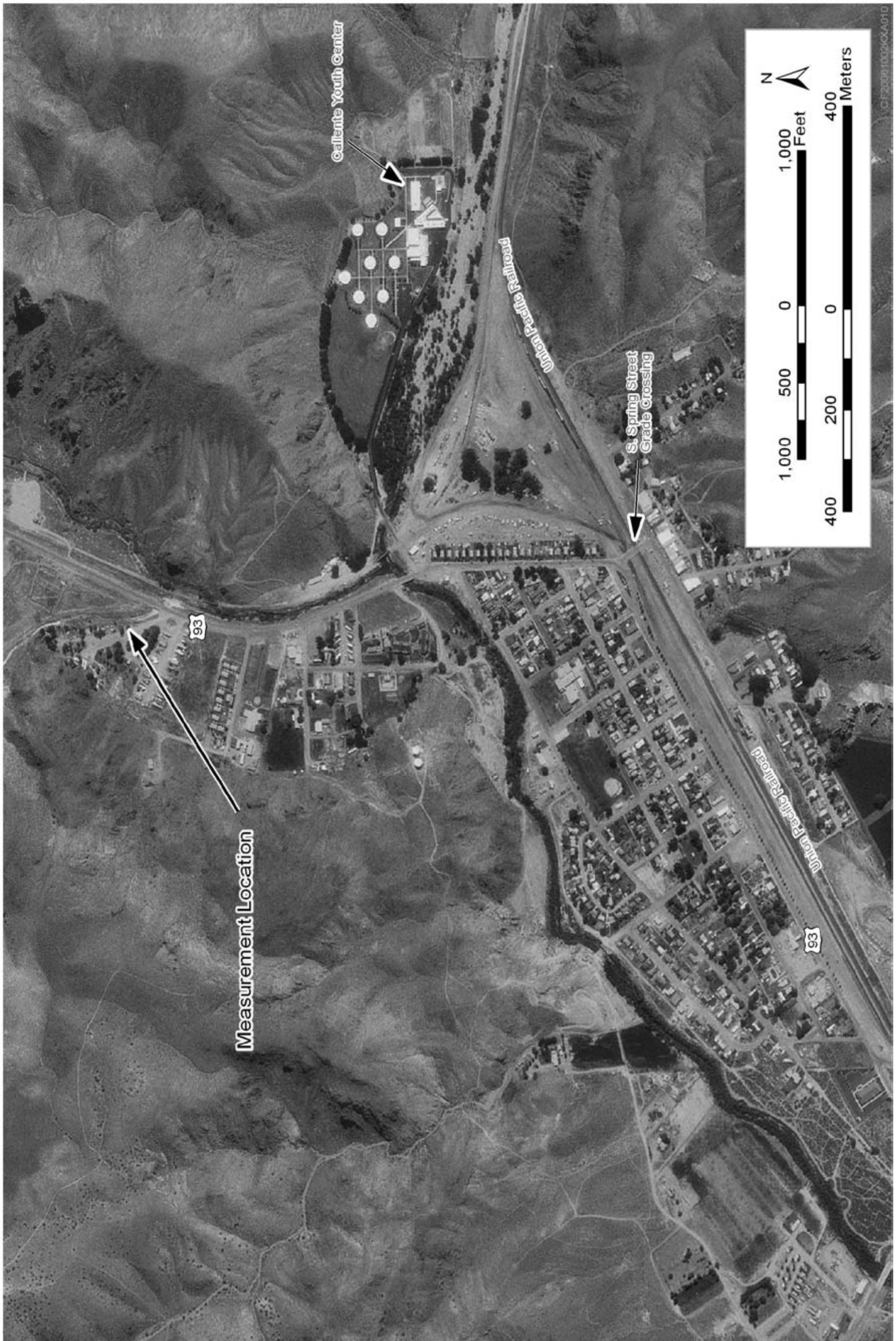


Figure 3-108. Ambient noise monitoring location at Agua Caliente Trailer Park, Caliente, Nevada.
(Source: Base map derived from DIRS 174497-Keck Library 2004, filename 37114E52.sid.)

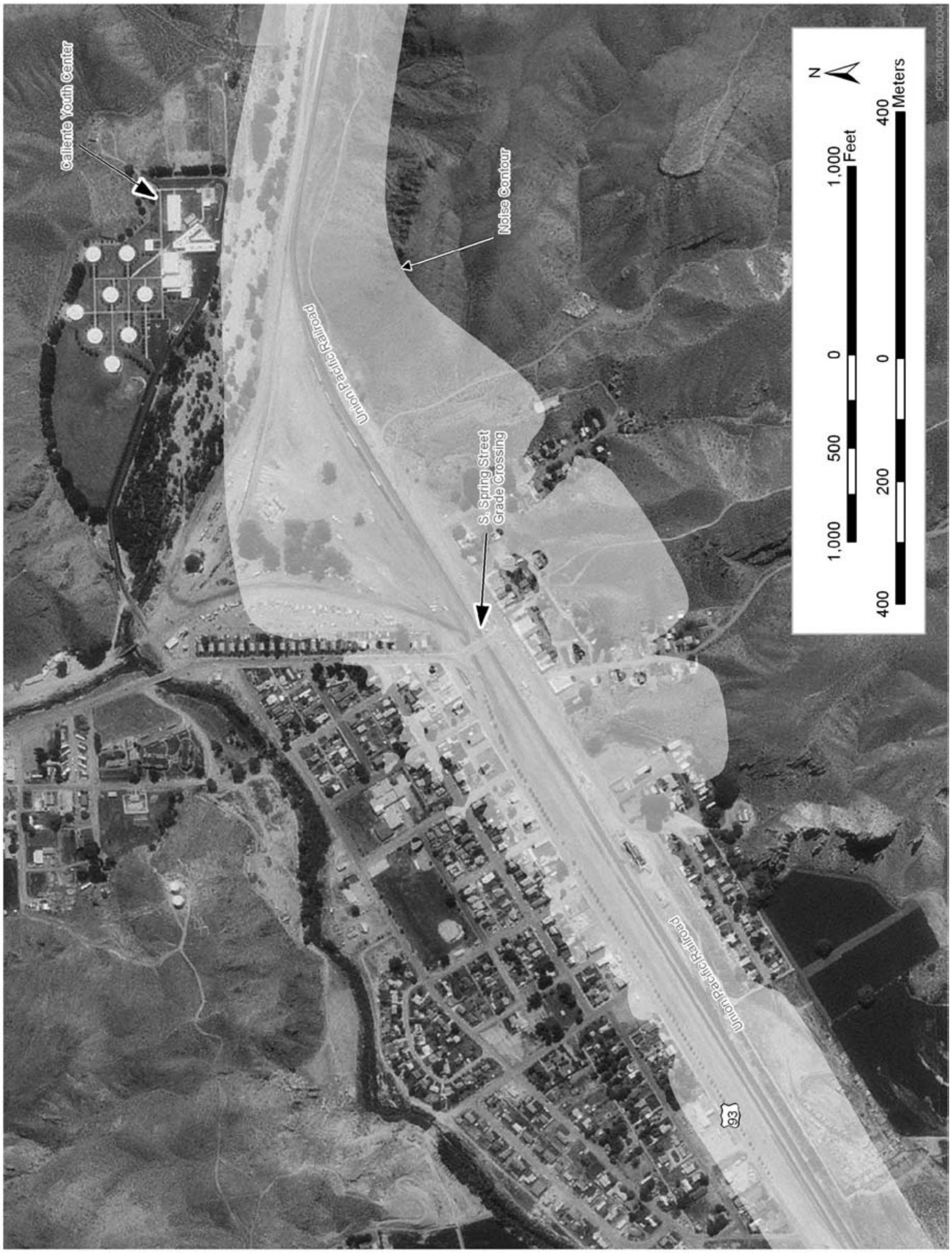


Figure 3-109. Union Pacific Railroad existing train activity in Caliente, Nevada, 65-decibel day-night average noise level contour.
(Source: Basemap derived from DIRS 174497-Keck Library 2004, filename 37114E52.sid.)

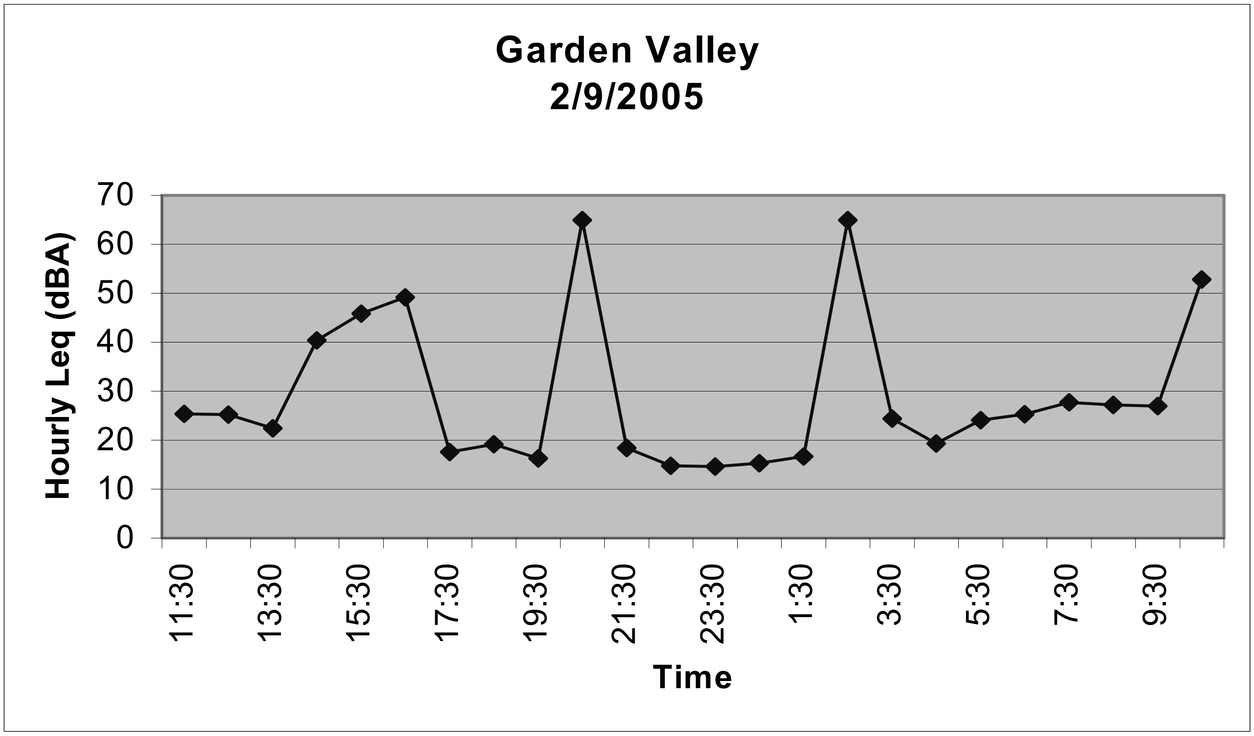


Figure 3-110. Measured noise levels over a 24-hour period in Garden Valley.

which resulted in two hourly equivalent noise level values of 65 dBA. Including these two loud noise events in the ambient noise results gives a noise level of 62 DNL (see Table 3-55). Excluding these two events, the noise level would have been 41 DNL. Measured noise levels at Garden Valley, excluding the two loud noise events, are consistent with the "small-town residential" category shown on Figure 3-106. Measured noise levels at Garden Valley, including the two loud noise events, are consistent with the "urban residential" category shown on Figure 3-106.

Noise levels varied dramatically at the Garden Valley location, from near the threshold of hearing to much higher levels. Military aircraft activity appears to be the cause of the high noise levels. While at this location, field personnel observed a substantial amount of military jet aircraft activity, some of which resulted in very high noise levels. U.S. Air Force noise data indicate that long-term noise levels associated with subsonic aircraft activity in this area range from 55 to 60 DNL (DIRS 174499-Frampton, Lucas, and Plotkin 1993, all). A separate U.S. Air Force report indicates that this Garden Valley location is within an area authorized for supersonic military training exercises to altitudes as low as 1,500 meters (5,000 feet) (DIRS 176798-Varnell et al. 1994, p. 2-5).

The measured DNL values confirm that ambient noise levels are high in this location. Noise sources consist of military aircraft and commercial aircraft. During the measurements, there were extended periods when there was no audible noise. Some construction equipment was operating at *City* during the measurements, but the noise monitor was sufficiently far away that the equipment had no effect on the measured noise level.

DOE also took ambient ground-borne vibration measurements at *City* on February 9, 2005. The vibration measurement was 29 VdB (see Table 3-56). Measured ambient vibration levels were low because of low population density and the resulting lack of activity that would produce vibration. Ambient vibration levels of this magnitude are lower than human perception levels.

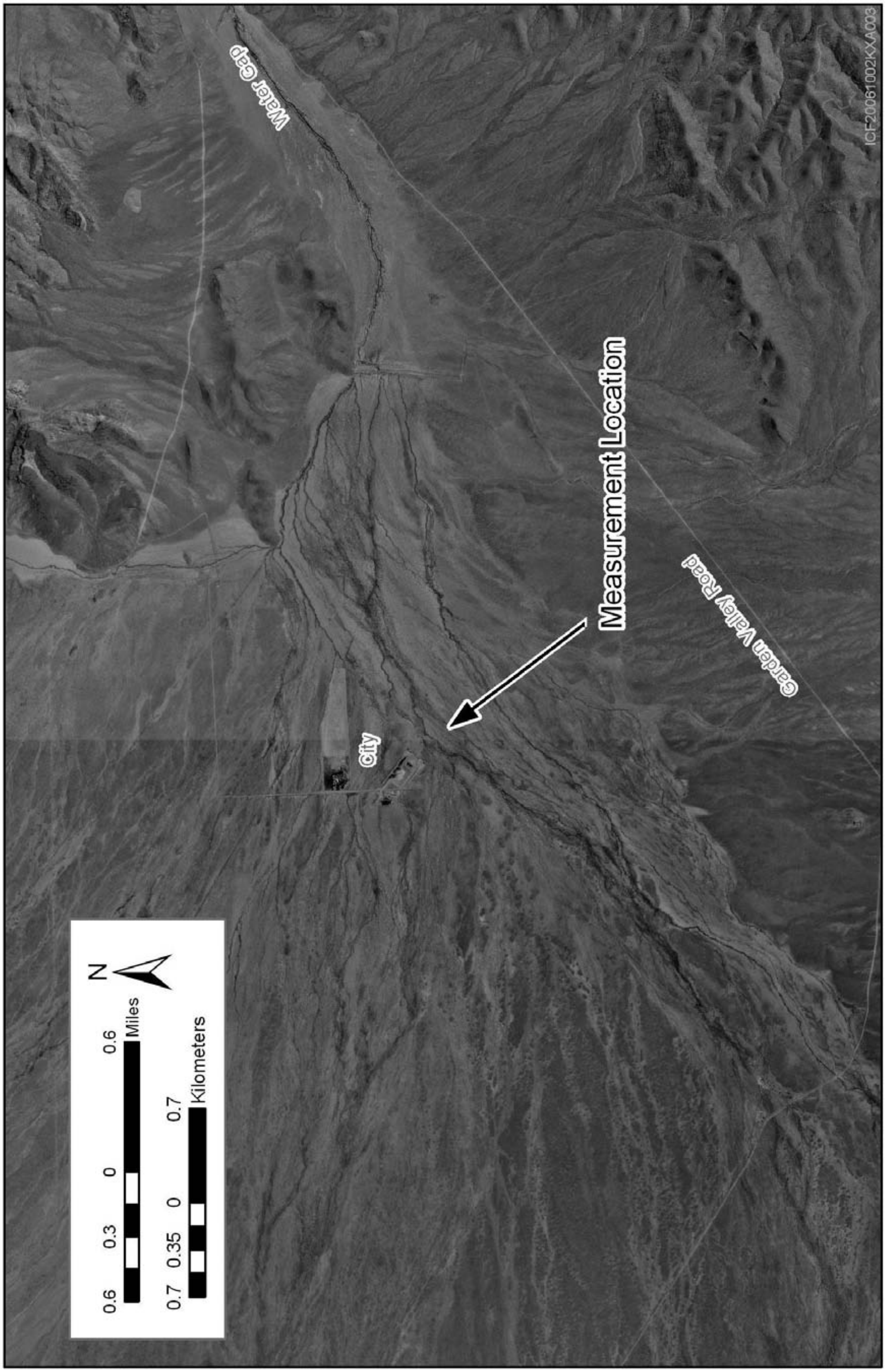


Figure 3-111. Ambient noise monitoring location in Garden Valley, Nevada.
(Source: Basemap derived from DIRS 174497-Keck Library 2004, filenames 381154A43.sid and 38115A44.sid.)

3.2.8.3.3 Goldfield

DOE conducted noise measurements for 24 hours in Goldfield on January 12, 2005. Hourly equivalent sound level values ranged from 30 to 44 dBA, as shown on Figure 3-112. The DNL at this location measured 47 dBA (see Table 3-55).

Noise sources included occasional vehicular traffic on U.S. Highway 95, barking dogs, wind, and occasional front-end-loader noise from the U.S. Department of Transportation maintenance station. Figure 3-113 shows where DOE took ambient noise measurements in the Goldfield area. Measured noise levels at Goldfield are lower than values associated with the "small-town residential" category, which is consistent with the low population density and desert environment (see Figure 3-104).

DOE also took ambient ground-borne vibration measurements at the Goldfield monitoring site on January 12, 2005. The vibration measurement was 25 VdB (see Table 3-56). Measured ambient vibration levels were low because of low population density and the resulting lack of ***ground vibration***-producing activity. Ambient vibration levels of this magnitude are lower than human perception levels.

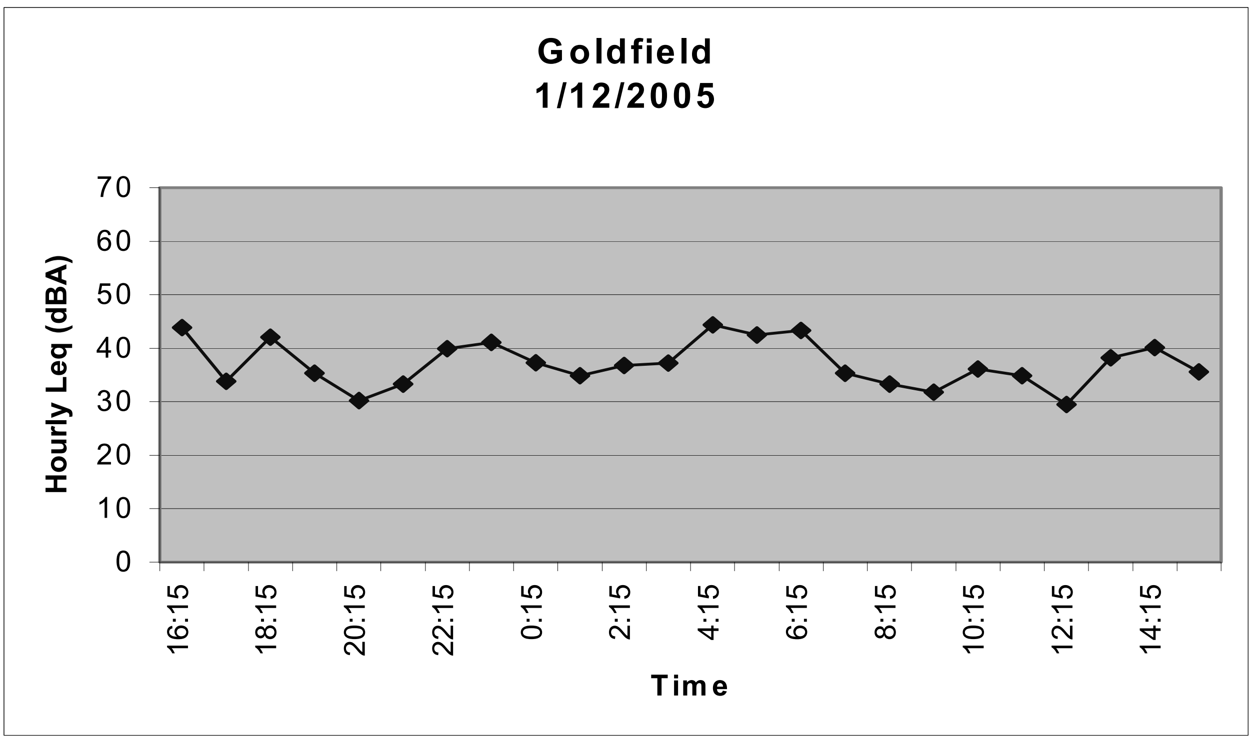


Figure 3-112. Measured noise levels over a 24-hour period in Goldfield, Nevada.

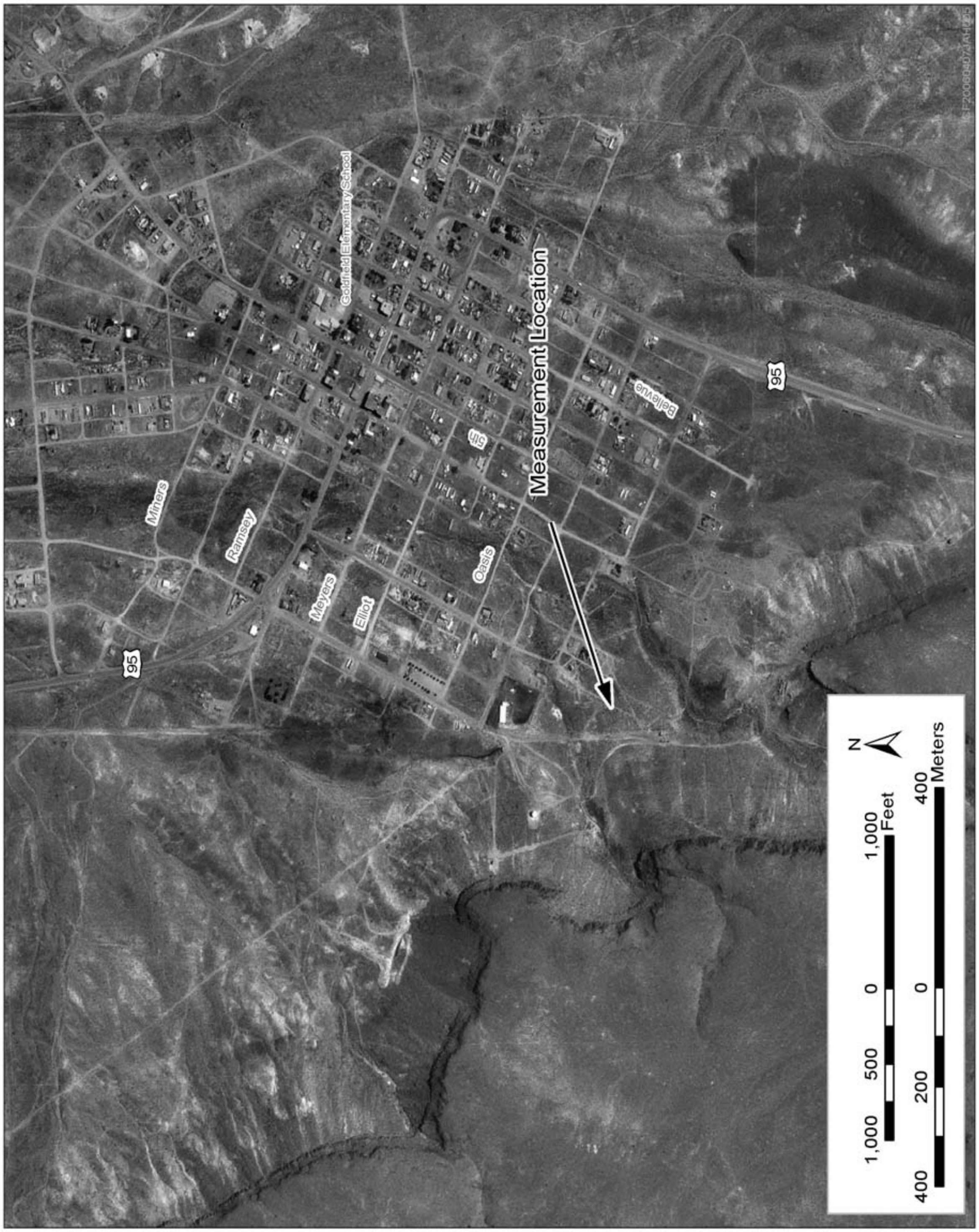


Figure 3-113. Ambient noise monitoring location on the southwestern edge of Goldfield, Nevada.
(Source: Basemap derived from DIRS 174497-Keck Library 2004, filename 37117F21.sid.)

3.2.9 SOCIOECONOMICS

This section describes the existing socioeconomic conditions (employment and income, population and housing, public services, and transportation) along the Caliente rail alignment. Section 3.2.9.1 describes the region of influence for socioeconomics; Section 3.2.9.2 summarizes the method DOE used to establish ***baseline*** socioeconomic conditions in the region of influence; and Section 3.2.9.3 describes general regional socioeconomic characteristics.

3.2.9.1 Region of Influence

The region of influence for the Caliente rail alignment socioeconomics analysis is Lincoln, Nye, Esmeralda, and Clark Counties and the Timbisha Shoshone Trust Lands. While the Timbisha Shoshone Trust Lands are included in the region of influence, they were not included in the socioeconomics analysis because no economic activity or growth is currently taking place or planned on these lands (Figure 3-114).

Construction and operation of a railroad along the Caliente rail alignment could affect social and economic activities and public services in these areas. This section examines baseline socioeconomic conditions for the counties and selected communities in the counties that would likely be affected during construction and operation of the proposed railroad. This analysis presents some socioeconomics detail for Clark County because, even though the rail line would not cross Clark County, construction workers for construction of the rail and associated facilities (except those in Nye County) are assumed to come from Clark County. This is because Clark is the only county with a sufficient workforce. Construction and operations workers for facilities located in Nye County are assumed to reside 80 percent in Clark County and 20 percent in Nye County, reflecting historical patterns. Operations workers for facilities outside Nye County are assumed to reside in the county of the facility. Furthermore, Clark County medical facilities could receive medical cases from the construction camps and construction sites.
The region of influence does not extend beyond these counties in Nevada because there is no indication of a regional or national socioeconomic effect from goods and services purchased outside the region of influence, and demand for goods and services would not be likely to adversely affect regional or national supplies of required goods and services. The Yucca Mountain FEIS examined the possibility that socioeconomic effects from purchasing construction materials could be felt beyond this four-county region and concluded that there would be little or no impact (DIRS 155970-DOE 2002, p. 4-77).

The region of influence for the analysis of transportation resources includes public roadways near the Caliente rail alignment, and the rail alignment itself.

During rail line construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. Most of the rail alignment would be within Nevada Department of Transportation District 1, crossing Lincoln, Nye, and Esmeralda Counties, with a small portion in District 3 near the State Route 318 crossing (along Caliente rail alignment common segment 1). There are no operating railroads along the Caliente rail alignment.

3.2.9.2 Methodology for Determining Existing Socioeconomic Conditions

DOE characterized socioeconomic activities and resources in the region of influence with a particular emphasis on community-level resources, as appropriate.

For this analysis, DOE used the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3) as a basic source of data, and supplemented that data where possible with current community-level data for Lincoln, Nye, and Esmeralda Counties.

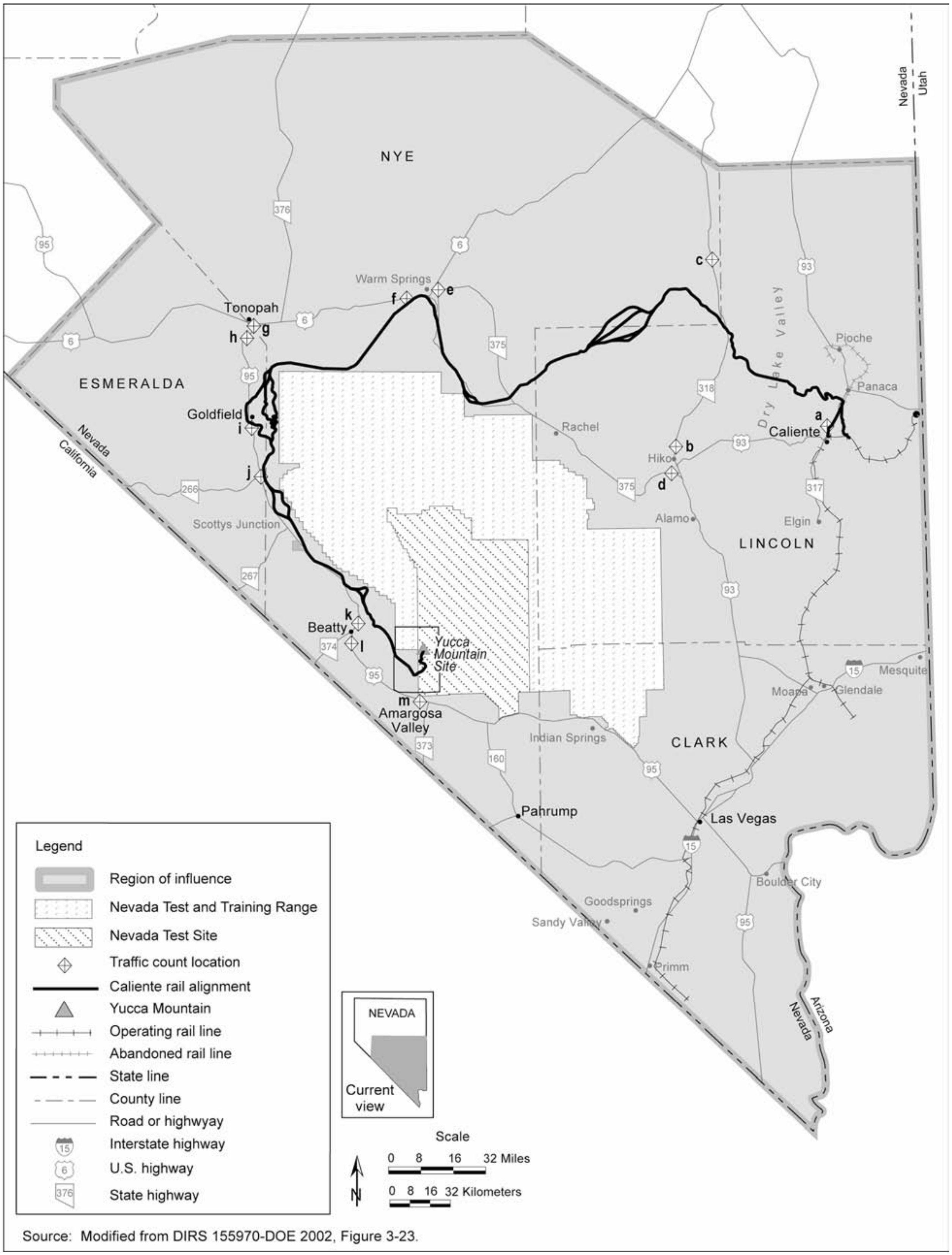


Figure 3-114. Socioeconomics region of influence – Caliente rail alignment.

> **Real disposable income** is the value of total income received after taxes; it is the income available for spending or saving.

DOE used an economic-demographic forecasting model known as *Policy Insight*, developed by Regional Economic Models, Inc. (DIRS 178610-Bland 2007, all), to generate employment, ***real disposable income***, and ***gross regional product*** data for Clark, Lincoln, Nye, and Esmeralda Counties. *Policy Insight* is an eight-region model, which includes Clark, Lincoln, Nye, Esmeralda, Mineral, and Lyon Counties, the joint area of Washoe County and Carson City, and one last region encapsulating the rest of Nevada. Appendix J, Socioeconomics, contains the results of the *Policy Insight* model runs.

The description of existing economic conditions in the Caliente rail alignment region of influence and the forecast values of populations, gross regional product, and real disposable income draw on data from *Policy Insight* version 9.0 (DIRS 182251-REMI 2007, all). The description includes revenue from DOE's Payments Equal to Taxes program, described in detail in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-90), and the Repository SEIS. Revenue from this program is not described separately. Because the model is based on nationally collected data for which there is a lag between collection and issuance by the national agencies, and another lag before the data are incorporated into the *Policy Insight* model, there is always a gap of approximately 2 to 3 years between the current year and the last history year. The year 2004 is the last history year for *Policy Insight* version 9.0 used in this baseline forecast. To compensate for this time lag, the model's employment update feature is specifically designed to accommodate new historical data provided by users, which update the model's growth-rate assumptions. *Policy Insight* version 9.0 uses an employment update module that relies on years 2004 to 2006 data from the Nevada Department of Education, Training, and Rehabilitation (DIRS 180712-NDETR 2006, all; DIRS 180740-DETR [n.d.], all; DIRS 180741-DETR 2005, all; DIRS 180742-DETR [n.d.], all). This version also incorporates information from the latest Clark County population projections prepared by the University of Nevada, Las Vegas (DIRS 178806-CBER 2006, all) and the latest population projections developed by the Nevada State Demographer (DIRS 178807-Hardcastle 2006, all).

Data for the affected environment (both those taken from the Yucca Mountain FEIS and supplemental information included here) come from various state, federal, community, and proprietary sources. DOE obtained current and historical population data from a report prepared for the Nevada Small Business Development Center (DIRS 177656-Nevada State Demographer's Office 2006, all). The Department obtained housing data, including information on housing stock, vacancy rates, median housing values, and gross rents, from the Nevada Small Business Development Center, which compiled the information from U.S. Census Bureau data (DIRS 173564-Nevada Small Business Development Center 2003, all; DIRS 173565-Nevada Small Business Development Center 2003, all; DIRS 173566-Nevada Small Business Development Center 2003, all; DIRS 173567-Nevada Small Business Development Center 2003, all). DOE uses the U.S. Census Bureau housing data because county-collected housing data can be inconsistent across counties due to unique county assessment practices. In addition, the Census Bureau's housing data contain characteristics that county housing data sources do not, such as whether a property is a rental property or owner-occupied, occupied, or vacant.

Income, poverty, and unemployment data come from the U.S. Census Bureau (DIRS 176856-U.S. Census Bureau 2003, all). DOE obtained current values for employment, real disposable income, and gross regional product for Lincoln, Nye, Esmeralda, and Clark Counties from the *Policy Insight* model, as previously described. DOE compiled business-establishment data from the *Nevada Workforce Informer, Data Analysis* (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all; DIRS 173542-Nevada Department of Employment, Training & Rehabilitation 2005, all; DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all). The Department obtained data on public services mainly from interviews with county representatives in the region of influence and from the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3), augmented in some instances with information from other sources cited herein. Yucca Mountain Oversight Offices in Lincoln and Esmeralda Counties provided contact information for county agencies and suggested data sources for this section. The County Manager provided similar assistance for Nye County. DOE obtained health data from the Nevada State Health Division (DIRS 173560-State of Nevada [n.d.], all); education data from Nevada District Accountability Reports (DIRS 177758-Lincoln County School District [n.d.], all; DIRS 177759-Nye County School District [n.d.], all; DIRS 177760-Esmeralda County School District [n.d.], all); law enforcement data from the Department of Public Safety (DIRS 173399-State of Nevada 2004, all; DIRS 177747-State of Nevada 2005, all; DIRS 177748-State of Nevada 2006, all).

DOE based the description of the affected transportation environment on existing traffic volumes on the roadways (measured as average daily traffic counts), and obtained traffic volumes for roads from the Nevada Department of Transportation traffic report for 2005 (DIRS 178749-NDOT [n.d.], all). The Department then estimated levels of service on the affected roadways using guidelines in the Highway Capacity Manual (DIRS 176524-Transportation Research Board 2001, all).

3.2.9.3 General Regional Socioeconomic Characteristics

DOE examined baseline socioeconomic conditions for selected communities within the region of influence that would be likely to be affected by railroad construction and operations. These communities include Caliente in Lincoln County; Tonopah, Beatty, the Town of Amargosa Valley, and Pahrump in Nye County; and Goldfield in Esmeralda County. This section presents baseline conditions for Clark County at the county level, primarily in relation to economic measures and health-care capacity. DOE assumes that there would be an overall income effect on Clark County from the workers living there and commuting to work on the proposed railroad project, but because of the large population of Clark County, the effect would be small.

3.2.9.3.1 Employment and Income

According to the *Policy Insight* baseline projections listed in Table 3-57, Lincoln County's economy is substantially smaller than Nye County's. The three largest employment sectors in Lincoln County are state and local government (27 percent of the employed population), services (21 percent), and retail trade (11 percent). Mining is also an important employment sector, with 11 percent of the employed population. The county's largest employers include the Lincoln County School District; Lincoln County; and an engineering firm, DynCorp Technical Services, LLC (DIRS 173542-Nevada Department of Employment, Training & Rehabilitation 2005, all). Lincoln County's employment has been declining after growth during the 1980s (DIRS 155970-DOE 2002, p. 3-87). According to *Policy Insight* baseline projections, the gross regional product of the county in 2007 will be $93.6 million, and the real disposable income will be $93.6 million.

Nye County has the second largest economy in the region of influence. The largest employment sectors are services (44 percent of the employed population), followed by retail trade (12 percent), and then transportation warehousing, information, and finance and insurance (11 percent collectively). State and local government and construction are also important sectors. The importance of construction reflects the county's population growth from 1990 to 2003 because new residents and businesses require construction materials and labor, and a range of services. Large employers include National Security Technologies, LLC (NSTec), the management and operating contractor for DOE at the Nevada Test Site, which employs between 1,000 and 1,500 people in the area, although many Nevada Test Site employees live in Clark County (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all).

Table 3-57. Lincoln, Nye, Clark, and Esmeralda County employment by industry, 2007.[a]

Industry sector	County			
	Lincoln	Nye	Esmeralda	Clark
Private				
Forestry and fisheries	14	67	3	306
Mining	242	1,094	84	1,420
Utilities	13	185	0	3,798
Construction	187	1,793	32	124,771
Manufacturing	32	342	1	28,737
Wholesale trade	22	186	12	26,567
Retail trade	247	2,140	30	121,883
Transportation and warehousing, information, and finance and insurance	141	1,975	23	158,506
Services	456	8,088	112	577,086
Farm	191	283	67	312
Public				
Federal Government–civilian	40	161	6	11,409
Federal Government–military	8	79	4	12,663
State and local government	576	1,792	101	83,135
Totals[b]	2,169	18,184	475	1,150,594

a. Source: DIRS 178610-Bland 2007, all.
b. Totals might differ from sums of values due to rounding.

Local government agencies such as the Nye County School District and Nye County, and mining companies such as the Round Mountain Gold Corporation, are also major employers (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all).

Nye County employment rebounded after a 15 percent decrease between 1990 and 1995 (DIRS 155970-DOE 2002, p. 3-87). According to *Policy Insight* baseline projections, the gross regional product of Nye County in 2007 will be $1.16 billion, and the real disposable income will be $1.12 billion.

Esmeralda has the smallest economy of the four counties. The county's three largest employment sectors are services, state and local government, and mining, which account for 24, 21, and 18 percent of the employed population, respectively. Employers include government agencies such as the State of Nevada and the Esmeralda County School District, and mining companies such as the Chemetall Foote Corporation, which runs Silver Peak Mine and Lode Star Gold, Inc. (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all).

According to *Policy Insight* baseline projections, the gross regional product of Esmeralda County in 2007 will be $25.7 million, and the real disposable income will be $29.3 million.

Clark County's economy dominates southern Nevada. The largest employment sectors are services (50 percent of the employed population; 46 percent of services employment is within the Accommodations and Food Services sectors); transportation warehousing, information, and finances and insurance (14 percent); construction (11 percent); and retail trade (11 percent). According to *Policy*

Insight baseline projections, Clark County surpasses the other counties with a gross regional product of $95.4 billion, which is more than 80 times that of Nye County. According to *Policy Insight* baseline projections, Clark County residents will have $60.7 billion in ***real disposable personal income*** in 2007.

3.2.9.3.1.1 Mining and Agriculture. This section describes existing conditions for mining and agricultural activities, because a railroad along the Caliente rail alignment would be likely to affect these interests more than other economic activities.

Mining At present, Lincoln, and Clark Counties have only industrial mines; Nye County has metallic and nonmetallic mines and oil production fields; and Esmeralda County has industrial and metallic mineral mines. In 2007, the mining industry employed 18 percent of the 475 workers in Esmeralda County and 6 percent of workers in Nye County (DIRS 178610-Bland 2007, all). Mining also constitutes a large part of the total personal income generated in the four-county region of influence. In Esmeralda County in 2002, almost 18 percent of personal income came from mining, making it the single largest source of personal income in the county (DIRS 173546-BEA 2004, Table CA05N). Almost 7 percent of personal income in Nye County came from the mining industry in 2002 (DIRS 173548-BEA 2005, Table CA05N).

Mined minerals in the region of influence include gold, silver, aggregate (consisting of crushed stone, natural sands, and gravel), salt, and a wide range of other non-metallic minerals. Gold is central to Nevada's mining industry, and at $2.4 billion in revenue (DIRS 169127-Driesner and Coyner 2003, all; DIRS 173554-Price and Meeuwig 2003, all), it brings in more revenue than any other type of mining. Silver production is also important and was Nevada's fourth leading mineral commodity in 2002, valued at $62 million.

The Caliente rail alignment would cross some mining areas and districts. Caliente common segment 1 would cross the northernmost portion of the Seaman Range Mining District. As discussed in Section 3.2.2.5.2, most of historic mining activity in this mining district occurred more than 5 kilometers (3 miles) south and southwest of Caliente common segment 1. The South Reveille alternative segments and common segment 3 would pass within 3 kilometers (2 miles) of the Reveille Valley Mining Area. A portion of common segment 3 would cross the Clifford Mining District, which is near Warm Springs. Goldfield alternative segments 1, 3, and 4 would cross the Goldfield Mining District; Goldfield alternative segment 1 also would cross the Diamondfield Mining District. A portion of Caliente common segment 4 would cross the westernmost portion of the Stonewell Mining District, although most of the historic mining activity in this district was approximately 5 kilometers (3 miles) east of the common segment. Finally, Caliente common segment 6 would cross the northeastern portion of the Bare Mountain Mining District, although most historical mining activity there occurred more than 3 kilometers (2 miles) south of this common segment.

Agriculture The primary agricultural activity the Caliente rail alignment would intersect would be grazing. As discussed in Section 3.2.2, Land Use and Ownership, there are 27 separate grazing allotments along the Caliente rail alignment, 24 of which are active. In Section 3.2.2, Land Use and Ownership, Tables 3-6 and 3-7 list and describe these grazing allotments, and Figures 3-26 through 3-33 show the locations of the allotments.

The permitted grazing operations support employment and provide income for ranchers and their workers, and income for the respective counties. BLM-issued grazing permits authorize these operations, and specify the total number of animal unit months apportioned (an animal unit month represents enough dry forage for one mature cow for 1 month). For those allotments for which information is available (see Table 3-6), animal unit months range from 118 to 48,250, and land area ranges from 17 to 4,363 square kilometers (4,200 to 628,000 acres). The BLM established the property base for each allotment based on land or water rights.

In addition to grazing, farming is an important source of both income and employment for the counties in the region of influence. As discussed in Section 3.2.1.2.3, less than 1 percent of soils along the Caliente rail alignment are classified as prime farmlands. Three rail alignment segments would cross prime farmland soils: Caliente common segment 1, the Caliente alternative segment, and the Eccles alternative segment (see Figure 3-5). DOE calculated the amount of potentially disturbed prime farmland soils by multiplying the total disturbance area by the percentage of prime farmland present along the construction right-of-way. Prime farmland soils along the Caliente and Eccles alternative segments consist of 0.11 square kilometer (27 acres) and 0.1 square kilometer (24 acres). This accounts for roughly 0.01 percent of Lincoln County's total 870 square kilometers (210,000 acres) of prime farmland. These soils are near private land and, at present, might be used for some farming purposes. The 0.22 square kilometer (54 acres) of prime farmland soils along common segment 1 are not being farmed, and are in a relatively isolated area in Nye County (DIRS 182843-ICF 2007, all, Plates 107 to 109). This accounts for roughly 0.04 percent of Nye County's total 610 square kilometers (150,000 acres) of prime farmland.

3.2.9.3.1.2 Personal Income, Poverty, and Unemployment. As shown in Table 3-58, Nye and Clark Counties have the highest median income in the region of influence, followed by Esmeralda and Lincoln Counties. While Nye and Clark Counties showed the highest incomes and the lowest percentage of residents in poverty in 1999 (see note on Table 3-58 for information on poverty thresholds), the unemployment rates in these counties were higher than Lincoln and Esmeralda Counties in 2000. The unemployment rate in Nye County decreased between 2000 and 2005, while Esmeralda County's unemployment rate increased over the same period. Esmeralda County had the highest unemployment rate in the region of influence.

At the community level, Beatty has the highest median income, although its poverty rate is third highest behind the City of Caliente in Lincoln County, and the Town of Amargosa Valley. The City of Caliente also has the highest unemployment rate of all communities in the region of influence.

Tonopah and Beatty in Nye County have higher median incomes and lower poverty and unemployment rates than Caliente in Lincoln County.

3.2.9.3.2 Population

Table 3-59 lists the county and community populations in the Caliente rail alignment region of influence in 1990, 2000, and 2005.

According to the Nevada State Demographer's Office Nevada 2000 census data (DIRS 173565-Nevada Small Business Development Center 2003, p. 1), the population of Lincoln County is 100-percent rural. It has a population density of only 0.15 people per square kilometer (0.4 people per square mile) (DIRS 173530-Bureau of Census 2005, all). A rail line along the Caliente rail alignment would begin in or near Caliente, Lincoln County's only incorporated city. The 2005 population of the City of Caliente accounted for more than one-fourth of the county's population (DIRS 177656-Nevada State Demographer's Office 2006, p. 6).

Nye County is the second most populous county in the region of influence. According to the U.S. Bureau of Census (DIRS 173530-Bureau of Census 2005, all), in 2005 the county had a population density of 0.69 people per square kilometer (1.8 people per square mile); according to population estimates and rural figures from the Nevada State Demographer's Office (DIRS 173564-Nevada Small Business Development Center 2003, p. 1), 55 percent of the population is considered rural. The largest town in Nye County is unincorporated Pahrump, which accounts for 80 percent of the county's population. Although Pahrump is not in the immediate vicinity of the Caliente rail alignment, it is reasonably foreseeable that some construction and operations workers would live in Pahrump, based on historical and current patterns of workers at the Nevada Test Site and the Yucca Mountain Site.

Table 3-58. County and place-level personal income, poverty, and unemployment.[a]

County, city/community	Median household income in 1999 (dollars)[b]	Poverty in 1999 (percent)[b]	Unemployment in 2000 (percent)[b]	Unemployment in 2005 (percent)[c]
County				
Lincoln	31,979	16	5.2	5.1
Nye	36,024	11	7.1	5.2
Clark	44,616	11	6.6	4.0
Esmeralda	33,203	15	3.3	5.3
City/community				
Tonopah	38,029	11	7.9	No data available
Pahrump	35,313	9	7.5	No data available
Goldfield	32,969	12	3.2	No data available
Caliente	26,458	22	9.1	No data available
Amargosa Valley	34,432	15	3.2	No data available
Beatty	41,076	13	5.6	No data available

a. The U.S. Census Bureau defines poverty based on estimates of how much money families need to meet their nutritional needs for 1 year. Poverty thresholds and a more thorough definition of poverty are available from the U.S. Census Bureau at http://www.census.gov/acs/www/UseData/Def/Poverty.htm, all.
b. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 7, 13, and 15.
c. Source: DIRS 177755-BLS [n.d.], all.

Table 3-59. County and community populations, Caliente rail alignment, 1990 to 2005.[a]

County	City/ community	1990 population[b]	2000 population	2005 population	1990 to 2000 change (percent)	2000 to 2005 change (percent)
Lincoln		3,810	4,165	3,886	9	-7
	Caliente	1,146	1,123	1,015	-2	-10
Nye		18,190	32,978	41,302	81	25
	Tonopah	3,671	2,833	2,607	-23	-8
	Amargosa Valley	724	1,167	1,383	61	19
	Beatty	1,662	1,152	1,032	-31	-10
	Pahrump	7,430	24,235	33,241	226	37
Esmeralda		1,350	1,061	1,276	-21	20
	Goldfield	672	424	438	-37	3
Clark		770,280	1,394,440	1,815,700	81	29

a. Source: DIRS 177656-Nevada State Demographer's Office 2006, all.
b. 1990 estimates for Tonopah, Amargosa Valley, Beatty, Pahrump, and Goldfield were not available through the Nevada State Demographer's Office; therefore, subdivision-level data for these locations were taken from the U.S. Census DP-1 (DIRS 179132-Bureau of Census [n.d.], all). The Census data reflect a different time series than the Governor's Certified Estimates.

Nye County also includes the communities of Tonopah, Beatty, and the Town of Amargosa Valley, all of which are near the Caliente rail alignment. Tonopah is the most populated of these communities.

Esmeralda County is the least populated of the counties in the Caliente rail alignment region of influence. Esmeralda is also the least densely populated county, with a density of 0.11 people per square kilometer (0.3 people per square mile) (DIRS 173534-Bureau of Census 2005, all) and a 100-percent rural population (DIRS 173566-Nevada Small Business Development Center 2003, p. 1). The community of Goldfield is close to the Caliente rail alignment, and its population accounts for more than one-third of Esmeralda County's population.

Clark County, which includes Las Vegas, is the most populated county in Nevada. It has a population density of 67 people per square kilometer (173.9 people per square mile) (DIRS 173533-Bureau of Census 2005, all), and a rural population of only 2 percent (DIRS 173567-Nevada Small Business Development Center 2003, p. 1). No part of the Caliente rail alignment is in or near Clark County; the closest part of the alignment would be common segment 6, 48 kilometers (30 miles) west of the Clark County boundary, in Nye County. However, a substantial proportion of the railroad construction workforce would probably come from Clark County.

In terms of population change, southern Nevada has been and continues to be among the fastest-growing areas in the United States (DIRS 155970-DOE 2002, p. 3-84). In the Caliente rail alignment region of influence, Lincoln and Nye Counties both experienced population increases from 1990 to 2000, with Nye County's growth of 81 percent being considerably greater than Lincoln County's growth of 9 percent. The population of Esmeralda County decreased between 1990 and 2000 by 21 percent. The growth and overall population of Clark County is substantial, with an increase of 81 percent during the same years.

Communities within these counties have also been undergoing population changes, though these shifts have not necessarily been in the same direction as the respective county. For example, Nye County experienced a substantial population increase (25 percent) between 2000 and 2005. The increase was largely fueled by population growth in Pahrump, while Tonopah's population declined by 8 percent, and Beatty's declined by 10 percent during the same period. The population of Goldfield in Esmeralda County increased by 3 percent between 2000 and 2005, which is consistent with the county's increase in population of 20 percent.

According to *Policy Insight* model baseline projections listed in Table 3-60, most of the counties in the region of influence are expected to grow through 2067, independent of potential project-related effects. These projections assume that current trends continue and incorporate county and state (that is, Nevada State Demographer's Office) demographic and economic data sources. Population projections for Lincoln, Nye, and Esmeralda Counties through 2026 are from the Nevada State Demographer's Office (DIRS 178807-Hardcastle 2006, all); population projections for these areas after 2026 assume constant growth at 2026 rates. Clark County projections to 2035 are from the University of Nevada Las Vegas Center for Business and Economic Research projections (DIRS 178806-CBER 2006, all), and projections to 2067 assume constant growth at 2035 rates. Because these projections assume a constant rate of growth over the period, rather than a growth rate that increases at a decreasing rate (which would be expected for population projections for Clark and Nye Counties), the projected populations are high estimates. This is a conservative assumption when analyzing for total radiological ***dose*** to resident populations, which is another use of the projections by the Yucca Mountain Project. By 2067, the population of Nye County is projected to increase by 187 percent over 2007 levels. Lincoln County's population is also projected to increase during the same period (63 percent increase over 2007 levels). Esmeralda County population is projected to decline by 2067 (11 percent decrease from 2007 levels). Clark County population is projected to increase by approximately 150 percent over 2007 levels.

Table 3-60. Projected values for population, employment, and economic variables, 2007 to 2067[a] (page 1 of 2).

.	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Population														
Lincoln County	4,250	4,754	5,330	5,694	5,875	5,991	6,112	6,235	6,361	6,489	6,620	6,754	6,891	6,946
Nye County	45,737	51,971	60,803	67,707	73,155	78,364	84,005	90,053	96,535	103,484	110,933	118,919	127,480	131,074
Clark County	1,990,481	2,258,748	2,652,070	2,946,350	3,169,797	3,358,455	3,544,362	3,739,880	3,946,181	4,163,863	4,393,553	4,635,913	4,891,642	4,997,841
Esmeralda County	1,215	1,147	1,069	1,012	997	1,007	1,016	1,027	1,038	1,048	1,058	1,068	1,079	1,083
All of Nevada	2,745,469	3,064,179	3,539,284	3,902,058	4,185,507	4,431,901	4,680,591	4,943,171	5,221,096	5,515,255	5,826,285	6,155,203	6,503,050	6,647,735
Employment														
Lincoln County	2,169	2,253	2,345	2,416	2,446	2,477	2,513	2,567	2,612	2,677	2,731	2,786	2,843	2,866
Nye County	18,184	19,194	20,585	21,683	22,628	23,706	24,923	26,310	27,732	29,274	31,381	33,640	36,062	37,079
Clark County	1,150,594	1,239,364	1,325,133	1,391,701	1,453,024	1,524,248	1,601,285	1,692,833	1,778,852	1,860,856	1,963,506	2,071,818	2,186,105	2,233,566
Esmeralda County	475	466	451	442	436	434	432	435	438	443	447	452	456	458
All of Nevada	1,609,884	1,719,682	1,834,877	1,918,883	1,996,005	2,085,078	2,182,024	2,299,188	2,409,726	2,518,704	2,659,417	2,808,145	2,965,352	3,030,717
Gross regional product[b,c]														
Lincoln County	0.936	0.105	0.122	0.138	0.151	0.166	0.183	0.201	0.220	0.242	0.247	0.252	0.257	0.259
Nye County	1.164	1.302	1.550	1.798	2.052	2.340	2.664	3.037	3.447	3.903	4.184	4.485	4.808	4.943
Clark County	95.392	109.494	131.517	151.836	172.974	197.204	224.494	256.596	291.013	327.876	345.963	365.047	385.184	393.546
Esmeralda County	0.026	0.027	0.029	0.032	0.035	0.039	0.042	0.046	0.050	0.056	0.057	0.057	0.058	0.058
All of Nevada	129.036	147.283	177.133	204.369	232.647	264.813	300.888	343.229	388.550	437.450	461.921	487.785	515.120	526.484

Table 3-60. Projected values for population, employment, and economic variables, 2007 to 2067[a] (page 2 of 2).

Economic parameter	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Government spending[b,c]														
Lincoln County	0.039	0.047	0.055	0.061	0.064	0.068	0.070	0.074	0.076	0.078	0.080	0.082	0.083	0.084
Nye County	0.174	0.202	0.252	0.291	0.323	0.356	0.390	0.427	0.466	0.503	0.539	0.578	0.620	0.637
Clark County	7.269	8.460	10.543	12.146	13.427	14.617	15.780	17.043	18.266	19.411	20.482	21.612	22.804	23.299
Esmeralda County	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
All of Nevada	10.592	12.085	14.762	16.841	18.541	20.159	21.769	23.523	25.226	26.830	28.335	29.925	31.607	32.307
Real disposable income[b,c]														
Lincoln County	0.094	0.103	0.115	0.124	0.131	0.138	0.146	0.156	0.166	0.186	0.190	0.194	0.198	0.199
Nye County	1.117	1.250	1.439	1.605	1.775	1.969	2.203	2.466	2.768	3.132	3.358	3.599	3.858	3.967
Clark County	60.731	68.974	79.836	89.500	99.788	111.517	124.864	140.518	156.612	173.027	182.571	192.642	203.269	207.682
Esmeralda County	0.029	0.030	0.033	0.035	0.037	0.041	0.043	0.047	0.050	0.054	0.054	0.055	0.055	0.056
All of Nevada	85.032	95.636	110.205	123.098	136.861	152.183	169.418	189.600	210.290	232.015	245.035	258.799	273.350	279.400

a. Source: DIRS 178610-Bland 2007, all; DIRS 178806- CBER 2006, all; DIRS 178807- Hardcastle 2006, all.
b. Values from *Policy Insight* (DIRS 182251-REMI 2007, all), converted to 2006 dollars using the ratio of the 2000 annual Consumer Price Index (CPI) and the annual CPI from 2006.
c. 2006 dollars in billions.

3.2.9.3.3 Housing

Table 3-61 lists housing characteristics in the Caliente rail alignment region of influence in 2000. The housing stock in Lincoln County and in Caliente consists mostly of single-family homes. Almost a fifth of housing units in Caliente are vacant. The *Lincoln County Master Plan* (DIRS 174520-State of Nevada 2001, pp. 24 and 25) identifies a potential new community development planned for the former Aerojet Nevada lands along the southern county border along U.S. Highway 93. Coyote Springs Investment owns an estimated 120 square kilometers (30,000 acres) of land in the area that is currently under development. The residential component of the development could house workers associated with the proposed railroad who might otherwise live in Caliente. Compared to Lincoln County, Nye County has a much larger housing stock, most of which is mobile (manufactured) homes; the housing stock in the Beatty ***Census County Division*** and the Amargosa Census County Division consists primarily of mobile homes. In Tonopah, almost one-third of the housing units are vacant, particularly in the rental segment.

Esmeralda County has the smallest housing stock. More than half the county's housing units are in Goldfield, where 48 percent are mobile homes, and 49 percent of all units were vacant in 2000. The housing stock of Clark County in 2000 reflects an increase of slightly more than 75 percent over the 1990 count (DIRS 173531-Bureau of Census 2000, Table DP-5 STF3). This increase is accounted for by the large population and employment growth in Clark County, which has spurred housing construction. Vacancy rates in both the homeowner and rental segments in Clark County tend to be lower than the rates in the other counties in the region of influence, with the exception of Lincoln County.

As shown in Table 3-62, in 2000 the median values of housing in Lincoln County and Esmeralda County were considerably below the median value in Nye County and Clark County. Similarly, rent levels in Lincoln and Esmeralda Counties were approximately half of those for Clark County and approximately two-thirds those of Nye County. Housing values in all of Southern Nevada rose rapidly between the 2000 Census and 2005. A Las Vegas-based housing research firm reported that the median price of the recorded new homes in the area in November 2005 was $301,519, which was a 5.9 percent annual increase. Omitting apartment conversions, the median price for new homes was $336,645, or an 18.2 percent annual increase (DIRS 176007-Home Builders Research 2005, all). Lodging options along U.S. Highway 95 between Goldfield and the Yucca Mountain Site are in and around Goldfield, Beatty, and the Town of Amargosa Valley. Visitors to Goldfield can stay in the Goldfield recreational vehicle park, which has 20 spaces (DIRS 182379-Nevada Commission on Tourism 2007, all). Beatty has a much higher accommodation capacity. It has six motels with a total of 275 rooms, and three recreational vehicle parks with a total of 63 spaces (DIRS 182381-Nevada Commission on Tourism 2007, all; DIRS 182384-Nevada Commission on Tourism 2007, all). Town of Amargosa Valley features a combined 60-room hotel and 51-space recreational vehicle park, one additional motel (17 rooms), and one additional recreational vehicle park (97 spaces) (DIRS 182380-Nevada Commission on Tourism 2007, all; DIRS 182383-Nevada Commission on Tourism 2007, all).

3.2.9.3.4 Public Services

This section summarizes conditions for health care, education, fire protection, and law enforcement. Section 3.2.11, Utilities, Energy, and Materials, describes utilities-related public services.

3.2.9.3.4.1 Health Care. While Lincoln, Nye, and Esmeralda Counties have some health care facilities, all three counties are federally designated as health professional shortage areas for primary, dental, and mental health care (DIRS 173558-State of Nevada [n.d.], all; DIRS 173559-State of Nevada [n.d.], all; and DIRS 173560-State of Nevada [n.d.], all). Health care services in the region of influence are concentrated in Clark County, particularly in the Las Vegas area.

Table 3-61. Housing characteristics in the Caliente rail alignment region of influence, 2000.[a]

Geographic area	Total housing units	Single-family homes	Multiple-family homes	Mobile homes	Occupied housing units	Vacant housing units	Vacancy rate (percent)	
							Homeowner	Rental
Lincoln County[b]	2,178	1,365	196	617	1,540	638	4.0	9.2
Caliente Census County Division[c]	536	337	77	122	437	99	4.2	11.8
Nye County[d]	15,934	6,383	1,014	8,537	13,309	2,625	3.4	17.9
Tonopah Census County Division[c]	1,608	766	385	457	1,152	456	3.6	32.3
Beatty Census County Division[c]	746	181	97	468	548	198	2.6	33.0
Amargosa Census County Division[c]	536	73	7	456	422	114	2.4	17.9
Pahrump[c]	8,206	3,660	479	4,067	7,234	972	3.2	11.8
Esmeralda County[e]	833	269	121	443	455	378	4.4	40.5
Goldfield Census County Division[c]	429	162	61	206	224	205	5.7	43.8
Clark County[f]	559,799	321,801	203,411	34,587	512,253	47,546	2.6	9.7

a. Total Housing Units, Occupied Housing Units, and Vacant Housing Units counts were taken from Summary File 1 U.S. Census Bureau data, and Single Family Homes, Multiple Family Homes, and Mobile Homes counts were taken from Summary File 3 U.S. Census data. Because Summary File 1 data are collected from all households, while Summary File 3 data are compiled from a sample of approximately 19 million housing units (approximately 1 in 6 households), total housing counts differ slightly from the sum of "Single Family Homes, Multiple Family Homes, and Mobile Homes." DIRS 173565-Nevada Small Business Development Center 2003 contains a detailed explanation of variations between Summary File 1 and Summary File 3 data.
b. Source: DIRS 173565-Nevada Small Business Development Center 2003, p. 55.
c. Source: DIRS 173535-Bureau of Census 2000, all.
d. Source: DIRS 173564-Nevada Small Business Development Center 2003, p. 55.
e. Source: DIRS 173566-Nevada Small Business Development Center 2003, p. 55.
f. Source: DIRS 173567-Nevada Small Business Development Center 2003, p. 55.

Table 3-62. Median housing values and gross rents in the region of influence, 2000.[a]

Geographic area	Median value (dollars)[b]	Median monthly gross rent (dollars)
Lincoln County	80,300	328
Caliente Census County Division	65,200	359
Nye County	122,100	541
Tonopah Census County Division	78,200	478
Beatty Census County Division	93,700	368
Amargosa Valley Census County Division	80,800	380
Pahrump	135,100	614
Esmeralda County	75,600	381
Goldfield Census County division	71,300	389
Clark County	139,500	716

a. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 25 and 29.
b. Median value applies to owner-occupied units.

Lincoln County has one hospital in Caliente, the Grover C. Dils Medical Center, near U.S. Highway 93. The service area for this facility is all of (and limited to) Lincoln County (DIRS 174545-Arcaya 2005, all). The hospital employs two full-time-equivalent physicians, two full-time-equivalent physician assistants, and eight licensed nurses (DIRS 175508-Arcaya 2005, all). In addition to providing all medical services and staffing a 24-hour emergency room at Grover C. Dils Medical Center, the hospital's physicians and physician assistants are responsible for staffing a medical clinic in Alamo, Nevada (DIRS 175508-Arcaya 2005, all). Sixteen of the beds at Grover C. Dils Medical Center are designated for long-term care and 4 are reserved for acute cases (DIRS 175508-Arcaya 2005, all). The Grover C. Dils hospital is not licensed for surgery. All patients in need of surgical procedures are referred to Valley View Medical Center in Cedar City, Utah, about 155 kilometers (96 miles) from Caliente; Dixie Regional Medical Center in St. George, Utah, about 177 kilometers (110 miles) from Caliente; or Las Vegas, about 241 kilometers (150 miles) from Caliente (DIRS 175508-Arcaya 2005, all). Lincoln County continues to be a medically underserved area and a health professional shortage area, although hospital-use data in Table 3-63 show the capacity of the health care system improving overall from 1995 to 2000.

Table 3-63. Hospital use in Lincoln and Nye Counties.

County	1995	1998	2000
Lincoln[a]			
Average number of beds	4	4	20
Beds per 1,000 residents	1	0.95	4.8
Patient days	360	300	No data available
Nye[b]			
Average number of beds	21	10	44
Beds per 1,000 residents	0.86	0.33	1.3
Patient days	1,900	560	No data available

a. Source: DIRS 175508-Arcaya 2005, all.
b. Source: DIRS 174732-Arcaya 2005, all.

According to a Nye County assessment, emergency service (county-wide medical and Pahrump's fire protection) personnel are currently overextended (DIRS 174548-Abaris Group 2004, pp. 2 and 3). Nye County medical services are widely distributed and consist of a mixture of public and private clinics.

The communities of Beatty, Pahrump, and Town of Amargosa Valley all have access to ambulance service, and are served by preventive care clinics staffed by physician assistants or community health nurses. These clinics focus on women's health, immunizations, and sexually transmitted diseases. They are funded in part by the State Rural Health Division (DIRS 174736-Arcaya 2005, all). Pahrump has a pediatric physician who runs a separate clinic in the community, a Veterans Administration clinic, and several private dermatologists, dentists, and chiropractors (DIRS 174736-Arcaya 2005, all; DIRS 174972-Arcaya 2005, all).

Additionally, Desert View Regional Medical Center (DVRMC), Pahrump's first hospital, opened in April 2006. The hospital has 24 beds and a 24-hour emergency room. The facility has a maternity ward, full-service lab and radiology services, as well as physical therapy services (DIRS 181897-Desert View Regional Medical Center 2007, all).

Nye County is also served by the Nye Regional Medical Center, a small, private hospital in Tonopah that has ambulance services. The center has 44 beds, 26 of which are long-term-care beds reserved for the hospital's nursing-home wing. Two full-time-equivalent physicians provide coverage for both the 24-hour emergency room and all other patients. The hospital's nursing home maintains 24-hour coverage consisting of one registered nurse and one certified nursing assistant. The Nye Regional Medical Center is able to perform diagnostic imagery and to provide services from its on-site laboratory, pharmacy, and outpatient clinic. However, the facility is not licensed for surgery. Nye County patients in need of more advanced care than can be provided at Tonopah's hospital are transported by helicopter to Reno or Las Vegas by Flight for Life, a medical air service (DIRS 174732-Arcaya 2005, all).

Although Nye County continues to be a medically underserved area and a health professional shortage area, Table 3-63 shows that the capacity of the health care system in Nye County improved between 1995 and 2000, with increases in the average number of beds and the number of beds per 1,000 residents.

Esmeralda County had no practicing doctors or dentists in 2005 (DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). The U.S. Health Resources and Services Administration designated Esmeralda County as both a health professional shortage area and a medically underserved population for primary health, dental, and mental-health care for 2004 (DIRS 173560-State of Nevada [n.d.], all). Because Esmeralda County has no health-care facilities, the county has prepared a proposal to fund a new facility (DIRS 175507-McCorkel et al. 2005, all).

Clark County has 13 general acute-care medical centers with a combined total of 3,439 beds (1.9 beds per 1,000 residents) and 2,729 active, licensed physicians practicing throughout the county in 2005 (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). Sunrise Hospital and Medical Center in Las Vegas is the largest hospital in Nevada, with 701 beds (DIRS 178100-State of Nevada 2006, p. v). It is also capable of providing all medical services and staffs a 24-hour emergency room. Of the remaining 12 hospitals in Clark County, 8 (Desert Springs Hospital, Mountain View Hospital, North Vista Hospital, Southern Hills Hospital and Medical Center, Spring Valley Hospital Medical Center, Summerlin Hospital and Medical Center, University Medical Center, and Valley Hospital and Medical Center) are in Las Vegas, 2 (St. Rose Dominican Hospital and St. Rose Siena Campus) are in Henderson, 1 (Boulder City Hospital) is in Boulder City, and 1 (Mesa View Regional Hospital) is in Mesquite (DIRS 178100-State of Nevada 2006, p. v).

3.2.9.3.4.2 Education. Lincoln County has a total of nine elementary, middle, and high schools. During the 2005 to 2006 school year, Lincoln County schools had a total enrollment of 1,001 students and a graduation rate for the class of 2005 of 83 percent (DIRS 177758-Lincoln County School District [n.d.], all). The average student-to-teacher ratio for kindergarten through eighth grades was 14 to 1 (DIRS 177758-Lincoln County School District [n.d.], all). This is consistent with the 2003 national average student-to-teacher ratio of 16 to 1 across elementary and secondary grades levels (DIRS 177757-Snyder, Tan and Hoffman 2006, Table 62). Caliente has an elementary school that serves Lincoln County students and a middle and high school that exclusively serve troubled youth (DIRS 174735-Arcaya 2005, all). Other middle- and high-school-aged students in Caliente are transported by bus approximately 24 kilometers (15 miles) to Lincoln County High School in Panaca (DIRS 174545-Arcaya 2005, all). Lincoln County High School had an enrollment of 173 students from Panaca, Caliente, Pioche, and outlying areas for the 2005-2006 school year. Lincoln County High School is functioning below maximum design capacity, with the building able to accommodate up to 240 students (DIRS 175973-Arcaya 2006, all).

During the 2005-2006 school year, Nye County had approximately 6,088 students. The county's 2005 graduation rate was 60 percent (DIRS 177759-Nye County School District [n.d.], all). The average student-to-teacher ratio for kindergarten through fifth grades was 20 to 1 (DIRS 177759-Nye County School District [n.d.], all). Tonopah has elementary, middle, and high school facilities.

Nye County's school system experienced approximately a 10-percent increase in enrollment in the 2004-2005 school year over the previous year. Most of this growth was due to increases in Pahrump's population. Pahrump is home to four elementary schools, one middle school, and one high school. Table 3-64 lists enrollment for each school. All of these schools are functioning at or above maximum design capacity (that is, they are all holding as many, or more, students than they were originally built to accommodate). To alleviate overcrowding, all six schools were scheduled to receive modular units over the summer of 2005 that would each hold two additional classes. A bond for a new elementary school is also under consideration for the area, with a timeline of roughly 18 months for discussion and a decision on the bond. The new elementary school would likely be designed to hold between 400 and 600 students, making it roughly equal in size to the four existing elementary schools (DIRS 174737-Arcaya 2005, all).

Table 3-64. Enrollment in Pahrump area schools, 2004-2005.[a]

School name	Type	Enrollment, 2004-2005
Pahrump Valley	High school	987
Rosemary Clark	Middle school	1,122
Hafen	Elementary school	560
JG Johnson	Elementary school	555
Mt. Charleston	Elementary school	574
Manse	Elementary school	478

a. Source: DIRS 174737-Arcaya 2005, all.

In Nye County, the Community College of Southern Nevada has a campus in Pahrump that provides post-secondary school education. The facility offers courses to fulfill general education requirements, with 4-year degree programs planned (DIRS 174737-Arcaya 2005, all). Some of these programs are also offered as distance learning courses that can be accessed at a secondary facility in Tonopah equipped for videoconferencing (DIRS 174737-Arcaya 2005, all). The nearest major university to southern Nye County is the University of Nevada, Las Vegas, 105 kilometers (65 miles) from Pahrump. The University of Nevada, Reno, is the closest major university to northern Nye County. In addition, the University of Nevada, Reno, has a Cooperative Extension Center in Pahrump.

In Esmeralda County, 86 students were enrolled in school during the 2005-2006 school year (DIRS 177760-Esmeralda County School District [n.d.], all). Three schools in the county (in Dire, Silver Peak, and Goldfield) serve kindergarten through eighth grade students. The average student-to-teacher ratio was 12 to 1 (DIRS 177760-Esmeralda County School District [n.d.], all). The county employs seven certified teachers and one certified literacy coordinator (DIRS 174970-Arcaya 2005, all). There is no high school in Esmeralda County; high-school students from Esmeralda County attend school in Tonopah, Nye County (DIRS 155970-DOE 2002, p. 3-156).

3.2.9.3.4.3 Fire Protection. Lincoln and Nye Counties meet fire suppression needs with volunteers from the individual communities in the counties. Lincoln County has four locations with all-volunteer fire departments: Caliente, Pahranagat Valley, Panaca, and Pioche. Caliente's fire department has 25 volunteers and owns three fully equipped fire trucks with a combined tank capacity of 10,600 liters (2,800 gallons). The Panaca Fire Department has a force of 25 volunteers and owns several firefighting vehicles, with a combined tank capacity of 9,500 liters (2,500 gallons). The Pioche Fire District has 20 volunteers and owns two outdated firefighting vehicles: a tanker with a 3,800-liter (1,000-gallon) tank and a vehicle with a 1,900-liter (500-gallon) foam tank, and extrication equipment. The Pahranagat Valley Fire District has a force of 25 volunteers and owns three firefighting vehicles, with a total tank capacity of 6,800 liters (1,800 gallons). All four locations have access to ambulance services (DIRS 174973-Arcaya 2005, all). In addition to these four fire departments, Lincoln County commissioners are currently forming a countywide fire district. This new district would increase fire protection for places at high risk for fires, such as the Mount Wilson area (DIRS 174971-Arcaya 2005, all). There are no plans for Caliente to increase fire protection services, but Caliente and the other three fire departments in the county are currently able to meet their communities' needs, and they maintain a stream of citizens in training to become new volunteers (DIRS 174973-Arcaya 2005, all).

Nye County has 11 volunteer fire departments, including one in Beatty and one in Town of Amargosa Valley. The county's only paid fire department is in Pahrump. The county recently spent $2.5 million to upgrade its fire trucks and has adequate fire protection in all areas of the county except for Pahrump, which is overextended (DIRS 174731-Arcaya 2005, all). A 2004 audit of the Pahrump Valley Fire-Rescue Service commissioned by the Pahrump Town Board found that "the community is currently underserved by fire suppression and emergency medical services operational staff" and suggested that staff be added to the service, specifically an additional daily three-person team (DIRS 174548-Abaris Group 2004, p. 3). The audit also noted that Pahrump has no overall fire suppression and emergency medical services master plan, and recommended that one be developed.

As of October 2006, Nye County did not have an agreement with DOE to provide fire protection services to the Yucca Mountain Site. At present, the Nevada Test Site provides these services. The Nevada Test Site has two active fire departments that operate 24 hours a day, 7 days a week. One of the fire departments is in Mercury, Nevada (Area 23), and the other is in Area 6 on the Nevada Test Site. The Yucca Mountain Site has two paramedics, a small medical facility, and an ambulance for emergency response. The site also has two fully trained underground rescue teams available any time underground work is underway (DIRS 177762-Gormsen 2006, all).

The BLM Las Vegas and Battle Mountain Field Offices supplement Nye County's fire-protection resources by providing wildfire suppression services to all the public lands within Nye County that are managed by the BLM and the U.S. Forest Service (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all). The Las Vegas Field Office provides fire suppression resources for wildfires during peak fire season, which is generally from April through October. The Battle Mountain Field Office provides fire suppression support from three locations in northern Nye County: Austin, Eureka, and Battle Mountain. In addition to firefighters, the fire-suppression resources available through these locations include Type-4 and Type-3 wildfire engines, a Type-3 helicopter, Type-3 incident commanders, and single engine air tanker and air attack bases (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all).

In Esmeralda County, Goldfield has nine volunteer firefighters and three fire trucks; Gold Point has eight volunteer firefighters and three fire trucks; Silver Peak has six volunteer firefighters and three fire trucks; and Fish Lake Valley has 16 volunteer firefighters and three fire trucks (DIRS 180977-Gormsen 2007, all). The community fire departments have access to the county's road department vehicles, if needed.

3.2.9.3.4.4 Law Enforcement. The Lincoln County Sheriff's Office employs eight full-time patrolmen, one captain, one sheriff, five corrections officers, two civilian dispatchers, and one administrative assistant, which yields a ratio of 2.6 officers per 1,000 residents. This force serves an area of 27,500-square kilometers (10,600 square miles). The Lincoln County Sheriff's Office relies heavily on federal grants for equipment, including vehicles, dispatch software systems, and communications systems (DIRS 178099-Arcaya 2006, all). However, none of the support is ongoing, so the county reapplies for federal grant assistance each year.

The Nye County Sheriff's Office has 105 sworn officers (85 street-patrol officers and 20 corrections and detention officers) (DIRS 174974-Arcaya 2005, all). This yields a ratio of 2.2 patrol officers per 1,000 residents. The Nye County Sheriff's Office receives some funding in the form of occasional grants from state and federal agencies (DIRS 177756-Gormsen 2006, all).

The Esmeralda County Sheriff's Office has 14 employees – six officers that handle patrol (one sheriff, one sergeant, two resident deputies, and two full-time street deputies), three corrections officers, four full-time dispatchers, and one part-time civilian dispatcher (DIRS 174753-Arcaya 2005, all). This yields a ratio of 5 officers per 1,000 residents in Esmeralda County. By comparison, the national officer-to-population ratio is 2.4 officers per 1,000 residents (DIRS 155970-DOE 2002, p. 3-92). The Esmeralda County Sheriff's Office receives limited state and federal support in the form of occasional equipment grants (DIRS 178094-Arcaya 2006, all). The county does not receive on-going state or federal grant support or training.

As Table 3-65 shows, crime rates for Lincoln, Nye, and Esmeralda Counties are below the national average, and decreased between 2003 and 2005.

Table 3-65. Crime rates in the Caliente rail alignment region of influence, 2003 to 2005.

Area	Crime rate[a] (percent)		
	2003[b]	2004[c]	2005[d]
Lincoln County	18	13	13
Nye County	35	35	31
Esmeralda County	13	10	7
Clark County	51	51	51
National	45	44	No data available

a. The crime rate is based on the occurrence of an offense per 1,000 residents.
b. Source: DIRS 173399-State of Nevada 2004, all.
c. Source: DIRS 177747-State of Nevada 2005, all.
d. Source: DIRS 177748-State of Nevada 2006, all.

3.2.9.3.5 Transportation Infrastructure

This section describes the public roadways and mainline railroads in the area around the Caliente rail alignment.

3.2.9.3.5.1 Public Roadways. Because the Caliente rail alignment region of influence for transportation resources is primarily in remote and rural areas, the rail line would cross mostly low-usage unpaved roads, including county roads, private roads, and off-road vehicle trails. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these roads are not heavily traveled. Section 4.2.10, Occupational and Public Health and Safety, describes safety issues concerning public road–rail crossings, and road traffic related to construction and operation of the proposed railroad.

In addition to the state and federal roads discussed below, there are three paved roads near the Caliente rail alignment: Cedar Pipeline Ranch Road in southern Reveille Valley and two Nevada Test and Training Range access roads (one approximately 19 kilometers [12 miles] east of Tonopah off U.S. Highway 6 and the other off U.S. Highway 95 between Scottys Junction and Beatty).

Generally, the main roads within the region of influence are two-lane highways with very little daily traffic. Table 3-66 lists annual average daily traffic volumes along primary roads in the region of influence, which DOE obtained from the Nevada Department of Transportation's 2005 annual traffic report (DIRS 178749-NDOT [n.d.], all). These traffic volumes indicate that roadways near the Caliente rail alignment are not congested.

All references to ***levels of service*** of roads shown in Table 3-66 are defined by the Highway Capacity Manual 2000, which is an industry standard for traffic engineering published by the Transportation Research Board (DIRS 176524-Transportation Research Board 2000, all). This manual defines six levels of service that reflect the level of traffic congestion and qualify the operating conditions of a roadway. The six levels are given letter designations ranging from A to F, with A representing the best operating conditions (free flow, little delay) and F the worst (congestion, long delays) (DIRS 176524-Transportation Research Board 2001, all). Various factors that influence the operation of a roadway or intersection include speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. The Highway Capacity Manual describes the levels of service as follows:

Level of service A describes completely free-flow conditions. Individual drivers are virtually unaffected by the presence of other vehicles in the traffic stream.

Level of service B also indicates free flow, but the presence of other vehicles becomes more noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from Level of Service A.

Level of service C is in the range of stable flow, but marks the beginning of the range of flow in which operation of individual drivers becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by others and maneuvering requires substantial vigilance on the part of the driver.

Level of service D represents high density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience.

Level of service E represents operating conditions at or near capacity. All speeds are reduced to a low, but relatively uniform, value.

Level of service F indicates a breakdown of traffic flow or stop-and-go traffic. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can cross the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable.

Levels of service A, B, and C are typically considered good operating conditions in which motorists experience minor or tolerable delays of service. Based on the traffic counts listed in Table 3-66, U.S. Highway 93, State Route 318, and State Route 375 are operating at a level of service A. All of U.S. Highway 95 within the Caliente rail alignment region of influence is operating at a level of service B, except for a portion that is operating at a level of C. Sections 3.2.10 and 4.2.10, Occupational and Public Health and Safety, discuss highway accidents and fatalities.

3.2.9.3.5.2 Mainline Railroads. Two major freight railroads, both Class I, serve Nevada: the Union Pacific Railroad and the Burlington Northern and Santa Fe Railway. Union Pacific is the dominant carrier of the two in terms of tonnage of freight hauled and miles of track. The Union Pacific mainlines consist of two northern routes and one southern route that cross Nevada east to west. At present, approximately 28 trains every 24 hours pass through Caliente on the Union Pacific Railroad Mainline (DIRS 178017-Holder 2006, all). Sections 3.2.10 and 4.2.10, Occupational and Public Health and Safety, discuss rail transportation in relation to public safety.

Table 3-66. Annual average daily traffic counts in southern Nevada (2005).[a]

Roadway and location of traffic count station	Legend in Figure 3-114	Vehicles per day[b]	Level of service
U.S. Highway 93			
Near the northern city limits of Caliente (Lincoln County)	a	1,300	A
State Route 318			
7.2 kilometers (4.5 miles) north of Hiko (Sunnyside Road) (Lincoln County)	b	1,050	A
(Sunnyside Road) near Nye/White Pine County Line (Nye County)	c	1,050	A
State Route 375			
0.8 kilometers (0.5 miles) west of State Route 318 at Crystal Springs (Warm Springs Road) (Lincoln County)	d	210	A
61 meters (200 feet) south of U.S. Highway 6 (Warm Springs Road) (Nye County)	e	150	A
U.S. Highway 6			
61 meters (200 feet) west of State Route 375 (Warm Springs Road) (Nye County)	f	290	A
U.S. Highway 95			
0.3 kilometer (0.2 mile) south of U.S. Highway 6 in Tonopah (Nye County)	g	5,550	C
At the Nye-Esmeralda county line south of Tonopah (Esmeralda County)	h	2,100	B
Just south of the town of Goldfield (Esmeralda County)	i	1,950	B
0.2 kilometer (0.1 mile) south of State Route 266 at Lida Junction (Esmeralda County)	j	2,150	B
1.6 kilometers (1 mile) north of State Route 374 (Death Valley Road) (Nye County)	k	2,400	B
0.2 kilometer (0.1 mile) south of State Route 374 (Death Valley Road) (Nye County)	l	3,400	B
0.3 kilometer (0.2 mile) north of State Route 373 (Nye County)	m	2,600	B

a. Source: DIRS 178749-NDOT [n.d.], all.
b. See Figure 3-114 for location of traffic counts.

3.2.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes the affected environment for occupational and public health and safety related to construction and operation of a railroad along the Caliente rail alignment. Section 3.2.10.1 describes the nonradiological, radiological, and transportation regions of influence; Section 3.2.10.2 describes the nonradiological health and safety environment; Section 3.2.10.3 describes the radiological transportation health and safety environment; Section 3.2.10.4 describes ***background radiation*** in the vicinity of the Yucca Mountain Site; and Section 3.2.10.5 describes the nonradiological transportation health and safety environment.

The radiological health and safety environment discussion is related to the impact analyses of public and occupational ***exposure to radiation***. The nonradiological health and safety environment discussion is related to the occupational health and safety impact analysis, including occupational incidents affecting construction and operations workers resulting from workplace physical hazards, exposure to nonradiological ***hazardous chemicals***, and exposure to other nonradiological hazards (such as biological hazards). The nonradiological transportation health and safety environment discussion relates to the nonradiological transportation impact analysis, which includes impacts to workers and the public from roadway and railway transportation accidents other than accidents involving releases of ***radiation***.

3.2.10.1 Region of Influence

3.2.10.1.1 Nonradiological Region of Influence

The region of influence for occupational nonradiological impacts includes:

- The nominal width of the Caliente rail alignment construction right-of-way
- Public roads in Lincoln, Nye, and Esmeralda Counties that the proposed railroad workforce would use during railroad construction and operations
- Rail line construction and operations support facilities including access roads, water wells, and quarries, where workers would perform construction, operations, or maintenance activities; operations support facilities include the following:
  - Interchange Yard
  - Staging Yard
  - Maintenance-of-Way Headquarters Facility
  - Maintenance-of-Way Trackside Facility
  - Satellite Maintenance-of-Way Facilities
  - Rail Equipment Maintenance Yard
  - Cask Maintenance Facility
  - ***Nevada Railroad Control Center*** and National Transportation Operations Center

- Construction support facilities include the following:
  - Quarries
  - Concrete batch plants
  - Construction camps
  - Water wells

The region of influence for occupational nonradiological impacts includes public roads upon which the proposed workforce would travel and the rail line right-of-way and construction and operations support facilities where the proposed workforce would work.

3.2.10.1.2 Radiological Region of Influence

The region of influence for radiological impacts to members of the public during ***incident-free transportation*** includes the area 0.8 kilometer (0.5 mile) on either side of the centerline of the Caliente rail alignment, which, for purposes of analysis, includes operation of cask trains and repository construction and supplies trains from Caliente or Eccles to the Rail Equipment Maintenance Yard.

The region of influence for occupational radiological impacts during incident-free operation includes the physical boundaries of railroad operations support facilities, where workers would perform activities involving the transportation of ***spent nuclear fuel*** and ***high-level radioactive waste***. Operations support facilities within the radiological region of influence include only the Interchange Yard, the Staging Yard, the Rail Equipment Maintenance Yard, and the Cask Maintenance Facility because DOE anticipates that the potential for workers to be exposed to ***ionizing radiation*** from ***radioactive*** materials will occur only at those facilities. Radioactive materials would not be handled at the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Headquarters Facility, the Satellite Maintenance-of-Way Facilities, or the Maintenance-of-Way Trackside Facility. Radioactive materials also would not be handled at any of the construction support facilities.

For purposes of this Rail Alignment EIS, the affected environment for radiological impacts to members of the public in relation to incident-free transportation includes:

- Residents within the region of influence of the Caliente rail alignment, including persons who live within 0.8 kilometer (0.5 mile) of either side of the centerline of the rail alignment from Caliente or Eccles to the Rail Equipment Maintenance Yard. For this analysis, DOE evaluated four specific alignments: the alignment that would have the largest exposed population, the shortest alignment, the longest alignment, and the alignment with the smallest exposed population (Table 3-67). Affected populations for the four evaluated alignments would include:
  - Populations within 0.8 kilometer of either side of the centerline of the rail alignment. These populations are based on 2000 Census data.
  - Populations within 0.8 kilometer of the Interchange Yard and the Staging Yard. These populations are also based on 2000 Census data. Based on the three possible locations of the Staging Yard, DOE anticipates that there could be members of the public within the region of influence for the facility. Affected populations within 0.8 kilometer of the Interchange Yard and Staging Yard footprint for the three locations would include:
    - The population around Eccles-North location for the Staging Yard
    - The population around Caliente-Indian Cove location for the Staging Yard
    - The population around Caliente-Upland location for the Staging Yard
  - Individuals at locations such as residences or businesses near the rail alignment.

For radiological accidents and sabotage, the populations within the region of influence are based on the population within 80 kilometers (50 miles) on either side of the centerline of the rail alignment. These populations are based on 2000 Census data. DOE based this region of influence on that described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 6-24).

3.2.10.1.3 Transportation Region of Influence

The region of influence for transportation includes public roadways in the vicinity of the Caliente rail alignment, and the Caliente rail alignment itself. The region of influence for public nonradiological transportation impacts includes public roads and the rail line right-of-way in relation to potential roadway and railway nonradiological transportation accidents that could involve the public.

Table 3-67. Alignments evaluated for radiological impacts to members of the public.[a]

Alignment with the largest population	Alignment with the smallest population	Longest alignment	Shortest alignment
279 people	78 people	112 people	213 people
335 miles	329 miles	336 miles	328 miles
Caliente alternative segment	Eccles alternative segment	Eccles alternative segment	Caliente alternative segment
Caliente common segment 1	Caliente common segment 1	Caliente common segment 1	Caliente common segment 1
Garden Valley alternative segment 2	Garden Valley alternative segment 3	Garden Valley alternative segment 3	Garden Valley alternative segment 1
Caliente common segment 2	Caliente common segment 2	Caliente common segment 2	Caliente common segment 2
South Reveille alternative segment 3	South Reveille alternative segment 2	South Reveille alternative segment 3	South Reveille alternative segment 2
Caliente common segment 3	Caliente common segment 3	Caliente common segment 3	Caliente common segment 3
Goldfield alternative segment 4	Goldfield alternative segment 1	Goldfield alternative segment 4	Goldfield alternative segment 1
Caliente common segment 4	Caliente common segment 4	Caliente common segment 4	Caliente common segment 4
Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3	Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3
Common segment 5	Common segment 5	Common segment 5	Common segment 5
Oasis Valley alternative alignment 3	Oasis Valley alternative alignment 1	Oasis Valley alternative alignment 3	Oasis Valley alternative alignment 1
Common segment 6	Common segment 6	Common segment 6	Common segment 6

a. Populations based on 2000 Census data.

The region of influence for transportation is primarily in remote and rural areas, and there are no operating railroads along the Caliente rail alignment. Although the existing Union Pacific Railroad Mainline that serves southern Nevada is used as a point of comparison in Section 4.2.10, this Rail Alignment EIS does not assess the impacts to the Union Pacific Railroad Mainline.

During railroad construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. Most of the Caliente rail alignment would be within Nevada Department of Transportation District 1 and would cross Lincoln, Nye, and Esmeralda Counties. The region of influence focuses on the vicinity of the Caliente rail alignment, but also includes other roadways that DOE could use to supply materials, equipment, and workers during the construction phase. DOE recognizes that during construction, completed segments of the rail line could be used to transport goods and services to construction sites and camps.

3.2.10.2 Nonradiological Health and Safety Environment

Nonradiological occupational health safety considers potential recordable incidents, lost-time accidents, and worker fatalities resulting from potential exposure of workers to physical hazards and nonradiological hazardous chemicals in their work environment during railroad construction and operations. The affected environment for nonradiological occupational health and safety also includes potential occupational health effects from exposure to exhaust emissions from vehicles and heavy equipment, including, for example, earth-moving equipment.

Nonradiological public health and safety addresses potential exposure of members of the public to nonradiological chemical hazards and vehicle emissions that would result from railroad construction and operations. Section 3.2.4, Air Quality and Climate, and Section 3.2.8, Noise and Vibration, describe the affected environments for potential public exposure to criteria and nonradiological ***hazardous air pollutants***, including vehicle emissions, and potential exposure to noise and vibration from railroad construction and operations.

The types of potential nonradiological health and safety hazards to construction workers and operations and maintenance workers under the Proposed Action include:

- Incidents resulting from physical hazards, such as occupational injuries and illnesses resulting in reportable cases, ***lost workday cases***, and fatalities. Fatalities could occur on or off the work site as a result of an incident or illness experienced on the work site. Physical hazards could include the potential for falls, excavation and confined-space entry hazards, mechanical hazards, electrical hazards, ergonomic hazards, and heavy construction equipment (not passenger vehicles) hazards, and illnesses related to workplace exposure to chemical hazards.
- Off-site vehicle emissions-related health effects, such as health effects related to off-site vehicular emissions from transportation of construction workers, equipment, and materials and wastes to and from the construction sites.
- On-site vehicle and heavy equipment-related health effects, such as health effects related to diesel-engine exhaust emissions from vehicles and heavy-equipment operated by construction workers on the construction sites. These health effects encompass workers who could be exposed to vehicular and heavy equipment emissions.
- Incidents resulting from other nonradiological chemical hazards, such as occupational exposure to chemicals (such as solvents and lubricants), dust (such as silica dust), and other nonradiological substances from railroad construction and operations. The U.S. Department of Labor Bureau of Labor Statistics incident rates include occupational illnesses and fatalities that could result from nonradiological chemical exposure. However, the Bureau of Labor Statistics incident rates do not include a breakdown by incident type (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).
- Noise hazards, such as short-term or long-term occupational exposure to noise that could impair hearing.
- Biological hazards that workers could encounter, such as venomous animals, West Nile Virus, valley fever, Hantavirus, and rabies.

3.2.10.3 Radiological Health and Safety Environment

There are ambient levels of radiation in the vicinity of the Caliente rail alignment, just as there are around the world. All people are inevitably exposed to the three sources of ionizing radiation: sources of natural origin unaffected by human activities, sources of natural origin but affected by human activities (called enhanced natural sources), and manmade sources. Natural sources (natural background radiation) include ***cosmic radiation*** from space, ***cosmogenic radionuclides*** produced when cosmic radiation interacts with matter in the atmosphere or ground, and naturally occurring, long-lived ***primordial radionuclides*** in the Earth's mantle. Enhanced natural sources include those that can increase exposure as a result of human actions, deliberate or otherwise. For example, a mill tailings pile from a uranium extraction process probably would contain concentrated levels of naturally occurring ***radionuclides***. A variety of radiation exposures, generally smaller than those caused by natural sources, result from manmade sources including nuclear medicine, medical ***X-rays***, and consumer products.

Natural background radiation is the largest contributor to the average radiation dose of individuals. The natural occurrence of cosmic radiation, cosmogenic radionuclides, and primordial radionuclides varies throughout the world depending on such factors as altitude and geology. External radiation comes from all three of these natural sources, but cosmic radiation and radiation from primordial radionuclides are the largest contributors to dose. Cosmic radiation consists of charged particles (primarily protons from extraterrestrial sources) that have sufficiently high energies to generate secondary particles that have direct and indirect ionizing properties. The three main primordial radionuclide contributors to external terrestrial gamma radiation are potassium-40 and the members of the thorium and uranium ***decay series***. Most external terrestrial gamma radiation comes from the top 20 centimeters (8 inches) of soil, with a small contribution from airborne radon ***decay*** products.

Internal radiation dose from natural sources comes primarily from the primordial radionuclides and their ***decay products***. The largest individual source of internal dose comes from the inhalation of radon-222 and its decay products, which are all members of the uranium-238 decay series. This exposure comes mainly from inhalation of these radionuclides in indoor air, coming from the soil underneath buildings. All of the primordial radionuclides are in the body in various concentrations, incorporated by ingesting or inhaling these radionuclides in air, water, and all types of food products. Although of smaller importance to natural internal dose than the other mechanisms, four cosmogenic radionuclides, tritium (hydrogen-3), beryllium-7, carbon-14, and sodium-22, produce quantifiable internal doses. Table 3-68 lists estimated radiation doses to individuals from natural sources in the region of influence and other locations in the United States. The radiation doses shown in the table are in terms of ***effective dose equivalent***, which is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body. Effective ***dose equivalent*** has units of ***rem***.

Sources of Radiation Exposure

Nationwide, on average, members of the public are exposed to approximately 360 millirem per year from natural and manmade sources. The relative contributions by radiation source to people living in the United States are (DIRS 155970-DOE 2002, p. F-4):

- Radon in homes and buildings: 200 millirem per year
- Medical radiation: 53 millirem per year
- Internal radiation from food and water: 40 millirem per year
- Terrestrial (external radiation from rocks and soil): 28 millirem per year
- Cosmic (external radiation from outer space): 27 millirem per year
- Consumer products: 10 millirem per year
- Other sources: Less than 1 millirem per year

Table 3-68 lists the background radiation results for Tonopah, Las Vegas, Goldfield, Beatty, Caliente, and Town of Amargosa Valley. DOE obtained cosmic and terrestrial background radiation for these Nevada locations from the Desert Research Institute Community Environmental Monitoring Program (DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all) and are based on radiological monitoring data from September 1999 through 2006. The average background radiation for the United States, including terrestrial and cosmic radiation, radon exposure, and natural radiation in the body, is 300 millirem per year, with radon exposure comprising 200 millirem per year, cosmic and terrestrial radiation comprising 55 millirem per year, and natural body radiation comprising 39 millirem per year (DIRS 100473-National Research Council 1990). The background radiation for Las Vegas (the closest large city to the Caliente rail alignment region of influence) is 328 millirem per year, with cosmic and terrestrial radiation doses resulting in a slightly higher total annual dose than the average for the United States (DIRS 179137-CEMP 2006; DIRS 179138-CEMP 2006; DIRS 179139-CEMP 2006; DIRS 179140-CEMP 2006; DIRS 179141-CEMP 2006; DIRS 179142-CEMP 2006). The background radiation for the reported locations within the region of influence range from 328 millirem per year to 390 millirem per year. Background data include background radiation resulting from fallout.

The Yucca Mountain FEIS includes a detailed discussion (DIRS 155970-DOE 2002, pp. 3-95 to 3-101) of the natural radiation levels, mineral-related radiation risks, and historical activities in the Yucca Mountain region that might have resulted in radiation effects to workers and the public.

Table 3-68. Radiation exposure from natural sources.

	Annual dose in millirem (effective dose equivalent)							
Source[b]	National	Tonopah	Las Vegas	Caliente	Beatty	Amargosa Valley	Goldfield	Yucca Mountain
Cosmic and terrestrial	55	143	88[a]	133[a]	150[a]	107[a]	130[a]	160[a]
Radon in homes (inhaled)[c]	200	200	200	200	200	200	200	200
Naturally occurring radiation in the body	39	39	39	39	39	39	39	39
Totals[d]	300	382	327	372	389	346	369	399

a. Combined cosmic and terrestrial radiation sources.
b. Sources: DIRS 100473-National Research Council 1990, p. 18, Table 1-3; DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all.
c. Value for radon is an average for the United States.
d. Totals might differ from sums of values due to rounding.

Radiation: Radiation is energy travelling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. In this Rail Alignment EIS the word "radiation" refers to ionizing radiation. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.

Cosmic radiation: A variety of high-energy particles including protons that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level where the Earth's atmosphere is most dense and provides the greatest protection.

Cosmogenic radionuclides: Radioactive nuclides generated when the upper atmosphere interacts with many of the cosmic radiations. Despite their short half-lives, they are found in nature because their supply is always being replenished.

Decay product: A nuclide resulting from the radioactive decay of a parent isotope or precursor nuclide. The decay product might be stable or it might decay to form a decay product of its own.

Decay series: The succession of elements initiated in the radioactive decay of a parent, as thorium or uranium, each of which decays into the next until a stable element, usually lead, is produced.

Effective dose equivalent: Often referred to simply as dose, it is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body.

Half-life: The time in which half the atoms of a radioactive substance decay to another nuclear form. Half-lives range from millionths of a second to billions of years depending on the stability of the nuclei.

Primordial radionuclides originate mainly from the interiors of stars and are still present because their half-lives are so long that they have not yet completely decayed.

3.2.10.4 Background Radiation at the Yucca Mountain Site

Ambient radiation levels from cosmic and terrestrial sources in the Yucca Mountain region are higher than the United States average. The higher elevation at Yucca Mountain results in higher levels of cosmic radiation because there is less ***shielding*** by the atmosphere. The United States average for cosmic and terrestrial radiation exposures is 55 millirem per year (DIRS 100473-National Research Council 1990, p. 18, Table 1-3). The exposures at the Yucca Mountain ridge and Yucca Mountain surface facilities are about 160 and 150 millirem per year, respectively. Moreover, there are higher amounts of naturally occurring radionuclides in the soil and parent rock of this region than in some other regions of the United States, which also results in higher radiation doses.

3.2.10.5 Transportation Health and Safety Environment

3.2.10.5.1 Public Roadways

Because the region of influence includes public roads primarily located in remote and rural areas, the Caliente rail alignment would cross areas with relatively low traffic volumes. Section 3.2.9, Socioeconomics, describes the public-road infrastructure and baseline traffic conditions along the Caliente rail alignment in more detail. In summary, the Caliente rail alignment would cross paved highways with low traffic volumes and unpaved roads with low traffic volumes. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these unpaved roads are not heavily traveled.

Table 3-69 lists the paved highways the Caliente rail alignment would cross. Figure 2-4 shows the locations of these crossings (DIRS 176165-Nevada Rail Partners 2006, Table D-1). Additionally, the primary paved highways near the Caliente rail alignment are U.S. Highway 93 and State Route 318 in the eastern portion of the rail alignment; State Route 375 in the central portion; and U.S. Highway 95 in the western portion. Overall highway safety statistics for Nevada show that the fatality rate per 100 million vehicle-miles traveled is approximately 1.28 (1.65 in rural areas). The national average is approximately 40 percent lower at 0.91 fatalities per 100 million vehicle-miles traveled (1.42 in rural areas) (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2).

Table 3-69. Potential rail line crossings of main highways.

Segment	Highway	County
Caliente and Eccles alternative segments; Caliente common segment 1	U.S. Highway 93	Lincoln
Caliente common segment 1	State Route 318	Lincoln
Caliente common segment 2	State Route 375	Nye
Goldfield 4 alternative segment	U.S. Highway 95 (at two locations)	Esmeralda

3.2.10.5.2 Railroad Accidents

This section describes the general characteristics of railroad accidents in the United States and in the State of Nevada. DOE commissioned a railroad study – *The Nevada Railroad System: Physical, Operational, and Accident Characteristics* (DIRS 104735-YMP 1991, all) (the Nevada railroad study), which covers the period between 1979 and 1988. Because the number of annual rail-related accidents and incidents in Nevada is very small, it is difficult to draw conclusions about how the safety of rail operations in Nevada has changed since 1988. However, the study is the most comprehensive and relevant rail accident study to date regarding the State of Nevada and it provides some insights into the general characteristics of rail accidents in Nevada and the United States. The study presented information on types, causes, and frequency of railroad accidents; accident locations; and some of the more significant accidents from 1979 through 1988. The important findings of the Nevada railroad study were:

- Numbers and types of accidents. During the study period, the numbers of reported rail accidents in Nevada and the entire United States were 208 and 48,256, respectively. The most common accident types for Nevada and the rest of the United States were derailment and rail–highway crossing collision.
- Causes of rail accidents. Track/roadbed conditions caused proportionately more accidents in the rest of the United States than in Nevada, and mechanical/electrical failure caused proportionately more accidents in Nevada than in the rest of the United States. Nevada showed a higher proportion of its reported accidents in the higher speed ranges than did the rest of the Nation.
- Speeds at times of accidents. In general, most rail accidents happened at very low speeds. Approximately half of all reported accidents in Nevada occurred at speeds of 16 kilometers (10 miles) per hour or less, and 40 percent of all accidents in Nevada were at 8 kilometers (5 miles) per hour or less. Nationally, 73 percent of all accidents occurred at 16 kilometers per hour or less, and 53 percent of all rail accidents occurred at 8 kilometers per hour or less.
- Elapsed time on duty. The Nevada railroad study showed that about 45 percent of all accidents occurred within the first 4 hours on duty, approximately 41 percent occurred between 4 to 8 hours on duty, and approximately 14 percent occurred after 8 hours on duty.
- Weather and time of day. In Nevada, approximately 73 percent of all accidents reported occurred in clear weather, while approximately 19 percent occurred in cloudy weather. Rain, fog, and snow accounted for lower proportions. In Nevada, approximately half (49 percent) of all rail accidents occurred at night. Nationally, approximately 42 percent of all accidents occurred at night.
- Locations of accidents. The Nevada railroad study revealed that accidents occur at slightly higher rates at switchyard tracks.
- Rail–highway ***at-grade crossing*** accidents. Excluding the switching and handling incidents, rail accidents seemed to occur at random locations. The notable exception was rail–highway at-grade crossings. In the United States, rail–highway at-grade crossings in general were a higher accident location.
- Fatal rail accidents. Fewer accidents occurred at the higher speeds, but the chance that an accident, once it did occur, produced a fatality increased as speed increased. Comparing the total number of accidents at each speed interval to the total number of fatal accidents at each speed interval revealed that an accident occurring at above 97 kilometers (60 miles) per hour was 31 times more likely to cause a fatality than an accident occurring at 8 kilometers (5 miles) per hour or less.

With the exception of accident causes, the Nevada railroad study found that rail-accident characteristics in Nevada were not markedly different from rail-accident characteristics in the rest of the United States. The most apparent differences related to the relatively large proportion of Nevada rail lines in open country where higher operating speeds are maintained, compared to the United States as a whole. Most rail accidents, both in Nevada and in the rest of the United States, happened at very low speeds. Nevada showed a slightly higher number of high-speed accidents compared to the national average. The Nevada railroad study also showed that Nevada had a larger percentage of accidents caused by equipment failure and human factors and that for accidents involving only rail equipment, there were no classical "high" accident locations as there typically are with highway transport. Instead, minor accidents tended to happen in rail yards and during switching operations. More severe accidents, occurring at higher speeds on open track, seemed to happen at random.

Railroads are required by law to submit accident/incident reports within 30 days after the end of the month to which they pertain. The Federal Railroad Administration annually publishes *Railroad Safety Statistics*, which contains statistical data, tables, and charts based on railroad accident reporting. In this publication, the terms “accidents” and “incidents” are used to describe the entire list of reportable events, which includes collisions, derailments, and other events involving the operation of on-track equipment and causing reportable damage above an established threshold; impacts between railroad on-track equipment and highway users at crossings; and all other incidents or exposures that cause a fatality or injury to any person, or an occupational illness to a railroad employee. As defined in *Railroad Safety Statistics*, accidents/incidents are divided into three major groups for reporting purposes:

- Train accident. A safety-related event involving on-track rail equipment (both standing and moving), causing monetary damage to the rail equipment and track above a prescribed amount.
- Highway–rail grade crossing incident. Any impact between a rail and highway user (both motor vehicles and other users of the crossing) at a designated crossing site, including walkways, sidewalks, and the like, associated with the crossing.
- Other incident. Any death, injury, or occupational illness of a railroad employee that is not the result of a train accident or highway–rail incident.

Table 3-70 summarizes rail accident data from the *Railroad Safety Statistics – Annual Report 2004* for the years 2000 through 2004 (DIRS 178016-DOT 2005, pp.13 and 17). Accident and incidents rates are not available for Nevada because train mile data is only available on a nationwide basis.

The data listed in Table 3-70 reflect rail operations involving general freight service. ***Dedicated train*** service, which would be used to move cask railcars to the Yucca Mountain repository, would follow stringent safety regulations. Additionally, dedicated train service has increased control and command capabilities, because shorter trains allow better visual monitoring from the locomotive and the escort car. Therefore, accident and incident rates for dedicated train service are expected to be lower than the ones listed in Table 3-70.

Table 3-70. Rail accidents in Nevada and the United States (2000 through 2004).[a]

	2000	2001	2002	2003	2004
Train accidents (excluding highway–rail crossing incidents)					
Nevada	12	14	9	8	17
United States	2,983	3,023	2,738	2,997	3,296
Train accidents rate (accidents per train mile) (excluding highway–rail crossing incidents)					
Nevada	NA[b]	NA	NA	NA	NA
United States	4.1×10^{-06}	4.2×10^{-06}	3.8×10^{-06}	4.0×10^{-06}	4.3×10^{-06}
Total highway-rail incidents at public crossings[c]					
Nevada	1	2	1	1	2
United States	3,032	2,843	2,709	2,610	2,644
Total highway-rail incident rates (incidents per train mile) at public crossings[c]					
Nevada	NA	NA	NA	NA	NA
United States	4.2×10^{-06}	4.0×10^{-06}	3.7×10^{-06}	3.5×10^{-06}	3.4×10^{-06}

a. Source: DIRS 178016-DOT 2005, pp. 13 and 17.
b. NA = Not available.
c. Any impact, regardless of severity, between railroad on-track equipment and any user of a public or private crossing site must be reported to the U.S. Department of Transportation, Federal Railroad Administration, on Form F 6180.57. The crossing site includes sidewalks and pathways at, or associated with, the crossing. Counts of fatalities and injuries include motor vehicle occupants, people not in vehicles or on the trains, and people on the train or railroad equipment.

3.2.11 UTILITIES, ENERGY, AND MATERIALS

This section describes the affected environment for public-service utilities (water, wastewater treatment, telecommunications, and electricity), energy (fossil fuels), and construction materials within the Caliente rail alignment region of influence.

Section 3.2.11.1 describes the regions of influence for utilities, energy resources, and construction materials; Section 3.2.11.2 describes public-service utilities in the region of influence; Section 3.2.11.3 describes energy resources (not related to public-service utilities) in the region of influence; and Section 3.2.11.4 describes resources for construction materials in their regions of influence.

3.2.11.1 Regions of Influence

3.2.11.1.1 Regions of Influence for Utilities

The regions of influence for public water systems, wastewater treatment, telecommunications, and electricity differ and are described below.

- Public water systems: The region of influence for public water systems is Lincoln, Nye, and Esmeralda Counties and communities within those counties.
- Wastewater treatment**:** The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lincoln, Nye, and Esmeralda Counties and communities within those counties. (Note: For wastewater treated using other methods [for example, on-site portable wastewater-treatment facilities], DOE would recycle treated wastewater, and there is no associated region of influence.)
- Telecommunications: The region of influence for telephone and fiber-optic telecommunications is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Lincoln County Telephone System, Inc.
- Electricity: The region of influence for electric-power resources includes areas serviced by the southern Nevada electrical grid operated by Caliente Public Utilities, Lincoln County Power District No. 1, Nevada Power Company; Sierra Pacific Power Company; and Valley Electric Association, Inc.

3.2.11.1.2 Region of Influence for Energy Resources (Fossil Fuels)

The description of the affected environment for energy resources focuses on consumption of fossil fuels. For purposes of this analysis, the region of influence for fossil fuels is limited to regional suppliers within the State of Nevada.

3.2.11.1.3 Regions of Influence for Construction Materials

Construction materials include concrete, ballast, subballast, steel, steel rail, and general building materials. The region of influence for each material is defined by the distribution networks and suppliers of that material to the general project area.

The region of influence for cast-in-place concrete and subballast is limited to the State of Nevada. Subballast, sand, and gravel would be generated from available sources within the rail roadbed earthwork area, overburden at quarries and borrow sites near the rail alignment. There is a high likelihood DOE would also find subballast, sand, and gravel along cuts for the rail line on alluvial fans. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 176034-Shannon & Wilson 2006, pp. 24 to 26).

DOE would obtain ballast rock from potential quarry sites close to the rail line construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase.

Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete, could be procured and shipped on a national level. Therefore, the region of influence for these materials is national.

3.2.11.2 Utilities

3.2.11.2.1 Utility Corridors and Rights-of-Way

Section 3.2.2, Land Use and Ownership, describes the major utilities and utility corridor networks in the Caliente rail alignment region of influence.

3.2.11.2.2 Public Water Systems

Figure 3-115 shows the locations of ***public water systems*** in Lincoln, Nye, and Esmeralda Counties. There are more than 100 regulated public water systems in these counties, including the 31 ***community water systems*** listed in Table 3-71.

Within the Caliente rail alignment region of influence, public water systems are generally in or near the City of Caliente, and the unincorporated towns of Town of Armargosa Valley, Beatty, and Pahrump. In addition, although not a community water system, the Yucca Mountain Site has a regulated public water system (NV0000867). This system is classified as a ***non-transient, non-community public water system***.

> **Public water system:** A water system that provides water for human consumption for an average of at least 25 persons per day (or 15 or more service connections) and is in use for at least 60 days each year.
>
> **Community water system:** A public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.
>
> **Non-transient, non-community water system:** A public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.
>
> Source: 40 CFR 141.2.

3.2.11.2.3 Wastewater-Treatment Facilities

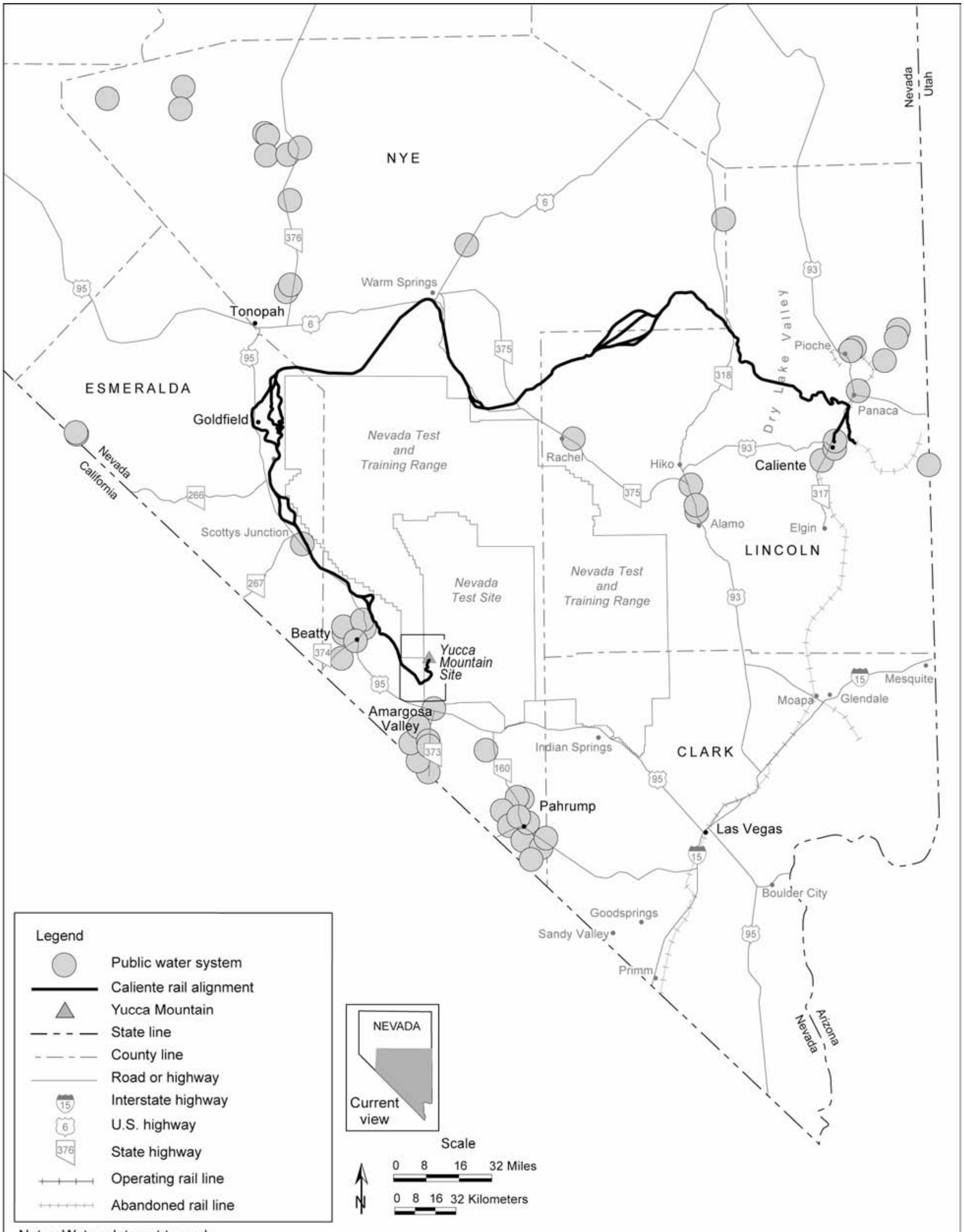
DOE would treat wastewater using municipal wastewater-treatment facilities, on-site portable wastewater-treatment facilities (***package plants***), or a combination of the two.

Most communities in southern Nye County rely primarily on individual dwelling or small communal wastewater-treatment systems, with the exception of Beatty, which has municipal sewer service. For example, Pahrump has no community-wide wastewater-treatment system. Several wastewater-treatment units serve parts of the town, such as the dairy and the jail, but most households have septic-tank and drainage-field systems, which are likely to be typical of the small communities in southern Nye County.

Municipalities with wastewater-treatment facilities include Caliente, Goldfield, Beatty, Tonopah, and Round Mountain. Table 3-72 lists the capacity of each system and the current load.

In 2003, a grant from the U.S. Department of Agriculture, Rural Development Nevada, allowed the City of Caliente, in Lincoln County, to complete the rehabilitation of its wastewater-collection system. Infiltration to the collection line and overflows to sewage treatment ponds made this rehabilitation necessary (DIRS 173561-USDA 2004, p. 9).

In Esmeralda County, Goldfield's sewage collection system was built in the 1940s and 1950s, and some of the system's original terra-cotta pipes are deteriorating. There are two lagoons, each 4,000 square meters (1 acre) in area, and a rapid infiltration system 1.6 kilometers (1 mile) north of Goldfield.



Note: Water plots not to scale.
Source: DIRS 176685-BHPS 2004, all.

Figure 3-115. Public water systems in Lincoln, Esmeralda, and Nye Counties.

Table 3-71. Community water systems in Lincoln, Nye, and Esmeralda Counties.[a]

County	Public water supply identification number	Name
Lincoln	NV0000005	Alamo Sewer and Water
	NV0000013	Caliente Public Utilities
	NV0000185	Panaca Farmstead Water Association
	NV0000186	Pioche Public Utilities
	NV0000187	Pioche Public Utilities Castelton
Nye	NV0002558	Amargosa Valley Water Association
	NV0005033	Anchor Inn Mobile Home Park
	NV0000009	Beatty Water and Sanitation District
	NV0000362	Big Five Parks
	NV0000369	Big Valley Mobile Home Park
	NV0002538	C Valley Mobile Home Park
	NV0002589	Calvada North, Utilities Inc. of Central Nevada
	NV0000218	Carver Smokey Valley Recreational Vehicle and Mobile Home Park
	NV0005032	Country View Estates, Utilities Inc. of Central Nevada
	NV0000831	Desert Mirage Home Owners Association
	NV0000300	Desert Utilities
	NV0002552	Escapee Co-Op of Nevada
	NV0000063	Gabbs Water System
	NV0004074	Hadley Subdivision
	NV0000926	Hafen Ranch Estates
	NV0000175	Manhattan Town Water
	NV0000920	Mountain Falls Water System
	NV0005067	Mountain View Mobile Home Park, Utilities Inc. of Central Nevada
	NV0000183	Pahrump Mobile Home Park
	NV0005028	Shoshone Estates Water Company
	NV0000359	Shoshone Water Company
	NV0005066	Sunset Mobile Home Park
	NV0000237	Tonopah Public Utilities
	NVU0000270	Utilities Inc. of Central Nevada
Esmeralda	NV0000072	Goldfield Town Water
	NV0000363	Silver Peak Water System

a. Source: DIRS 176686-BHPS 2004, all.

Table 3-72. Municipal wastewater-treatment facilities in the Caliente rail alignment region of influence.

Location	Capacity (liters per day)[a]	Existing load (liters per day)
Alamo, Lincoln County	260,000[b]	230,000[b]
Caliente, Lincoln County	1,500,000[b]	980,000[b]
Panaca, Lincoln County	150,000[b]	300,000[b]
Pioche, Lincoln County	340,000[b]	340,000[b]
Beatty, Nye County	570,000[b]	420,000[b]
Gabbs, Nye County	190,000[b]	190,000[b]
Tonopah, Nye County	3,800,000[b]	1,600,000[b]
Round Mountain (Hadley Subdivision), Nye County	610,000[c]	260,000[c]
Goldfield, Esmeralda County	170,000[b]	114,000[b]

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 178590 U.S. EPA 1999, all.
c. Source: DIRS 178697-Kaminski 2003, all.

The community has recently been awarded a $3 million grant under the Water Resource Development Act of 2000 (114 Stat. 2472) to renovate and upgrade the system. These renovations will allow Esmeralda County to increase the number of users served by its sewer system (DIRS 174751-Arcaya 2005, all).

3.2.11.2.4 Telecommunications Services

Local telephone service in the Caliente rail alignment region of influence is provided by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Lincoln County Telephone System, Inc. (DIRS 173401-Nevada Telecommunications Association 2005, all). One or more broadband providers (such as Comcast Cable and Bandwidth T1) serve Caliente, Tonopah, Goldfield, and Amargosa Valley (DIRS 176453-FCC 2005, pp. 348 to 350).

3.2.11.2.5 Electrical Services

Nevada Power Company is the electric utility serving most customers in southern Nevada, covering a territory of 12,000 square kilometers (4,600 square miles). Its customer base includes approximately 630,000 residential and 84,000 commercial or industrial accounts (DIRS 172302-Nevada Power Company 2004, all). The utility has 2,200 megawatts of generating capacity and purchases additional power to meet peak load demands of 5,800 megawatts. Nevada Power Company forecasts a 1.8 percent average annual rate of growth in peak-load demand through 2020. Total electricity sales in 2005 were 19 million megawatt-hours (DIRS 173383-Nevada State Office of Energy 2005, p. 23).

Sierra Pacific Power Company serves 330,000 electricity customers in a 130,000-square-kilometer (50,000-square-mile) territory that encompasses Carson City, Reno, Winnemucca, Elko, and Tonopah in Nevada, as well as the Lake Tahoe area in northeastern California (DIRS 173382-Sierra Pacific Power 2005, all). The utility has 1,100 megawatts of generating capacity and purchases additional power to meet peak load demands of 1,900 megawatts. Sierra Pacific Power Company forecasts a 1.6 percent average annual rate of growth in peak-load demand through 2020. Total electricity sales in 2005 were 8.8 million megawatt-hours (DIRS 173383-Nevada State Office of Energy 2005, p. 9). Both Nevada Power Company and Sierra Pacific Power Company are wholly owned subsidiaries of Sierra Pacific Resources.

Valley Electric Association, Inc., and Lincoln County Power District No. 1 are members of the Nevada Rural Electric Association. Nevada Rural Electric Association members are customer-owned, not-for-profit electric utilities with no generating capacity. They purchase power from other sources to supply rural customers.

Valley Electric Association, Inc., distributes power to southern Nye County, including the Pahrump Valley, Amargosa Valley, Beatty, and the Nevada Test Site. The Western Area Power Administration allocates a portion of the lower-cost hydroelectric power from the Colorado River dams to Valley Electric Association, Inc. The private power market supplies the supplemental power necessary to meet the needs of the members. Valley Electric Association, Inc., sells about 400,000 megawatt-hours to more than 15,000 members (DIRS 173383-Nevada State Office of Energy 2005, p. 39).

Lincoln County Power District No. 1 is a general improvement district that supplies power to about 800 customers, totaling more than 72,000 megawatt-hours per year (DIRS 173383-Nevada State Office of Energy 2005, p. 40). Its maximum peak load has been 16 megawatts. All of this power normally comes from the Hoover Dam, although a supplemental agreement with Nevada Power Company allows Lincoln County Power District No. 1 to buy extra energy when Colorado River levels are too low to support demand. Although demand has remained relatively steady over the past several years (growing by 1 to 2 percent per year), Lincoln County Power District No. 1 has plans to increase long-term supply by buying into the planned coal-fired Intermountain Power Project plant in Delta, Utah. This plant could be running as early as 2010, and Lincoln County would purchase 15 megawatts of additional capacity (DIRS 175509-Kahn 2005, all).

A small municipal utility, Caliente Public Utilities, purchases and then resells electricity to customers in Caliente. It sells less than 10,000 megawatt-hours annually and the reported peak load demand is 3 megawatts (DIRS 173383-Nevada State Office of Energy 2005, p. 39).

3.2.11.3 Energy

Existing fossil-fuel supplies within the Caliente rail alignment region of influence are available from nearby communities, mainly from relatively highly populated towns such as Tonopah, and along busy highways, such as on U.S. Highway 6 between Warm Springs and Tonopah. The regional supply system can respond flexibly to demand. Table 3-73 lists sales of distillate fuel oils (diesel fuel) in Nevada from 1997 through 2004. Fuel consumption remained fairly constant through 2003. The recent upward trend reflects current population growth in southern Nevada as a key determinant of total energy consumption closely linked to rising demand for housing, services, and travel.

Table 3-73. Sales of distillate fuel oils in Nevada, 1997 through 2004.

Year	Annual sales of distillate fuel oils (millions of liters)[a]
1997	1,640[b]
1998	1,530[b]
1999	1,580[c]
2000	1,620[c]
2001	1,550[d]
2002	1,580[d]
2003	1,510[e]
2004	1,810[e]

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 178588-EIA 1999, Table 4
c. Source: DIRS 178609-EIA 2001, Table 4.
d. Source: DIRS 173384-EIA 2003, Table 4.
e. Source: DIRS 176397-EIA 2005, Table 4.

3.2.11.4 Construction Materials

Most of the Caliente rail alignment area is in the remote Nevada countryside, but is within the southern Nevada supply chain for construction materials.

The region of influence for cast-in-place concrete is the State of Nevada, where annual production in 2004 equaled approximately 16 million metric tons (18 million tons) (DIRS 173400-NRMCA 2004, p. 2).

Precast concrete is available nationally, and annual national production in 2003 equaled approximately 15 million metric tons (17 million tons) (DIRS 173392-van Oss 2003, Table 15). Annual national production of pre-cast concrete railway ties was about 720,000 ties in 2004 and is projected to grow to about 1,180,000 ties by 2007 (DIRS 173573-Gauntt 2004, p. 17).

Ballast for rail roadbed construction is generally obtained locally because of the costs associated with transporting large volumes of these materials. Within the Caliente rail alignment region of influence there are large areas of public lands that contain materials suitable for use as ballast. DOE has identified six potential quarry sites near the Caliente rail alignment (see Chapter 2, Table 2-16) of which the Department could develop up to four. However, if DOE selected the Eccles alternative segment, there would not be a suitable quarry location available along this portion of the rail alignment and the Department would have to obtain ballast from an existing commercial quarry – which most likely would be the nearest active quarry, at Milford, Utah, approximately 200 kilometers (120 miles) east of Caliente. Following construction, the DOE-developed quarries would be closed. During the operations phase, DOE would obtain ballast for track maintenance commercially. Again, the nearest active quarry to the region of influence is the Milford Quarry. The Milford Quarry is on the Union Pacific Railroad route that travels from Salt Lake City, Utah, to Los Angeles, California, and processes much of the high-quality ballast for the Union Pacific Railroad lines throughout the southwest. There is an active quarry at Oroville, California, approximately 650 kilometers (400 miles) west-northwest of Caliente, which is a commercial source of ballast in the western United States. Suitable sands and gravels would likely be available along cuts for the rail line and from overburden at potential quarry rock and borrow sites.

The steel market is worldwide in scope, but the region of influence DOE considered for steel supply is national. Raw production of carbon steel in the United States in 2003 equaled 86 million metric tons (95 million tons) (DIRS 173387-Fenton 2003, Table 1). Steel rail production equaled 540,000 metric tons (600,000 tons) in 2002 and 520,000 metric tons (570,000 tons) in 2003 (DIRS 173387-Fenton 2003, Table 3).

3.2.12 HAZARDOUS MATERIALS AND WASTE

This section describes existing facilities in Nevada that could receive and dispose of ***hazardous waste*** derived from hazardous materials, ***low-level radioactive wastes***, and nonhazardous waste associated with constructing and operating the proposed railroad along the Caliente rail alignment. Section 3.2.12.1 describes the region of influence for hazardous materials and wastes. Section 3.2.12.2 describes landfills for the disposal of nonhazardous, nonrecyclable, nonreusable wastes; Section 3.2.12.3 describes disposal facilities for hazardous wastes; and Section 3.2.12.4 describes the disposal of low-level radioactive wastes. Hazardous materials DOE might use during construction and operation of the proposed railroad are described throughout Section 4.2.12.

Hazardous waste: Waste designated as hazardous by U.S. Environmental Protection Agency or State of Nevada regulations. Hazardous waste, defined under the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*), is waste that poses a potential hazard to human health or the environment when improperly treated, stored, or disposed of. Hazardous wastes appear on special Environmental Protection Agency lists or possess at least one of the following characteristics: ignitability, corrosivity, toxicity, or reactivity.

Low-level radioactive waste: Radioactive waste that is not classified as high-level radioactive waste, transuranic waste, or byproduct tailings containing uranium or thorium from processed ore. Usually generated by hospitals, research laboratories, and certain industries (42 U.S.C. 108).

3.2.12.1 Region of Influence

The region of influence for the use of hazardous materials and the generation of hazardous and nonhazardous wastes includes the nominal width of the rail line construction right-of-way, and the locations of railroad construction and operations support facilities.

The region of influence for the disposal of hazardous wastes includes the entire continental United States because commercial hazardous waste disposal vendors could utilize facilities throughout the country.

The region of influence for the disposal of nonhazardous waste includes the disposal facilities in Lincoln, Nye, Esmeralda, and Clark Counties in Nevada.

The region of influence for the disposal of low-level radioactive wastes includes DOE low-level waste disposal sites, sites in ***Agreement States***, and U.S. Nuclear Regulatory Commission-licensed sites.

Industrial and special wastes: Construction debris and other ***solid waste***, such as tires, that have specific management requirements for permitted landfill disposal.

Solid waste: For purposes of this analysis, defined as nonhazardous general household waste.

3.2.12.2 Nonhazardous Waste Disposal

DOE would dispose of nonhazardous, nonrecyclable, nonreusable wastes in municipal landfills in Nevada. Nevada has 23 operating municipal landfills that combined accept more than 12,700 metric tons (14,000 tons) of waste per day (DIRS 174663-State of Nevada 2005, Slide 5; DIRS 181625-Simpson 2007, all). According to the *Draft Solid Waste Management Plan* (DIRS 174041-State of Nevada 2004, p. 7), Nevada municipalities have ensured landfill capacity for decades into the future. Table 3-74 lists the capacities the Nevada Division of Environmental Protection reported in 2002 (DIRS 174041-State of Nevada 2004, Appendixes 2 and 3) for the active landfills in Lincoln, Nye, Esmeralda, and Clark Counties. All of these landfills have permits to accept ***industrial and special wastes***.

DOE would utilize a contractor for the disposition of recyclable materials.

Table 3-74. Capacities of active landfills in Lincoln, Nye, Esmeralda, and Clark Counties.[a]

County	Facility name[b]	Operator	Capacity (cubic meters)[c]	Per day disposal rate (metric tons)[d]	Projected closure (year)
Lincoln	Crestline Class II	Crestline Recycling and Disposal	550,000	20	2049
Nye	Round Mountain Class I Expansion	Nye County	540,000	10	2028
	Tonopah Class II	Nye County	120,000	15	2011
Esmeralda	Goldfield Class I	Esmeralda County	210,000	4	2023
Clark	Apex Regional Classes I and III	Republic Silver State	61,900,000	8,000	2147
	Laughlin Class I	Silver State Services	4,600,000	85	2019
Totals			67,920,000	8,134	

a. Source: DIRS 174041-State of Nevada 2004, Appendixes 2 and 3.
b. Class I landfills receive 18 metric tons or more of waste per day; Class II landfills receive less than 18 metric tons of waste per day; and Class III landfills receive only industrial waste. Each of these landfills accepts solid and industrial and special waste.
c. To convert cubic meters to cubic yards, multiply by 1.3079.
d. To convert metric tons to tons, multiply by 1.1023.

3.2.12.3 Hazardous Waste Disposal

The U.S. Ecology Treatment and Disposal Site in Beatty, Nevada, is a Nevada-permitted hazardous waste disposal site (DIRS 173918-American Ecology Corporation 2005, all). This facility treats and disposes of hazardous wastes and nonhazardous industrial wastes. Safety-Kleen Systems, Inc., operates a hazardous waste-permitted treatment, storage, and disposal facility in North Las Vegas, Nevada, and Philip Services Corporation operates a similar facility in Fernley, Nevada (DIRS 177662-NDEP 2006, all). Hazardous waste disposal capacity in western states has been estimated to be 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50).

3.2.12.4 Low-Level Radioactive Waste Disposal

Low-level radioactive wastes would be generated during operation of the Cask Maintenance Facility. DOE would control and dispose of site-generated low-level radioactive waste in a DOE low-level waste disposal site, a site in an Agreement State, or in a U.S. Nuclear Regulatory Commission-licensed site.

3.2.13 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470), as amended, requires federal agencies to take into account the effects of their undertakings on historic properties. The procedures established by the Advisory Council on Historic Preservation, described in 36 CFR Part 800, define how federal agencies meet these statutory responsibilities. The section 106 process seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation between the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess effects, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties.

Identification of sites eligible for listing on the *National Register of Historic Places* is a primary component of historical preservation work. Evaluation of archaeological sites with the purpose of determining National Register significance is accomplished through the application of eligibility criteria identified in 36 CFR Part 60, as follows:

> The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, material, workmanship, feeling and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

Prehistoric archaeological sites are most often found eligible under criterion (d), while archaeological sites containing historical deposits and some prehistoric sites are also often considered under other criteria. For example, ordinarily, cemeteries, birthplaces or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories: (a) a religious property deriving primary significance from architectural or artistic distinction or historical importance; (b) a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; (c) a birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life; (d) a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; (e) a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; (f) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or (g) a property achieving significance within the past 50 years if it is of exceptional importance.

Likewise, historic structures (as opposed to archaeological sites) are assessed under a variety of National Register criteria.

While nearly all sites have the potential to yield information useful in addressing a limited number of research questions, this limited potential is not considered sufficient to qualify a site for inclusion on the National Register under criterion (d). By establishing guidelines, agencies have clearly set the precedent that not all information is important, and thus, not all sites are important. Federal guidelines encourage the use of a set of research questions that are generally recognized as important research goals as a means of evaluating significance. If a site contains information that is demonstrably useful in answering such questions, it can be considered an important site. National Register evaluation guidelines state that a site must retain integrity to be considered eligible under one or more of the criteria.

The *National Register of Historic Places* describes buildings, structures, objects, sites, and districts that are at least 50 years old, or have achieved significance within the past 50 years. Archaeological resources are prehistoric or historic remains of human lifeways or activities that are at least 100 years old, and include artifact concentrations or scatters, whole or fragmentary tools, rock carvings or paintings, and buildings or structures. Resources that incorporate geographic areas, including both cultural and natural features, and that are associated with historic events or other cultural values include ***traditional cultural properties***, cultural landscapes (DIRS 174501-Birnbaum 1994, all), ***ethnographic landscapes*** (DIRS 155897-Parker and King 2002, all), rural historic landscapes (DIRS 155896-McClelland et al. 1990, all), and historic mining landscapes (DIRS 175489-Noble and Spude 1997, all).

For purposes of analysis in this Rail Alignment EIS, DOE has completed a sample inventory of the Caliente rail alignment alternative segments and common segments which provides a thorough characterization of the nature and distribution of resources along the rail alignment. The Department would perform an intensive cultural-resource inventory before starting construction of any specific alternative segment or common segment, and would compile a data recovery plan that would include prudent and feasible practices and measures to avoid or reduce potential adverse impacts to archaeological and historical resources.

This section focuses on cultural resources in the Caliente rail alignment region of influence, including those associated with the American Indian culture. Section 3.4 further identifies and discusses American Indian interests in the region. This section summarizes information obtained through a review of available data from federal, state, and local agencies, and findings of data-gathering efforts and field investigations.

Section 3.2.13.1 describes the region of influence for cultural resources along the Caliente rail alignment; Section 3.2.13.2 describes the methodology DOE used to identify such sources; Section 3.2.13.3 is a general description of the cultural resources setting and characteristics; Section 3.2.13.4 describes site-specific cultural resources; and Section 3.2.13.5 describes cultural resources for each Caliente alternative segment and common segment, including those associated with American Indian culture.

3.2.13.1 Region of Influence

The region of influence for the cultural resources analysis includes two levels of coverage that incorporate areas where construction or other land disturbances could directly or indirectly affect cultural resources:

- Level I – The first level of coverage is the nominal width of the construction right-of-way, the area where ground disturbance could have direct or ***indirect impacts*** on cultural resources. Under Section 106 of the National Historic Preservation Act, the Level I region of influence would comprise the project's Area of Potential Effect.
- Level II – The second level of coverage is a 3.2-kilometer (2-mile)-wide area centered on the rail alignment, and includes the area of potential disturbances that could have indirect impacts on cultural resources. Unless otherwise noted, references to historic and archaeological sites in the text that

follows refer to the Level II region of influence. For example, impacts could extend beyond this area where railroad operations and maintenance activities could have an aesthetic, auditory, or visual impact on a potentially significant historic or ***ethnographic*** vista.

3.2.13.2 Methodology

DOE prepared cultural resource documents to support the description of the affected environment and the impacts assessments for the Caliente rail alignment. For this analysis, the Department used the following methods to evaluate known and potential resources in the Caliente rail alignment region of influence:

- ***Class I inventory***. Reviewing existing cultural resource files, examining the literature, and interviewing knowledgeable people to identify potentially significant resources within the Level II region of influence of the alternative segments and common segments. DOE compiled the results into an historic context baseline report on cultural resources (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all) that establishes the basis for the analytical methodology and the results of the site-file and literature reviews. This report also lists all published and unpublished documents and archival sources DOE consulted during the analysis.
- ***Class II inventory***. Conducting a statistical sample field survey (DIRS 174691-BLM 1990, all) of the Level I region of influence for the alternative segments and common segments. The Class II inventory involved intensive inspection of 184 sample units that measured 122 meters (400 feet) by 800 meters (2,625 feet), centered on the rail alignment. This inventory was guided by a research design prepared in consultation with the BLM and State Historic Preservation Office and was designed to provide a 20-percent sample of the length of common segments and alternative segments. The results of this effort provide a predictive view of the possible types of cultural resources that might be expected to occur along the alternative segments and common segments and an evaluation of the possible significance of potential historic properties. To augment the Class II inventory and help to minimize later resource conflicts, DOE performed additional preliminary archaeological reconnaissance in locations of potential ballast quarries and areas of restricted construction right-of-way. The Class II survey report summarizes the results of this effort (DIRS 174689-HRA Conservation 2005, all).
- Consultation with American Indians with regional ties. Interactions with American Indian tribes and organizations that have ties to the region to identify traditional cultural places within the Level I and II regions of influence that are important to American Indian cultural and religious values and beliefs, and to identify other resources, such as plants and animals, that might have historic or current uses. The perspectives of American Indian tribes and organizations that have traditional ties to the region of influence are compiled in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all), which assesses American Indian interests.

As previously noted, DOE prepared cultural-resource reports to support the description of the affected environment and the impacts assessments for this Rail Alignment EIS. The reports include detailed information about the methods and investigative approaches DOE utilized and about evaluation of the findings. Preparation of the baseline resource reports involved consulting and citing a large number of published and unpublished sources, and contacting knowledgeable persons, institutions, and offices holding relevant data.

DOE is using a phased cultural-resource identification and evaluation approach, as described in 36 CFR 800.4(b)2, to identify specific cultural resources along a final alignment. Under this approach, DOE has completed Class I and Class II inventories of rail alignment alternative and common segments. The Department would perform final field surveys (the BLM Class III intensive inventories) of the actual right-of-way and centerline, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, p. 15). In the interim, the 20-percent Class II inventories have provided more than enough information to characterize the nature and distribution of cultural resources along the Caliente rail alignment alternative segments and common segments. Before starting any ground-disturbing activities that could affect cultural resources, the Department would perform the intensive ***Class III inventory*** of the selected alternative segments, site evaluations, impact assessments, and implement impacts reduction or prevention measures, as appropriate.

3.2.13.3 General Environmental Setting and Characteristics

Sections 3.2.13.3.1 through 3.2.13.3.4 summarize the prehistoric, American Indian, and Euroamerican cultural history of southern Nevada. Additional detail, including sources and references, is presented in the historic context report prepared in support of the Rail Alignment EIS. (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all).

3.2.13.3.1 Prehistoric Period

Native people inhabited the region that encompasses the Caliente rail alignment for thousands of years and left artifacts and traces of their settlement and subsistence patterns and religious beliefs. The prehistoric archaeological record in the vicinity of the Caliente rail alignment is subdivided into the following three cultural periods:

- Pre-Archaic (11,500 to 7,500 years before present). The Pre-Archaic cultural period is marked by relatively few people, who traveled in small bands hunting game and gathering food. Archaeological sites dating to this period are commonly preserved on gravel bars and other landforms associated with ***pluvial lakes***, marshes, and riparian zones. These sites and their artifacts indicate a reliance on wetlands, with an emphasis on hunting large game. Isolated finds of distinctive fluted points associated with the Clovis and Folsom groups of people have a wide but sporadic distribution throughout the region.
- Early to Middle Archaic (7,500 to 1,500 years before present). During the Early to Middle Archaic cultural period, a shift occurred to a wider use of the environment, including sites near springs, perennial streams, caves, and rockshelters. A gradual increase in populations was marked by the use of plant seeds and nuts, along with hunting small game. Seventeen rockshelters dating to this period and the Late Archaic period have been investigated in the vicinity of the Caliente rail alignment.
- Late Archaic (1,500 to 150 years before present). Hallmarks of the Late Archaic cultural period include ceramics and small projectile points, along with the bow and arrow. Settlement patterns and subsistence practices continued from the earlier period, with sites in a variety of settings but clustered around permanent springs and riparian settings.

3.2.13.3.2 American Indian Historic Period

The Caliente rail alignment would cross lands historically occupied by two indigenous ethnic groups, the Western Shoshone and the Southern Paiute. Other neighboring groups, such as the Owens Valley Paiute and Shoshones from adjacent regions, had strong kinship ties and occasionally visited the region.

Both the Western Shoshone and the Southern Paiute were characterized by local subgroups, defined by slight language or dialectical differences, traditional centers of residential occupation, more or less regular home ranges or districts, and closeness of kin ties. Local subgroups clustered around small oases scattered throughout the desert where springs and flowing streams could be found.

Mountains and surrounding valleys were important resource collection areas, but seasonal changes in food availability prevented areas from being occupied year-round. Figure 3-116 shows areas occupied by these subgroups.

The Caliente rail alignment would cross or be adjacent to the territories of several American Indian subgroups. Western Shoshone areas include the Oge'pi District near Beatty; the Piadoya District in the Kawich Range, extending into Stone Cabin Valley and Reveille Valley; the Lida-Goldfield area; and other subgroups in Ralston Valley, Hot Creek Valley, and Railroad Valley. The eastern part of the rail alignment was inhabited by two Southern Paiute subgroups, the Pahranagat of the Pahranagat Valley and Pahroc Range areas, and the Panaca of Meadow Valley Wash near the present-day City of Caliente and town of Panaca.

Following initial contact by European Americans in the early to middle 1800s, native people in central and southern Nevada began to adapt to changing conditions as settlement and development by miners, prospectors, and ranchers rapidly encroached on the landscape. As their essential resources were being lost to the Euroamerican expansion, both the Western Shoshone and the Southern Paiute were forced to confine their activities to selected reservations carved out of small portions of their traditional lands. Given the difficulties of making a living on these restricted areas, many responded by providing labor and other services to mining and ranching ventures, oftentimes living in mining towns or at ranches.
In the vicinity of the region of influence, there were Indian encampments at mining communities in the Beatty–Bullfrog, Goldfield, Tonopah, Reveille Valley, and Panaca–Pioche areas. There was another Western Shoshone village on the eastern side of Stone Cabin Valley, where American Indians worked as ranch hands and laborers for the Reeds Ranch and the Reeds United Cattle and Packing Company, which operated over 12,000 square kilometers (3 million acres) between 1906 and 1940. American Indian children attended small schools set up at places such as Reeds Ranch and the Reveille Mill.

3.2.13.3.3 Euroamerican Historic Period

Initial forays by European Americans (settlers and explorers) into the region of influence began in 1849 along the Jayhawker's Emigrant Trail to California, which the eastern part of the Caliente rail alignment would cross. The alignment would also cross areas of later exploratory surveys by Lt. John C. Fremont, in 1854, and Lt. George Wheeler, in 1869 and 1872.

Settlement of the area began with Mormon colonization of Meadow Valley and Pahranagut Valley in the eastern part of the rail alignment. These efforts began in the late 1850s and involved both mining, primarily for silver and gold, and agricultural developments. Another early mining center was developed in the Reveille Range in the 1860s, with a mill built in Reveille Valley in 1869. Later mining districts that developed in the early 1900s include the Freiberg District in the northern Worthington Mountains and the Harriman, Eden, Clifford, Horseshoe, Bellehellen, Golden Arrow, and Blake's Camp districts in the Kawich Range. Of these districts, only the Clifford District would be within the Caliente rail alignment region of influence, although resources that were common to mining, such as roads, might also be present. More extensive mining developments took place in the Goldfield area and in the vicinity of Beatty.

Contemporaneous with mining was widespread ranching that took advantage of the valley floors and adjacent mountain ranges for grazing of cattle and sheep. Within the Caliente rail alignment region of influence, early historic ranching operations are found in Reveille Valley, Stone Cabin Valley, and upper Oasis Valley along the Amargosa River drainage.

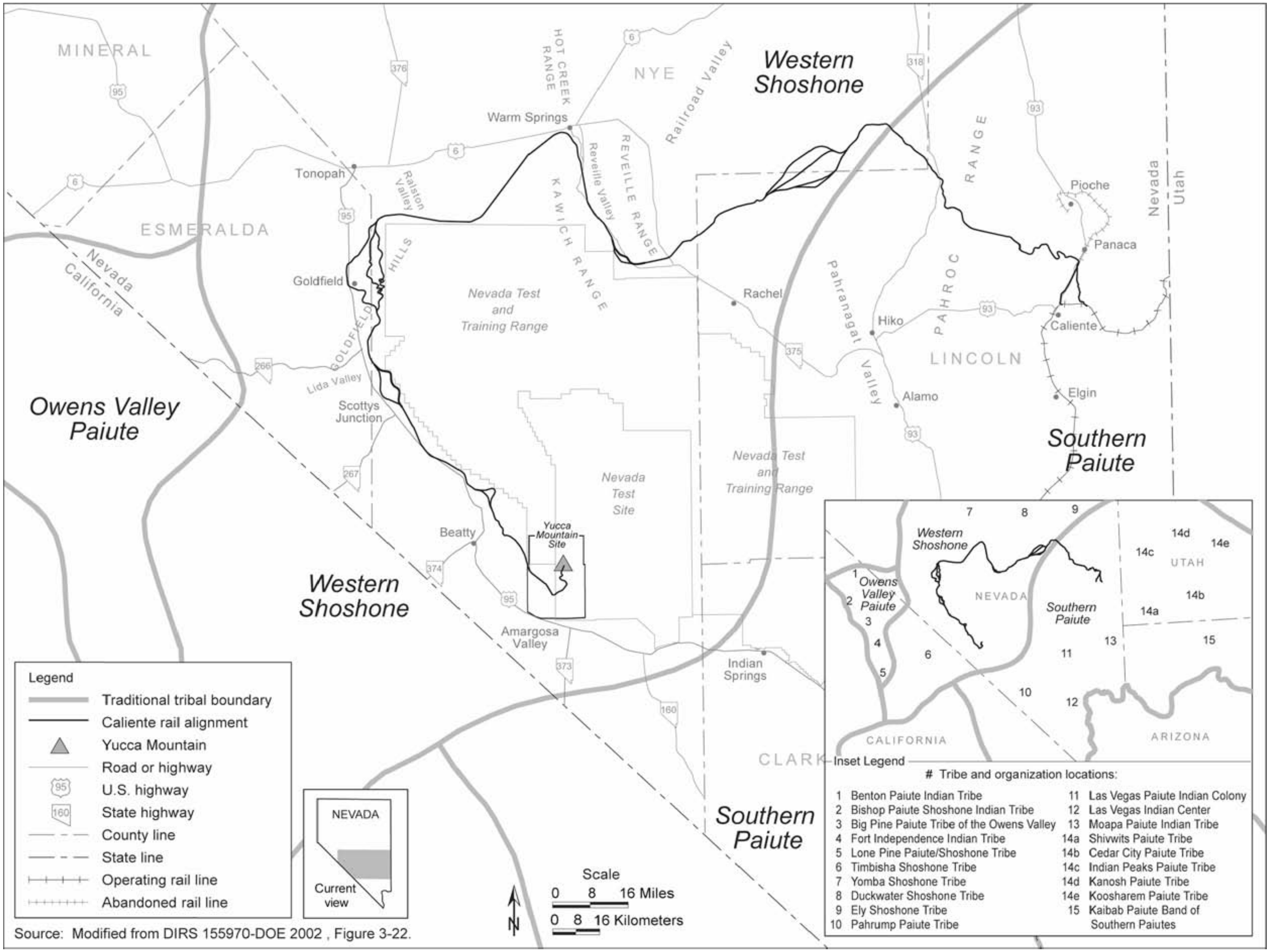


Figure 3-116. Traditional boundaries and locations of federally recognized tribes.

3.2.13.3.4 Cultural Landscapes

Based on the literature review of the cultural history of the region of influence, DOE identified several examples of potential cultural landscapes reflecting significant ethnographic, mining, ranching, and railroading activities within the Level II region of influence that might be eligible for listing on the *National Register of Historic Places* (DIRS 174688-AGEISS 2005, all). These include:

- Ethnographic. Historic period Western Shoshone villages and surrounding use areas in Oasis Valley, the Goldfield area, Stone Cabin Valley, and Reveille Valley
- Rural historic. Early cattle ranching operations in Oasis Valley, Stone Cabin Valley, Reveille Valley, and Railroad Valley, sheep ranching in northern Garden Valley and Coal Valley (including the neighboring Quinn Canyon, Golden Gate and Seaman Mountain Ranges), and the early Mormon settlement of Meadow Valley Wash
- Historic mining districts in the Goldfield, Clifford, and Reveille areas

3.2.13.4 Site-Specific Cultural Resources

The corridor through which the rail alignment would pass demonstrates a history of diverse prehistoric and historic land-use patterns. Native peoples occupied this area for many thousands of years, as exhibited by the archaeological sites identified in the area. These sites include campsites, rockshelters, rock-art sites, quarries, ***lithic scatters***, rock rings and alignments, and trail systems. Important residential camps dating to the early contact and ethnographic periods are also known. Euroamerican presence in the area is largely limited to the past 150 years or so, and is characterized by diverse activities represented at a wide variety of site types. Recorded and anticipated sites include early exploration and transportation features such as trails, wagon and stage roads; railroads and railroad camps and sidings; early ranching features such as homesteads, farms, and ranches; cattle and sheep camps, enclosures, and other features; mining features such as claim markers and mines, mills, and mining camps; and wells, pipelines, and irrigation systems. Isolated features and artifacts related to all of these activities can also be anticipated.

This section presents data on both previously recorded cultural resources and known, but unrecorded, properties along the Caliente rail alignment. This section first presents the results of the Class I site-file search of the Level II region of influence and the Class II inventory (field survey) of the Level I region of influence for the entire Caliente rail alignment, including alternative segments. The results are followed by a segment-by-segment discussion for each of the alternative segments and common segments. DOE based individual segment analyses on three data sources: (1) the known-site file search and literature review (DIRS 174688-AGEISS 2005, all); (2) the Class II inventory (DIRS 174689-HRA Conservation 2005, all); and (3) information from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all). All references consulted or used in the different analyses can be found in those reports.

3.2.13.4.1 Previously Recorded Prehistoric Resources

A Class I site-file search for archaeological sites within the Level II region of influence identified 432 prehistoric recorded sites and ***isolates*** (Table 3-75). Of this total, 107 (25 percent) are isolated artifacts that were previously assigned archaeological site numbers. Although isolates are generally considered not eligible for listing on the *National Register of Historic Places*, they indicate, along with other types of sites, the presence of prehistoric people in the region of influence. A total of 118 (27 percent) of the sites and isolates have been recorded within the current ***Yucca Mountain Site boundary***, where there have been more intensive field surveys. Site-type terminology reflects the site classification system employed in the BLM Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, Section 3.9).

In total, 30 sites are considered eligible for listing on the *National Register of Historic Places*, including five prehistoric specialized activity area sites within the Level I region of influence.

Table 3-75. Previously recorded prehistoric archaeological sites in the Level II region of influence.[a]

Site type	Number of sites and isolates	Eligible[b]	Not eligible	Unevaluated
Specialized activity areas (campsites)	23	12	4	7
Rockshelters	17	6	1	10
Rock-art sites	4	3	0	1
Toolstone sources and quarry sites	19	2	11	6
Specialized activity areas (lithic scatters)	254	7	207	40
Isolates[c]	107	0	103	4
Other:				
Rock ring	2	0	0	2
Rock features	5	0	5	0
Hearth	1	0	0	1
Unknown	0	0	0	0
Totals	432	30	331	71

a. Source: Data from a site-file search at Southern Nevada Site Survey Repository, Harry Reid Center for Environmental Studies, University of Nevada, Las Vegas (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for listing on the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system. Isolates are generally considered ineligible for listing on the *National Register of Historic Places*.

3.2.13.4.2 Previously Recorded Historic Euroamerican Resources

A Class I site-file and literature search for historical Euroamerican sites within the Level II region of influence identified 147 historic sites and isolates (see Table 3-76). Of this total, 17 (11 percent) are isolated artifacts that were previously assigned site numbers and 47 (32 percent) sites have both prehistoric and historic components.

In total, 23 sites are considered eligible for listing on the *National Register of Historic Places*, and two of these sites, the Goldfield downtown district and the Caliente Union Pacific Depot, are listed on the National Register. Of the 23 eligible sites within the Level II region of influence, seven are within the Level I region of influence. Historic resources identified as being either within the Level I region of influence or adjacent thereto include the following:

- Caliente Union Pacific Depot, listed on the *National Register of Historic Places*. The depot is within the Caliente alternative segment.
- Meadow Valley. Early Mormon colonization; the Caliente and Eccles alternative segments would cross this valley.

Table 3-76. Previously recorded historic Euroamerican sites in the Level II region of influence.[a]

Site type	Number of sites	Eligible[b]	Not eligible	Unevaluated
Historic town sites	3	3 Goldfield downtown district listed on the *National Register of Historic Places*	0	0
Historic railways	10	5 Caliente Union Pacific Depot listed on the *National Register of Historic Places*	3	2
Historic mining sites	27	4	21	2
Historic ranching sites	4	1	1	2
Campsite	1	1	0	0
Historic roads	2	0	2	0
Historic cemetery	2	0	0	2
Historic debris scatters	34	1	30	3
Sites with both historic and prehistoric components	47	8	27	12
Isolates[c]	17	0	16	1
Totals	147	23	100	24

a. Source: Data from site-file search at Southern Nevada Site Survey Repository, Harry Reid Center for Environmental Studies, University of Nevada, Las Vegas (DIRS 174688-AGEISS 2005, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system.

- Historic railroads. The Las Vegas and Tonopah, Tonopah and Goldfield, and Union Pacific railroads, including the present-day mainline and the abandoned Caliente and Pioche spur line. The Caliente alternative segment would follow the Caliente and Pioche spur line for most of the segment's 18-kilometer (11-mile) length and Caliente common segment 4 would intersect or follow many segments of the Las Vegas and Tonopah line for 11 kilometers (7 miles), south of Goldfield. In these locations, DOE would refurbish the historic rail beds for use with the proposed rail line.
- Ralston (ghost town). A station on the Las Vegas and Tonopah Railroad with a small store and saloon, established in 1907. Located southeast of Goldfield, this site lacks remaining architecture but is a historical archaeological site adjacent to Caliente common segment 4.
- Cedar Pipeline Ranch. In Reveille Valley, just south of Caliente common segment 2 and the South Reveille alternative segments.
- Reveille Mill. In Reveille Valley, east of Caliente common segment 3; the segment would intersect the original wagon road leading to the mines.
- Reveille Mining District. In Reveille Range, just west of South Reveille alternative segment 4.
- Reeds Ranch. In Stone Cabin Valley, just north of Caliente common segment 3.
- Black Rock Spring Dugout. South of Caliente common segment 3.

- Possible World War II airplane crash sites associated with training at the Tonopah Army Air Base. In the Mud Lake vicinity, just south of Caliente common segment 3 and east of Goldfield alternative segment 3.
- The downtown district of Goldfield, listed on the *National Register of Historic Places*. The town dump and a cemetery (determined eligible for listing on the National Register) are located within the Goldfield 4 alternative segment.
- Clifford Mine. In Stone Cabin Valley, within the Caliente common segment 4 Level II region of influence.
- Beatty Cattle Company Ranch and Colson Ranch, with associated Western Shoshone villages, Oasis Valley. One site is within the Oasis Valley alternative segment 3 Level II region of influence; the other is within the Oasis Valley alternative segment 1 Level II region of influence.

3.2.13.4.3 Known American Indian Resources

Previous American Indian studies and consultations associated with the Yucca Mountain Project, the Nevada Test Site, the Nevada Test and Training Range, and other projects have yielded significant information on the concerns of modern-day American Indians regarding traditional and cultural values (DIRS 174205-Kane et al. 2005). These concerns include evidence of their ancestors' occupation and use of traditional homelands, and their feelings about natural resources and geologic formations in the region, such as plants, animals, and natural landforms that mark important locations. Opportunities for the identification of traditional cultural properties and additional places of concern to American Indians will remain open through the consultation process.

Based on past studies and research for this Rail Alignment EIS, DOE has obtained information regarding the following potentially eligible historic properties that could be of cultural value for American Indians:

- Hot springs, rockshelters, plant resources, and trails used by Southern Paiutes in the Caliente area, including Meadow Valley and Clover Creek. Within the Level II region of influence.
- Black Rock Spring Campsite in North Pahroc Range. Within the Level II region of influence.
- ***Petroglyphs***. Within the Level II region of influence.
- Western Shoshone camp in Reveille Valley. Within the Level II region of influence.
- Western Shoshone winter camp in the vicinity of Warm Springs. Within the Level II region of influence.
- Western Shoshone winter village of Hugwapagwa in Stone Cabin Valley. Within the Level II region of influence.
- Rabbit Spring Rock shelter camp near Goldfield. Within the Level II region of influence.
- Winter village, probable site of a Western Shoshone village named Matsum in the vicinity of Willow Springs. Within the Level II region of influence.
- Beatty area petroglyphs. Within the Level II region of influence.
- Western Shoshone Ogwe'pi District, a cluster of winter villages along the upper Oasis Valley and the headwaters of the Amargosa River, including two probable villages. Within or adjacent to Level II region of influence.
- Black Cone site, a place of religious significance near the Crater Flat area. Within the Level II region of influence.

- Significant crossroad where numerous traditional American Indian trails came together near Fortymile Wash. Within the Yucca Mountain Site boundary.
- Rock art near Busted Butte. Within the Yucca Mountain Site boundary.

3.2.13.5 Cultural Resources by Alternative Segments and Common Segments

Sections 3.2.13.5.1 through 3.2.13.5.12 describe the cultural resources for each of the Caliente rail alignment common segments and alternative segments, including data from the previously recorded Class I site-file and literature search (DIRS 174688-AGEISS 2005, all), the results of the Class II inventory (DIRS 174689-HRA Conservation 2005, all), and associated American Indian interactions (DIRS 174205-Kane et al. 2005, all).

3.2.13.5.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline

3.2.13.5.1.1 Caliente Alternative Segment. The Class I site-file search identified 11 previously recorded cultural resources along the Caliente alternative segment. These resources include three prehistoric sites (two rockshelters and a campsite), three isolated artifacts, and five historic sites (two railroad features, two trash scatters, and a cemetery). The search revealed that one site, the Caliente Union Pacific Railroad Depot, is listed on the *National Register of Historic Places* and two sites, the Caliente-Panaca Railroad ***berm***, and a prehistoric rockshelter site, are evaluated as eligible for listing on the *National Register of Historic Places.* The rails have been removed from the eligible railroad berm, but the proposed rail line would cover several undocumented wooden and metal bridges that remain. Additionally, the Caliente Union Pacific Railroad Depot, listed on the *National Register of Historic Places*, is in the middle of town, south of the proposed rail line departure point. Historic maps and photographs indicate several buildings, including a depot and a roundhouse, that existed in the area. It is probable that subsurface historical Euroamerican remains exist even though the structures have been removed.

Also in the vicinity of the Interface with the Union Pacific Railroad Mainline is the potential historic property of the Caliente Hot Springs Motel and Bath (Figure 3-117). The City of Caliente has other potential historic sites, including a hotel. Also of note, the hot springs were known to have been used by American Indian people for medicinal purposes.

The area known as Indian Cove, just north of the City of Caliente, through which the Caliente alternative segment would pass, has evidence of prehistoric use in the form of a previously recorded rockshelter (evaluated as eligible for listing on the *National Register of Historic Places*), an unevaluated rock-art panel, and lithic scatters and isolates.

Nearly the entire length of this segment would lie in the potential early Mormon colonization cultural landscape along Meadow Valley Wash. Examples of architecture typical of early Mormon farming ventures can still be found in the ranches and communities in this area. This segment is also characterized as a historic railroad alignment, but DOE could not inventory this area because the Department did not have the access to private property necessary to perform the inventory.

Most of the lands along the Caliente alternative segment are privately owned, but sufficient data have been collected on the area to characterize archaeological sensitivity. If DOE selected the Caliente alternative segment, the Department would complete the cultural resources inventory of this segment before starting construction.

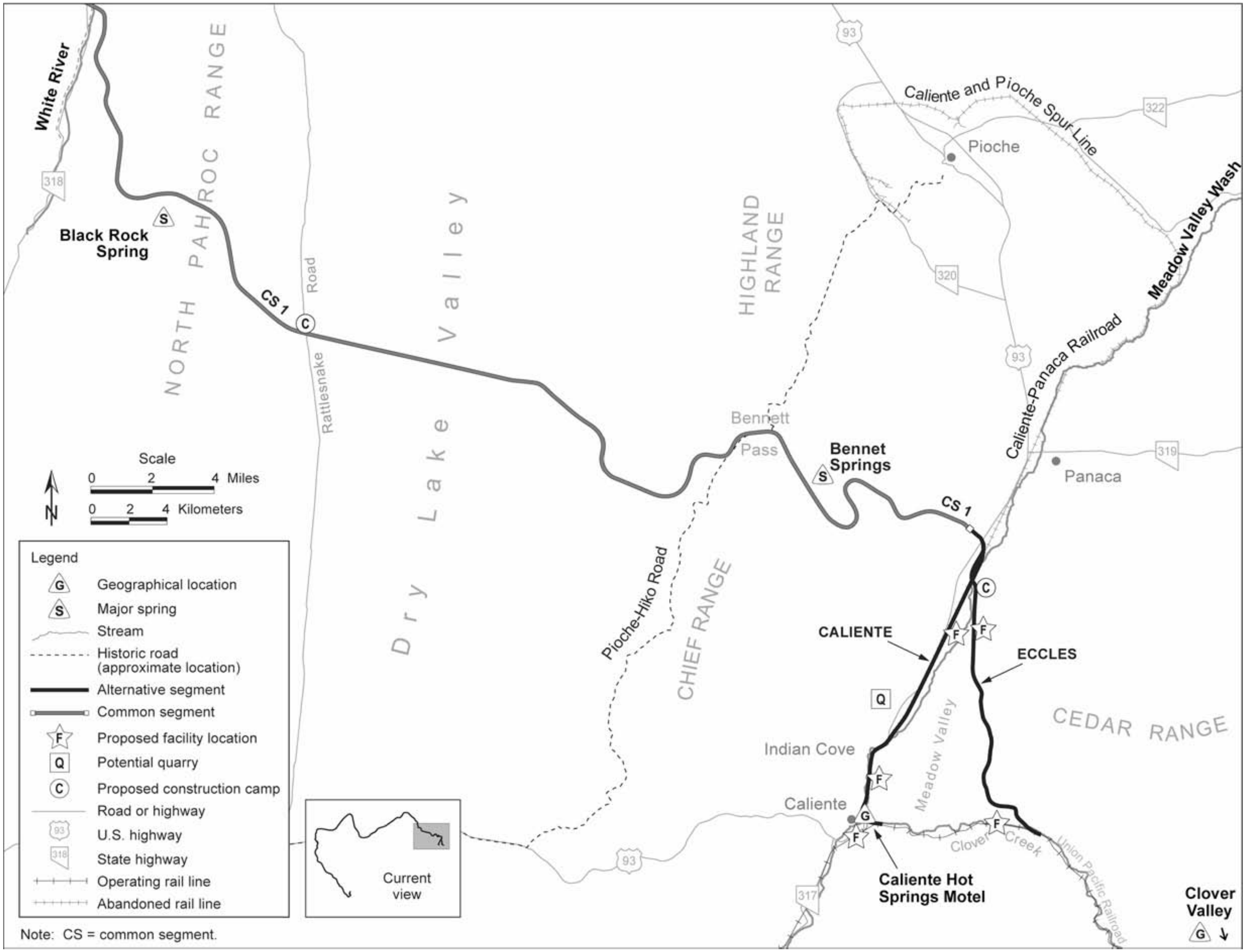


Figure 3-117. Major historic and geographical locations within map area 1.

There is a potential quarry site (CA-8B) along the Caliente alternative segment on the eastern exposure of a rocky ridge overlooking Meadow Valley Wash. Preliminary archaeological reconnaissance of the location did not identify any cultural materials or other evidence of prehistoric or historic activities.

3.2.13.5.1.2 Eccles Alternative Segment. The Class I site-file search identified three previously recorded cultural resources along the Eccles alternative segment. These resources include two prehistoric rockshelter sites and one isolated artifact. One rockshelter site is located in the Level I region of influence. If DOE selected the Eccles alternative segment, the Department would complete the cultural resources inventory along the segment, much of which lies on private property, prior to construction. However, there are two previously recorded but unevaluated prehistoric rockshelters in the vicinity of the proposed location of the Staging Yard (Eccles-North). The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also indicates that Clover Valley is a culturally important place with associated songs, plants and animals, and water resources.

DOE inventoried three Class II survey sample units along this segment, a total of 2.4 kilometers (1.5 miles). No sites were recorded, but five isolated artifact occurrences were found. In the area of the Meadow Valley Wash at the northern end of the segment, there is a potential early Mormon colonization cultural landscape.

3.2.13.5.2 Caliente Common Segment 1 (Dry Lake Valley Area)

The Class I site-file search identified 39 previously recorded cultural resources along Caliente common segment 1 (see Figure 3-118), including nine within the Level I region of influence. These resources include 11 prehistoric sites (a toolstone quarry locale and 10 lithic scatters), seven historic sites (three ranching campsites, three trash scatters, and Old State Route 38 along the White River), one site with both prehistoric and historic components, and 20 isolated artifacts. One site with both historic and prehistoric components, located in the Level II region of influence, has been evaluated as eligible for listing on the *National Register of Historic Place*s. The site is in the vicinity of Black Rock Spring and includes a prehistoric campsite with abundant lithics and ceramics, and an early historic-period habitation site. This spring is one of three in the vicinity, and field reconnaissance of the place indicates that there are archaeological sites associated with each of the springs.

DOE surveyed 23 sample units during the Class II effort, a total of 19 kilometers (12 miles). The survey recorded two sites, a prehistoric lithic scatter and an historic campsite; neither site was recommended as eligible for listing on the *National Register of Historic Places*. Seventeen isolated artifact occurrences were also recorded during the field survey along this segment.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all), does not identify any potentially significant American Indian resources in the Caliente common segment 1 region of influence. However, the American Indian Writers Subgroup notes that systematic ethnographic studies have not been conducted. The subgroup does note the significance of cultural resources in the White River Valley, such as the well-known White River Narrows rock-art sites, charcoal ovens, and the area of Pahranagat Valley. These resources would be several kilometers from the proposed rail alignment region of influence.

The eastern part of Caliente common segment 1 would begin in the potential early Mormon colonization cultural landscape and quickly leave it going westward. The segment from Meadow Valley Wash passing through Bennett Pass, Dry Lake Valley, the White River Valley, and eastward to Garden Valley is historically important as the route of one of the 1849 Jayhawkers Emigrant parties, the Bennett-Arcane Party. One of the leaders of this party, Asabel Bennett, left his name inscribed in rock at the pass.

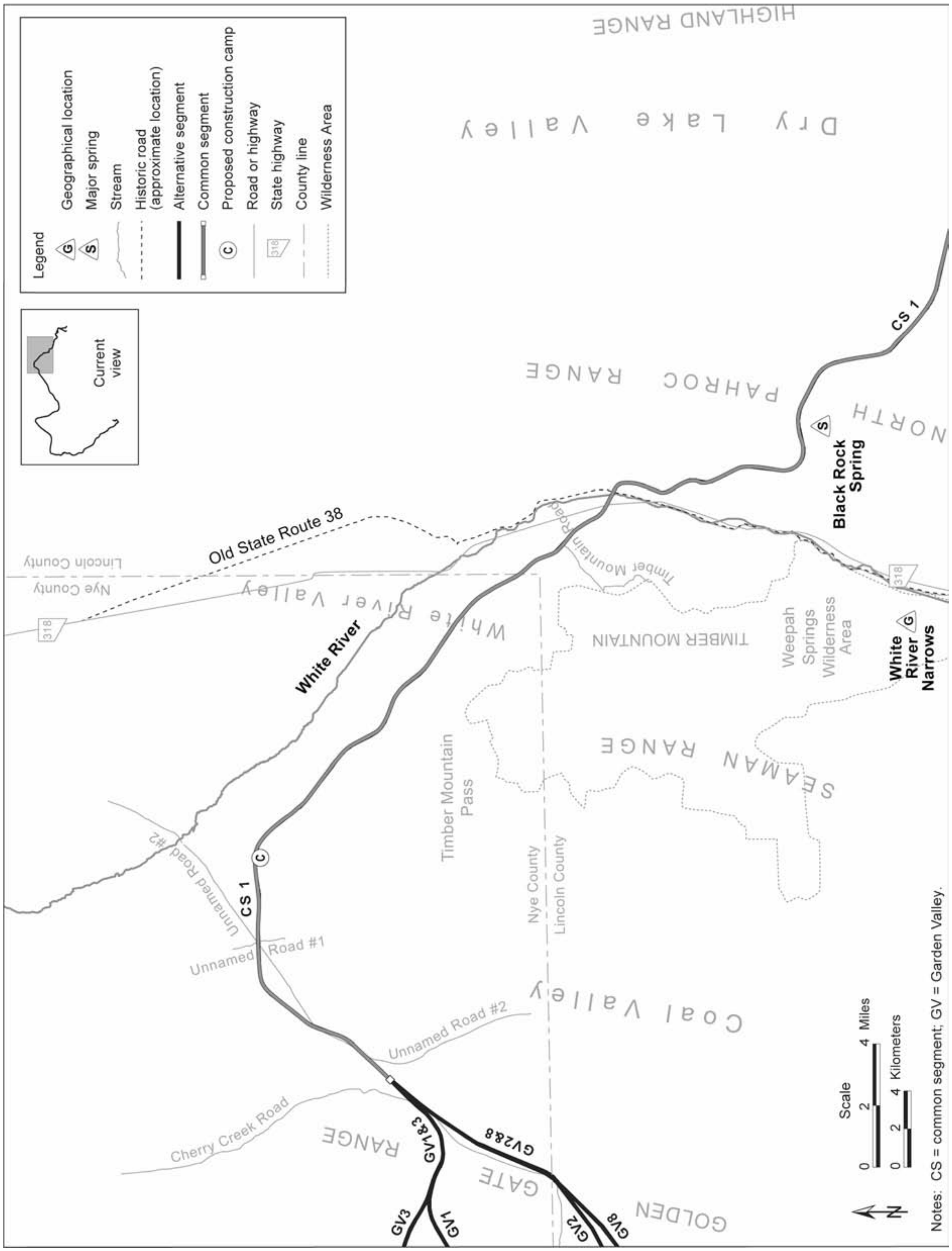


Figure 3-118. Major historic and geographical locations within map area 2.

The 1849 party reportedly camped at Bennett Springs, about 1.6 kilometers (1 mile) from the common segment. The party also camped in the vicinity of Black Rock Spring before crossing the North Pahroc Range. The route the party followed, commonly referred to as the Lost '49er Trail, has not been physically identified but is known to have crossed Bennett Pass and Pahroc Summit. To date, no archaeological sites associated with the Bennett-Arcane Party are identified in the Caliente common Segment 1 region of influence. In the 1870s, Bennett Pass became a well-traveled route between the silver mining communities of Pioche and Hiko. The Pioche-Hiko road remained a principal east-west route into the early 1900s.

3.2.13.5.3 Garden Valley Alternative Segments

3.2.13.5.3.1 Garden Valley Alternative Segment 1. The Class I site-file and literature search identified 10 previously recorded cultural resources along Garden Valley alternative segment 1 (Figure 3-119). These resources include five prehistoric sites (two rockshelters and three lithic scatters), four isolated artifacts, and one historic trash scatter. No sites have been evaluated as eligible for listing on the *National Register of Historic Places*. DOE surveyed five sample units during the Class II effort, a total of 4 kilometers (2.5 miles); only six isolated artifact occurrences were recorded.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) notes that Garden Valley had extensive American Indian trail systems used for trade, commerce, pilgrimage, and for access to mountain ranges. The Resource Document does not give specific locations for trails or other potential American Indian resources.

3.2.13.5.3.2 Garden Valley Alternative Segment 2. The Class I site-file search revealed 12 previously recorded cultural resources along Garden Valley alternative segment 2 (Figure 3-119). These resources include four prehistoric sites (two campsites and two lithic scatters), and eight isolated artifacts that include a prehistoric Folsom point reported in the vicinity of Water Gap. Three of these sites are evaluated as eligible for listing on the *National Register of Historic Places*, including the two campsites and a lithic scatter associated with a cluster of rock features. DOE surveyed four sample units during the Class II effort, a total of 3.2 kilometers (2 miles); two isolates were recorded.

The same comments from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) made for Garden Valley alternative segment 1 apply to this segment.

Of the four Garden Valley alternative segments, Garden Valley 2 would pass closest to the historic Freiberg Mining District in the northeast part of the Worthington Mountains. The segment would pass about 5 kilometers (3 miles) north of the district.

3.2.13.5.3.3 Garden Valley Alternative Segment 3. The Class I site-file search identified 17 previously recorded cultural resources along Garden Valley alternative segment 3 (Figure 3-119). These resources include two prehistoric sites (a rock feature and lithic scatter), 13 isolated artifacts, and two historic trash scatters. DOE surveyed four sample units during the Class II effort, a total of 3.2 kilometers (2 miles). Only two isolates were recorded.

The same comments from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) made for Garden Valley alternative segment 1 apply to this segment.

3.2.13.5.3.4 Garden Valley Alternative Segment 8. The Class I site-file and literature search identified five previously recorded cultural resources along Garden Valley alternative segment 8. These resources include three prehistoric lithic scatters and two isolated artifacts. DOE surveyed three sample units during the Class II effort, a total of 2.4 kilometers (1.5 miles); eight isolated artifacts were recorded.

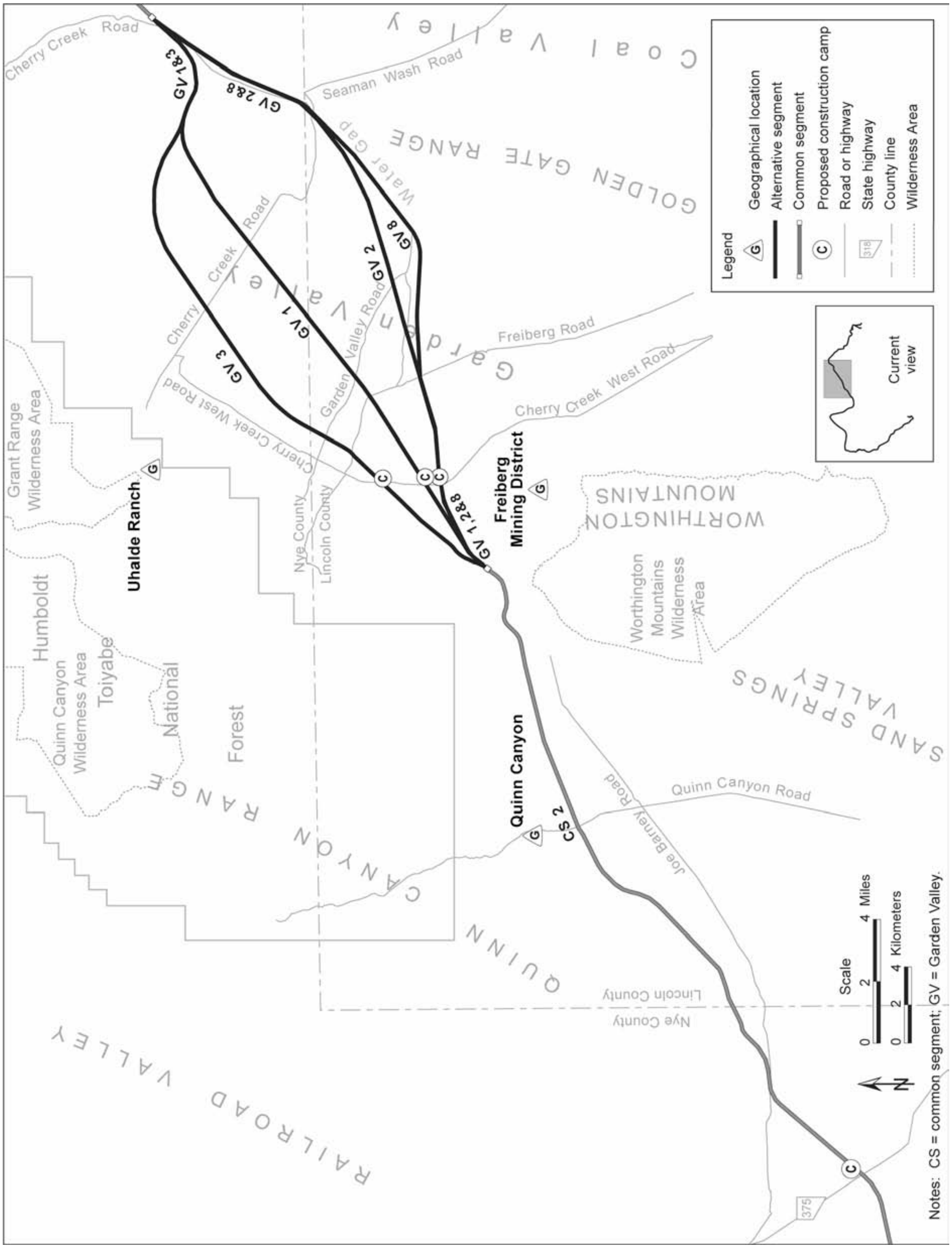


Figure 3-119. Major historic and geographical locations within map area 3.

The same comments from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) made for Garden Valley alternative segment 1 apply to this segment.

3.2.13.5.4 Caliente Common Segment 2 (Quinn Canyon Range Area)

The Class I site-file search identified eight previously recorded cultural resources along Caliente common segment 2 (Figure 3-119). These resources include seven prehistoric sites (two campsites, a rockshelter, and four lithic scatters) and one isolated artifact. DOE surveyed seven sample units during the Class II effort, a total of 5.6 kilometers (3.5 miles); three prehistoric sites and 16 isolated artifacts were recorded. Three sites are evaluated as eligible for listing on the *National Register of Historic Places*, including two lithic scatters and one locale with rockshelters and an associated scatter of artifacts. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) notes the rockshelter site as a culturally significant place, and refers to it as the "Black Top Archaeological Locality."

The unrecorded historic Cedar Pipeline Ranch is at the western end of and about 1.6 kilometers (1 mile) south of Caliente common segment 2. This ranch was an element of the early vast holdings of the Reed Ranch and later part of the historic Twin Springs Ranching operations. Together, these ranches form a potential ranching cultural landscape that includes all of Reveille Valley and Stone Cabin Valley to the west, along with the adjacent Reveille and Kawich Mountain Ranges. The vicinity of Cedar Pipeline Ranch also marks the intersection of Caliente common segment 2 with the trail explorer John C. Fremont followed in 1854.

3.2.13.5.5 South Reveille Alternative Segments

Because the Level II region of influence for the South Reveille alternative segments (Figure 3-120) overlap, they are discussed jointly for the Class I site-file search and the Class II survey. The Class I site-file search revealed the presence of three cultural resources along these segments. These resources include two recorded prehistoric lithic scatter sites and one historic mine prospect. Also in this vicinity are the Reveille Valley rock-art panels. This location was identified in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) as a culturally important site for American Indian people.

DOE examined two sample units for each of these alternative segments during the Class II field survey, a total of 1.6 kilometers (1 mile) or 8.5 percent of the segments. Only a single isolate was encountered along South Reveille 2. The Class II survey also recorded the rock-art site noted above.

A potential quarry (NN-9A) would be along South Reveille alternative segments 2 and 3. The potential NN-9A quarry site would occupy the top and eastern face of a broad, flat terrace, which drops steeply down to a wash along the eastern face. Preliminary archaeological reconnaissance of this site did not identify any cultural materials or other evidence of historic or prehistoric activities.

Another potential quarry (NN-9B) would be in south Reveille Valley, along South Reveille alternative segments 2 and 3. The NN-9B quarry site would occupy a long, narrow sandy ridge with frequent rocky outcrops. Preliminary archaeological reconnaissance of this site did not identify any cultural materials or other evidence of prehistoric or historic activities.

3.2.13.5.6 Caliente Common Segment 3 (Stone Cabin Valley Area)

Caliente common segment 3 (Figure 3-120) would pass close to a number of potentially important sites and through several potential cultural landscapes. The Class I site-file search identified 35 cultural resources along Caliente common segment 3. These resources include 29 prehistoric sites and six historic sites.

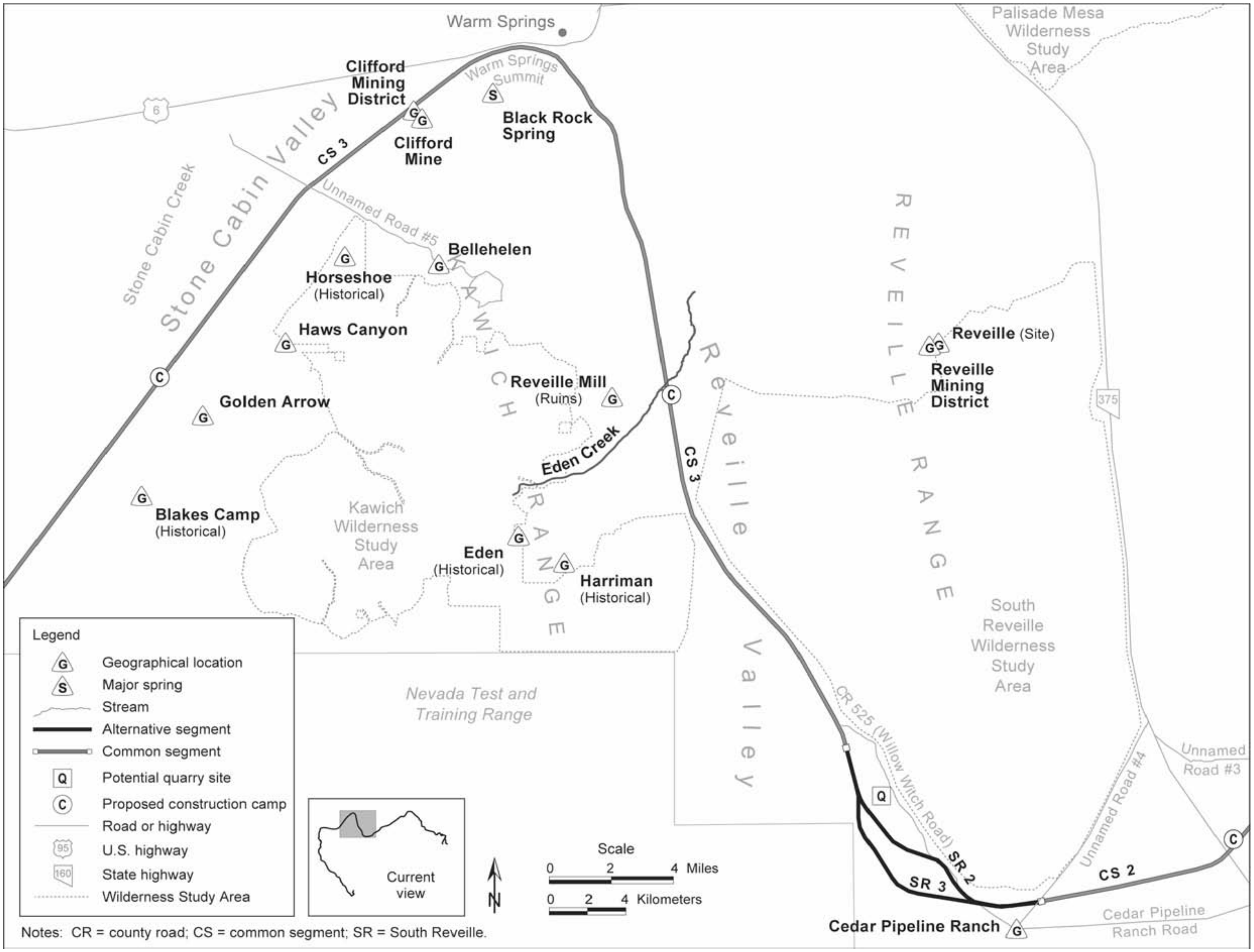


Figure 3-120. Major historic and geographical locations within map area 4.

The Class II survey examined 22 sample units, a total of 18 kilometers (11 miles). Three prehistoric sites are evaluated as eligible for listing on the *National Register of Historic Places*, including two lithic scatters within the Level I region of influence and a rock-art site within the Level II region of influence. Several potentially important cultural resources are found along Caliente common segment 3, although most are just outside the Level II region of influence.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) also notes the high significance of locations within this region to American Indian people. The entire Kawich Range, including the foothills along the eastern and western edges of the adjacent valleys, provided traditional homelands and use areas for Western Shoshone people. Especially important in these areas were a number of springs. Special reference is made in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) to the Warm Springs and Reveille Mill areas. As discussed in Section 3.4, American Indian Interests in the Proposed Action, American Indians still use the Warm Springs area and it is highly revered it for its healing power. In addition, a Western Shoshone man initially discovered the Clifford Mine.

3.2.13.5.7 Goldfield Alternative Segments

3.2.13.5.7.1 Goldfield Alternative Segment 1. The Class I site-file search identified four cultural resources within Goldfield alternative segment 1 (Figure 3-121). These resources include two prehistoric lithic scatters and two historic sites (a trash scatter and a campsite). The Class II survey examined six sample units along this segment, a total of 4.8 kilometers (3 miles), and 52 isolated artifacts were recorded. No sites are eligible for listing on the *National Register of Historic Places*.

Within this area, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies possible Western Shoshone camps east of Goldfield. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also notes the existence of a rockshelter along the shoreline of Mud Lake in the vicinity of Goldfield alternative segment 1, and states that this site retains a high level of cultural significance. There are also rock-art panels at this location. These locations are outside the Level II region of influence.

3.2.13.5.7.2 Goldfield Alternative Segment 3. The Class I site-file and literature review revealed three previously recorded cultural resources along Goldfield alternative segment 3 (Figure 3-121). These resources include two rockshelters and a prehistoric campsite. The Class II survey covered 2.4 kilometers (1.5 miles), and 13 isolated artifacts were recorded. The campsite is the same possible group of Western Shoshone winter camps discussed in the preceding section. The American Indian Resource Document discussion from Goldfield alternative segment 1 also applies for this segment.

A potential quarry (NS-3A) would occupy a large area on the crest and slopes of two adjacent ridges in the Goldfield Hills, south of Mud Lake, along Goldfield alternative segment 3. No cultural materials or other evidence of prehistoric or historic activities were noted during preliminary archaeological reconnaissance of the potential quarry NS-3A location. Access roads to this quarry location from Goldfield to the south and west would pass through recent and historic mining areas, but neither the quarry location nor the access roads would directly overlie the historic mining areas.

3.2.13.5.7.3 Goldfield Alternative Segment 4. Because of its proximity to the Goldfield community, there are numerous known historic sites in the vicinity of Goldfield alternative segment 4 (Figure 3-121). The Class I site-file search revealed 154 previously recorded cultural resources. These resources include 74 prehistoric sites, five isolated artifacts, and 71 historic sites. Sites that are evaluated as being *National Register of Historic Places*-eligible include the downtown section of

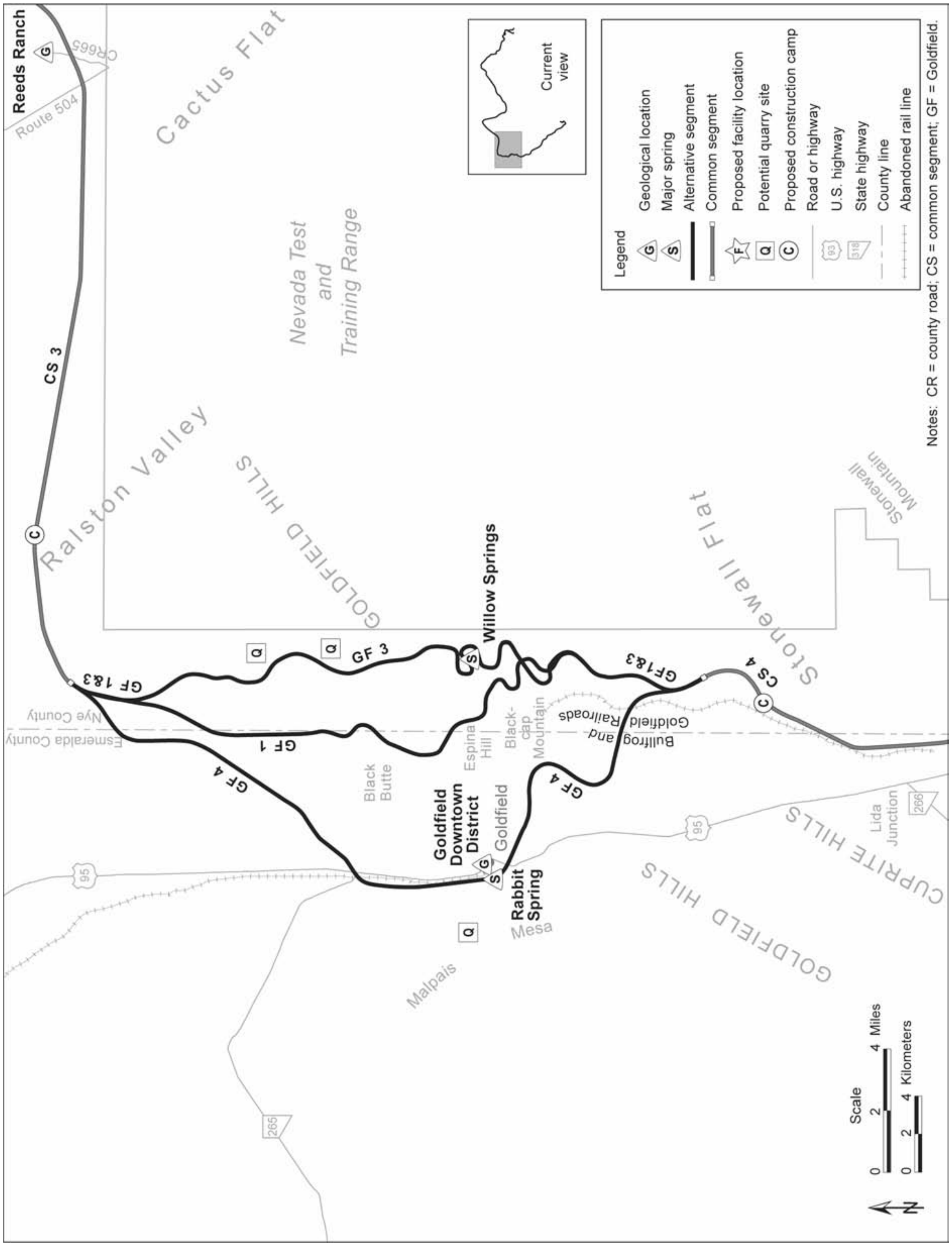


Figure 3-121. Major historic and geographical locations within map area 5.

Goldfield itself, which is National Register listed. Goldfield alternative segment 4 would pass through the National Register-eligible historic Goldfield town dump area and two mining sites. Other eligible sites outside the Level I region of influence include two town-related features, three mining sites, and three lithic scatters. In addition, several unrecorded prehistoric and historic sites are known to exist in the region of influence (see Section 3.2.13.1), based on literature reviews and field reconnaissance, along with an unmarked historic cemetery. The Class II field effort examined eight sample units along this segment, a total of 6.4 kilometers (4 miles), resulting in the identification of 69 isolates.

The American Indian Resource Document comments on the known presence of numerous American Indian resources in the vicinity of Goldfield alternative segment 4 (DIRS 174205-Kane et al. 2005, Section 2.3). Field reconnaissance by the American Indian Writers Subgroup noted the presence of several rockshelters, a boulder with rock art, and several unrecorded lithic scatters. Also of interest in the Level II region of influence is the presence of a grave marker in the paupers' section of the historic Goldfield Cemetery indicating that an American Indian woman was buried there in 1908.

A potential quarry (ES-7) would be near Goldfield alternative segment 4, west of the community of Goldfield. No cultural materials or other evidence of prehistoric or historic activities were noted during preliminary archaeological reconnaissance of the quarry area. However, recent mining-claim markers are present in the area. Access to this quarry from Goldfield would pass through recent and historic mining areas, but neither the potential quarry location nor the access road would directly overlie the historic mining areas.

3.2.13.5.8 Caliente Common Segment 4 (Stonewall Flat Area)

In Stonewall Flat, Caliente common segment 4 (Figures 3-121 and 3-122) would generally follow an abandoned historic rail line for much of its length to a place in Lida Valley. The Class I site-file search identified one previously recorded but unevaluated rockshelter site along this segment. The Class II survey examined four sample units, a total of 3.2 kilometers (2 miles). Eight isolates were recorded. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not note any specific areas of importance to American Indians.

There are unrecorded and unevaluated segments of historic rail roadbeds along Caliente common segment 4, although the rails were removed many decades ago. Of note is the unrecorded train stop of Ralston where limited commercial establishments once stood, along with railroad crew quarters and a water tower. Nothing remains of the architectural elements of Ralston, but historical archaeological features and artifacts are certain to exist.

3.2.13.5.9 Bonnie Claire Alternative Segments

DOE is considering two alternative segments in the area north of Scottys Junction–Bonnie Claire alternative segments 2 and 3 (Figure 3-122).

3.2.13.5.9.1 Bonnie Claire Alternative Segment 2. The Class I site-file search identified one cultural resource site along Bonnie Claire alternative segment 2. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II survey examined five sample units, a total of 4 kilometers (2.5 miles). Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and groundstone scatter,

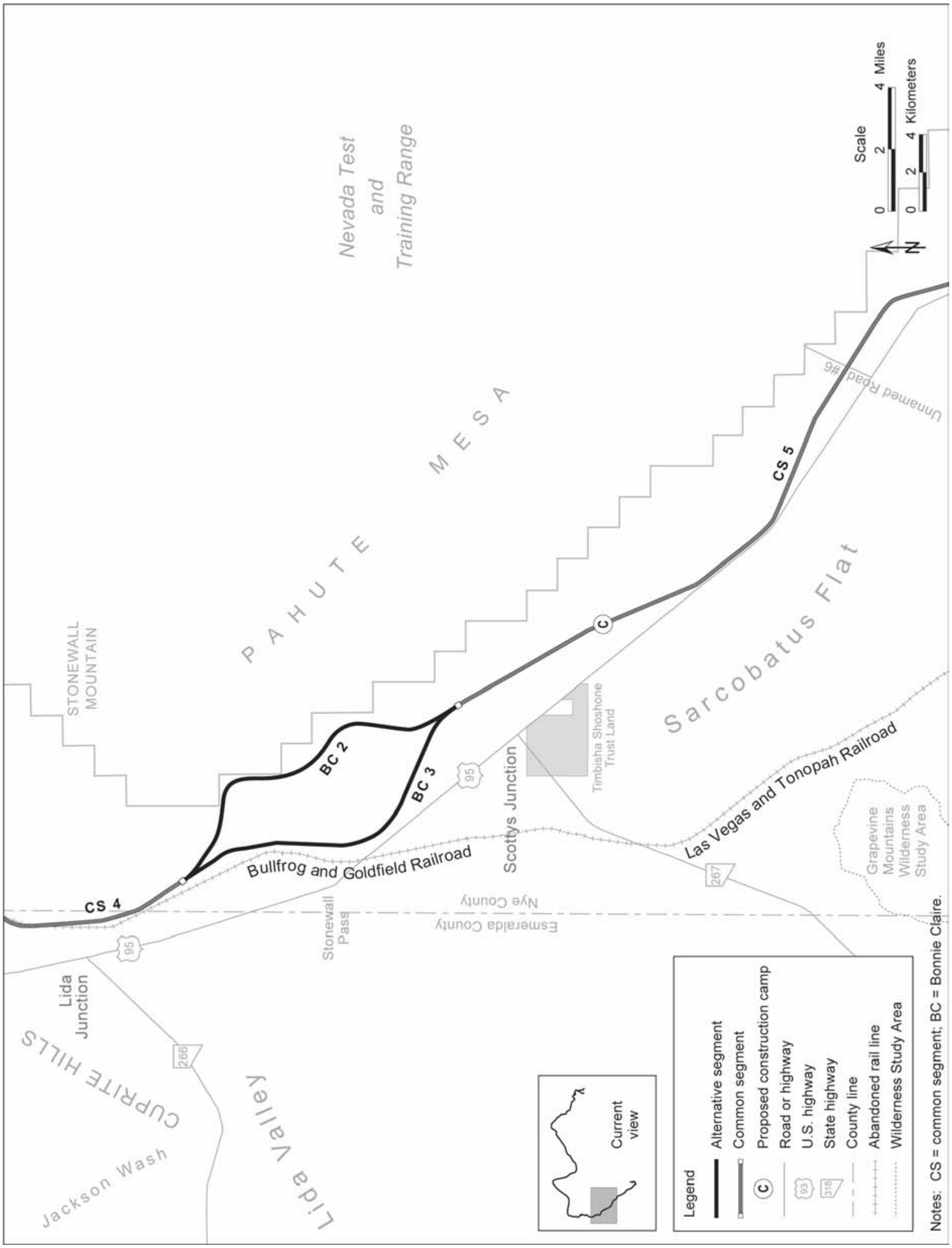


Figure 3-122. Major historic and geographical locations within map area 6.

evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

3.2.13.5.9.2 Bonnie Claire Alternative Segment 3. The Class I site-file search identified four cultural resources along Bonnie Claire alternative 3. These resources include four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences. The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles). One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

3.2.13.5.10 Common Segment 5 (Sarcobatus Flat Area)

The Class I site-file search identified 33 cultural resources within common segment 5 (Figures 3-122 and 3-123). These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for listing on the *National Register of Historic Places*; 11 are not eligible, and 14 remain unevaluated. DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles). Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places*, and the three lithic scatters are not eligible. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this common segment.

3.2.13.5.11 Oasis Valley Alternative Segments

The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3 (Figure 3-123). These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places)* and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

3.2.13.5.11.1 Oasis Valley Alternative Segment 1. The Class II survey looked at three sample units along Oasis Valley 1, a total of 2.4 kilometers (1.5 miles). Two prehistoric sites (lithic scatters) and one historic mine site were recorded.

DOE surveyed three sample units along this segment for the Class II effort; 19 isolates were recorded. Oasis Valley alternative segment 1 would pass to the east of the historic ranch known today as the Beatty Cattle Company Ranch. In addition to being an unrecorded historic ranch, the area adjacent to the ranch is known to be the location of an early historic Western Shoshone winter camp. This camp has been partially recorded but has not been evaluated.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated with and supplied labor for the ranches.

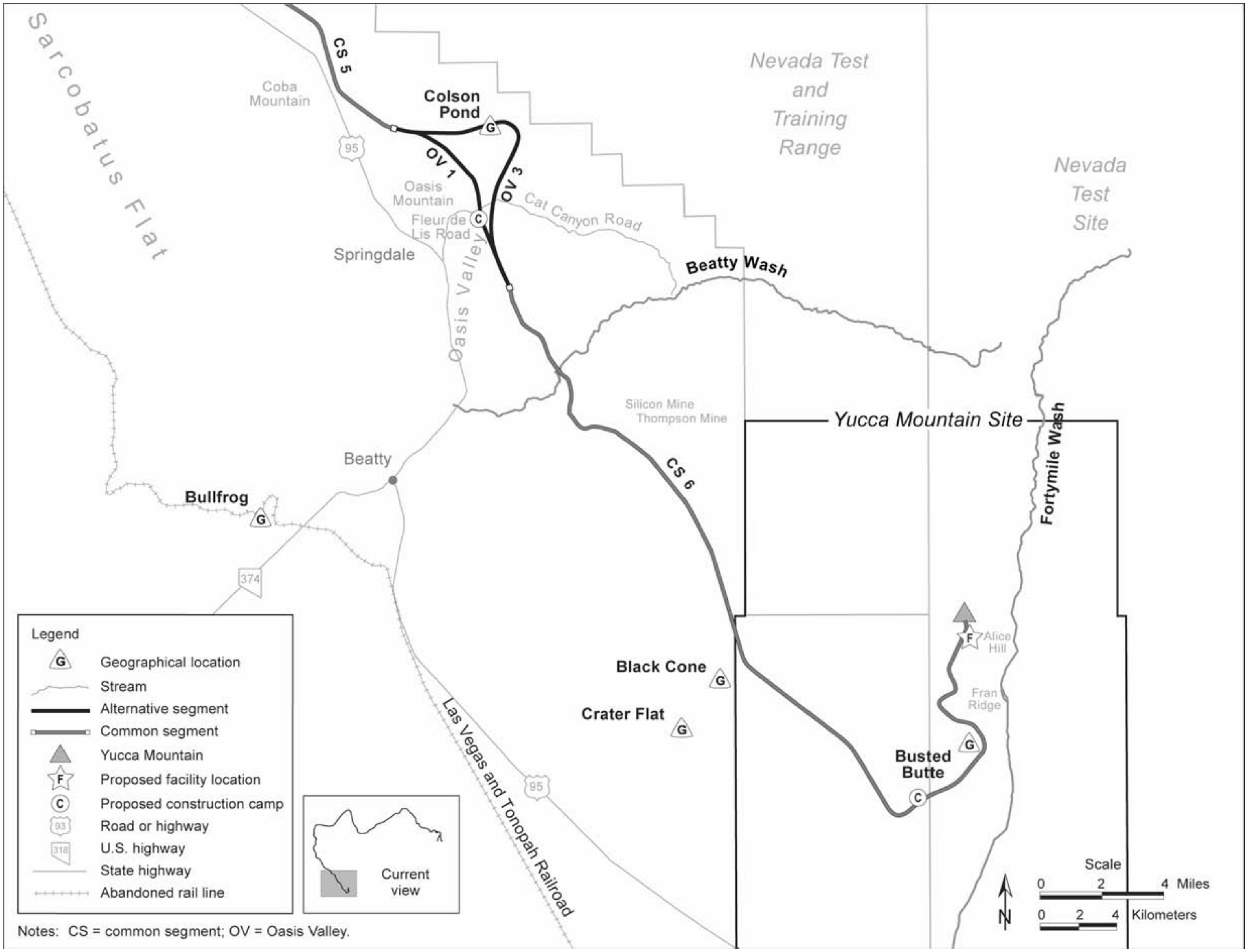


Figure 3-123. Major historic and geographical locations within map area 7.

3.2.13.5.11.2 Oasis Valley Alternative Segment 3. Oasis Valley alternative segment 3 would cross Oasis Valley farther to the east than Oasis Valley 1, but because of proximity, much of the discussion for Oasis Valley 1 applies to this alternative segment. During the Class II survey, DOE inspected four sample units, a total of 3.2 kilometers (2 miles); five sites and 28 isolates were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 also would cross the culturally sensitive Oasis Valley. It would pass just east of another historic ranch, the Colson or Indian Camp Ranch, which also has an early Western Shoshone winter camp adjacent to the ranch buildings. While both the ranch and Western Shoshone camp are unevaluated, rock lines (geoglyphs) were observed at the Indian camp area during field reconnaissance. These resources would be additional components of the potential Oasis Valley ethnographic and historic ranching cultural landscapes. Construction of the alternative segment could result in a visual intrusion to these cultural landscapes.

3.2.13.5.12 Common Segment 6 (Yucca Mountain Approach)

The Yucca Mountain area has been heavily analyzed in conjunction with repository site characterization studies. Intensive cultural resource studies related to the development of the repository site have been completed. Consequently, a large number of archaeological sites have been found along common segment 6 (Figure 3-123). This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified a total of 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, 3 historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected 13 sample units, a total of 11 kilometers (7 miles). Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6 within the Yucca Mountain Site boundary, Desert Research Institute (DRI) conducted a Class III supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary (DIRS 182290-Desert Research Institute 2007, all). This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that was previously surveyed during repository site characterization activities. DRI identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Given the large number of cultural resources in the area, construction of common segment 6 could result in direct and indirect impacts to prehistoric and historic sites. Three National Register-eligible prehistoric quarry sites are in this area within the Level I region of influence. The Beatty Wash Petroglyphs Site, listed on the National Register, is in the vicinity of a proposed bridge over Beatty Wash. Direct and indirect impacts from construction activities would include vibration of the rock ***matrix*** exhibiting the rock-art panels and a potential for inadvertent or deliberate adverse impacts due to increased access and worker presence. The site holds important cultural value for American Indians. Over the long term, American Indians would likely view the bridge and operating trains as a visual and noise impact to the rock-art cultural landscape site.

After common segment 6 crossed onto the Yucca Mountain Site, it would cross an area that has undergone earlier intensive archaeological inventory and has been the subject of previous American Indian studies during repository characterization. As discussed in Section 4.2.13.1, DOE would consider identification, evaluation, and mitigation of potential impacts to these resources under a separate programmatic agreement with those along the proposed rail alignment. Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this common segment. Several of these fall inside the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty area rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

3.2.14 PALEONTOLOGICAL RESOURCES

Paleontology is a science that uses fossil remains to study life in past geological periods. DOE, the BLM, and other federal agencies recognize paleontological resources as a fragile and nonrenewable scientific record of the history of life on earth and consider them a critical component of America's natural heritage. Once such resources are damaged, destroyed, or improperly collected, their scientific and educational value could be greatly reduced or forever lost.

> **Fossil:** Fossils include the body remains, traces, and imprints of plants or animals that have been preserved in the Earth's crust since some past geologic or prehistoric time. Generally, to be considered a fossil, the remains must be older than recent in age (older than 10,000 years). Fossils are found in sedimentary rock.
>
> **Sedimentary rock:** Rock formed from material deposited by water, wind, or glaciers.

The BLM manages and protects paleontological resources under the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*), and in accordance with 43 CFR 8365 and 43 CFR 3622. The BLM has developed policies and management actions to protect and manage paleontological resource areas of high scientific value consistent with the *Draft - Resource Management Plan/Environmental Impact Statement for the Ely District* (DIRS 174518-BLM 2005, all) and the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), while allowing casual and academic collecting of invertebrate (animals without backbones) fossils within the regulatory framework. Because of their relative rarity and scientific importance, vertebrate (animals with backbones) fossils may only be collected with a BLM permit and remain the property of all Americans in museums or other public institutions (*Collecting on Public Lands*, DIRS 180122-BLM [n.d.], all, and *Fossils on America's Public Lands*, DIRS 180123-BLM 2007, all).

Section 3.2.14.1 describes the region of influence for paleontological resources along the Caliente rail alignment, and Section 3.2.14.2 describes the paleontological resources within the region of influence, including the identification of previously recorded important fossil resources and the approaches for managing those resources.

3.2.14.1 Region of Influence

The region of influence for paleontological resources along the Caliente rail alignment is the nominal width of the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities.

3.2.14.2 Affected Environment

> BLM ranking of areas for their potential to contain paleontological resources (DIRS 176084-BLM 1998, pp. II-2 and II-3):
>
> **Condition 1** - Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.
>
> **Condition 2** - Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.
>
> **Condition 3** - Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

The BLM has established a classification system to rank areas according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils (*Paleontological Resource Management* and *General Procedural Guidance for Paleontological Resource Management*). The BLM uses these rankings (called ***Condition 1***, ***Condition 2***, and ***Condition 3***) in land-use planning and to identify areas that might warrant special management or special designation (DIRS 176085-BLM 1998, all; DIRS 176084-BLM 1998, all).

To determine the affected environment for paleontological resources along the Caliente rail alignment, DOE consulted the BLM and reviewed existing documentation of paleontological resources, including applicable BLM resource management plans.

A rail line along the Caliente rail alignment would cross large areas of volcanic rock and granite. It is not likely that there would be paleontological resources within these types of rock; fossils are more likely to be found in sedimentary rock. There are no known or likely occurrences of paleontological resources within the region of influence of the Caliente rail alignment alternative segments and common segments. However, there is one known paleontological resource near Caliente common segment 1.

Caliente common segment 1 would cross Bennett Pass. There is a Condition 1 paleontological resource within an area known as Ruin Wash, approximately 4.8 to 8 kilometers (3 to 5 miles) south of Bennett Pass. Ruin Wash contains outcrops of the fossil-rich Pioche Formation (DIRS 174204-Palmer 1998, all; DIRS 173841-Shannon & Wilson 2005, pp. 108 and 109; DIRS 174509-Russ 2005, all). Area outcrops of the Pioche Formation are among the most fossil-rich late Lower Cambrian and early Middle Cambrian (about 510 to 530 million years ago) outcrops in the western United States, and these fossil beds contain important scientific information regarding the timing of extinctions of many species (DIRS 174509-Russ 2005, all; DIRS 174204-Palmer 1998, all; DIRS 174518-BLM 2005, p. 3.10-1). These specimens of soft-bodied marine animals are scientifically important because of their completeness and excellent state of preservation.

There are other outcrops of the Pioche Formation within 2 kilometers (1.2 miles) of the Caliente rail alignment, also in the vicinity of Bennett Pass. The BLM has not fully evaluated these resources.

A rail line along the Caliente rail alignment would not cross any known fossil-rich rock outcrops. The possibility exists that beds containing fossils could be uncovered during construction in those few areas along the rail alignment containing sedimentary rock.

3.2.15 ENVIRONMENTAL JUSTICE

> **Minority** individuals are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, and Hispanic.
>
> A **low-income** household is one for which the household income is below the U.S. Census Bureau poverty thresholds.
>
> Source: DIRS 155970-DOE 2002, Section 3.1.13.1.

To support the assessment of the potential for ***disproportionately high and adverse impacts*** on ***minority*** and low-income communities, this section provides the information on minority and ***low-income populations*** and communities in the Caliente rail alignment region of influence. Section 3.2.15.1 describes the region of influence, Section 3.2.15.2 describes the methodology DOE used to determine population groups, and Section 3.2.15.3 describes regional population characteristics for ***environmental justice*** considerations.

Executive Order 12898, *Federal Actions to Address Environmental Justice in* ***Minority Populations*** *and Low-Income Populations*, directs federal agencies to make achieving environmental justice part of their missions by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations, and provide access to public information on, and an opportunity for public participation in, matters relating to human health or the environment. Executive Order 12898 also directs agencies to provide opportunities for public input on the incorporation of environmental justice principles into federal agency programs or policies. Executive Order 12898, and associated implementing guidance, establishes the framework for characterizing existing conditions related to environmental justice. For this analysis, DOE uses the terms minority and low-income in the context of environmental justice as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13.1) and *Poverty Thresholds* (DIRS 174625-Bureau of Census 2005, all).

3.2.15.1 Region of Influence

The Caliente rail alignment region of influence for environmental justice encompasses the regions of influence for all other resource areas because impacts in other resource areas could result in environmental justice impacts. Section 3.2 describes the regions of influence for the environmental resource areas analyzed in this Rail Alignment EIS. For some resource areas, the relevant region of influence is an area extending a given distance from the centerline of the rail alignment. For others, the relevant region of influence is not so precisely definable, but generally includes the landscape the rail line would cross. However, the most inclusive region of influence is that defined for hazardous materials and waste (see Section 3.2.12), which considers a nationwide region of influence.

In addition to the regions of influence delineated via direct physical proximity to the Caliente rail alignment, the environmental justice region of influence includes populations that could be affected by the project that have cultural or religious ties in the area, even though the population may not have a physical presence. For a discussion of American Indian populations, and resulting region of influence, see Section 3.4, American Indian Interests in the Proposed Action, and *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all).

3.2.15.2 Methodology

Following the Council on Environmental Quality guidance (DIRS 103162-CEQ 1997, all) and the approach used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13), DOE considered that a minority population exists where either: (a) the minority population of the affected area exceeds 50 percent; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (DOE used both the United States and the State of Nevada minority populations).

DOE used the Council on Environmental Quality definition of low income and the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is meaningfully greater than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE applied the U.S. Nuclear Regulatory Commission guidance of a 20-percent threshold above the state average of 11 percent (that is, 31 percent) for low-income populations (69 *FR* 52040).

> A **census block** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block is the smallest geographic unit for which the Census Bureau tabulates 100-percent data.
>
> A **census county division (CCD)** is a subdivision of a county that is a relatively permanent statistical area established cooperatively by the Census Bureau and state and local government authorities. It is used for presenting decennial census statistics in those states that do not have well-defined and stable minor civil divisions that serve as local governments.
>
> A **census block group** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block group is the smallest geographic unit for which the Census Bureau tabulates sample data. A block group consists of all the blocks within a census tract with the same beginning number.
>
> A **census tract** is a small, relatively permanent statistical subdivision of a county delineated by a local committee of census data users for the purpose of presenting data. Designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions at the time of establishment, census tracts average about 4,000 inhabitants.
>
> Sources: DIRS 181904-U.S. Census Bureau 2007; DIRS 181905-U.S. Census Bureau [n.d.].

To identify low-income populations, DOE used U.S. Census Bureau data for census block groups. The census block group, which typically consists of between 600 and 3,000 people with an optimum size of 1,500 people, is the smallest census unit for which the Census Bureau collects 100-percent data. Block groups on American Indian reservations, off reservation trust lands, and special places must contain a minimum of 300 people. (Special places include correctional institutions, military installations, college campuses, workers' dormitories, hospitals, nursing homes, and group homes). To identify minority populations, DOE used U.S. Census Bureau data for ***census blocks***. The census block is the smallest census unit for which the Census Bureau collects 100-percent data. The Department assessed the population within 3 kilometers (1.8 miles) on either side of the centerline of the Caliente rail alignment, to be consistent with the Yucca Mountain FEIS.

DOE developed these analyses by creating Geographic Information System (GIS) representations of the Caliente rail alignment alternative segments and common segments and creating a computer program to extract specific census data based on the 3-kilometer buffer distance. The specific census data required to develop the analyses included:

- Total population and number of minority persons by census block
- Total population and number of individuals below the poverty level by census block group

For Census 2000, the Census Bureau used two forms, one short and one long. The Bureau sent the short form to every household, and sent the long form, containing the seven 100-percent questions plus the sample questions, to only a limited number of households. Generally, about one in every six households nationwide received the long form. The rate varied from one in two households in some smaller areas, to one in eight households for more densely populated areas. The long form requests information on the numbers and ages of members of each household and income received during the previous full year. From this information, the Census Bureau makes a determination of the poverty status of the individuals living in the household. The Census Bureau additionally uses school districts, child protective services, and social services to supplement the census data to develop estimates that more fully represent actual poverty status among all populations.

3.2.15.3 Regional Characteristics

3.2.15.3.1 Minority and Low-Income Populations

The Caliente rail alignment would affect portions of three counties in southern Nevada (Nye, Esmeralda, and Lincoln). Table 3-77 summarizes Census 2000 data on the relative size of minority and low-income populations within these general areas. The table includes specific county subdivisions and small population centers that encompass or are near the Caliente rail alignment. For comparison, the table includes statewide and countywide minority and poverty data.

There are no census blocks in the region of influence with minority population percentages that are at or more than 50 percent. This calculation includes federally recognized American Indian lands, because American Indians are included in the definition of minority populations. Based on Census 2000 estimates, the population living within 3 kilometers (1.8 miles) on either side of the Caliente rail alignment is approximately 1,800.

Census block groups, depending on their size, can be further divided into smaller sections and provided a number designation. For example, the population center of Caliente, the largest population center in census block group 2, which is part of census tract 9502 in Lincoln County, comprises more than 90 percent of the population of the block group. Of these people, 15 percent are members of minority groups. This percentage is lower than the percent of the minority population for the State of Nevada and is well within the percent of the minority population of counties along the Caliente rail alignment (10 to 19 percent).

Based on Census 2000 estimates, the population within 3 kilometers (1.8 miles) on either side of the centerline of the Caliente rail alignment for whom poverty status is determined is approximately 1,100. Of these, about 150, or 13 percent, are living below the poverty level. This percentage is higher than the percent of the population living in poverty for the State of Nevada as a whole (11 percent) and is generally lower than the population living in poverty in the counties along the Caliente rail alignment (11 percent to 17 percent) (see Table 3-77). There are no census block groups with poverty rates more than 20 percent above the state average (11 percent). Census block group 2 of census tract 9502 in Lincoln County has the highest percentage of low-income populations with 22 percent (250 people) of the population below the poverty level. The Department also used county subdivisions and population centers for comparative analyses. Based on the data in Table 3-77, most of the county subdivisions that would surround the Caliente rail alignment have a higher proportion of minority residents than the associated county-wide proportion of minority residents. The Amargosa Valley ***Census County Division***, a subdivision of Nye County, shows the widest percentage difference with a 28-percent minority population compared to only a 13-percent minority population for Nye County as a whole. However, for purposes of analyses in this Rail Alignment EIS, DOE has chosen 50 percent as the threshold. As shown in Table 3-77, there are no minority populations that exceed that benchmark.

As shown on Table 3-77, poverty rates in the affected county subdivisions tend to be higher than the associated county-wide poverty percentages, except in the Goldfield subdivision, where the poverty rate is lower than the Esmeralda County percentage (DIRS 176856-Bureau of Census 2003, all). In all cases, poverty rates in the county subdivisions are higher than the state-wide figure of 11 percent. However, for the purposes of this analysis, DOE has chosen 20 percent above the state average (10.5 percent) as the threshold (31 percent) and there are no low-income populations that exceed that benchmark as can been seen in Table 3-77.

Population centers are often assessed in relation to the county in which they are located. As shown in Table 3-77, Caliente has a higher minority population rate and higher poverty rate than Lincoln County. Compared to Nye County, Beatty has a slightly lower minority population rate but a higher poverty rate.

Table 3-77. Minority and low-income populations in the jurisdictions potentially affected by construction and operation of the proposed rail line – Caliente rail alignment.[a]

Areas	Population	Percent minority	Percent low-income
State of Nevada	2,000,000[b]	35	11
Counties			
Nye County	32,500	13	11
Esmeralda County	970	19	15
Lincoln County	4,200	10	17
County subdivisions			
Amargosa Valley Census County Division, Nye County, Nevada	1,100	28	15
Beatty Census County Division, Nye County, Nevada	1,090	11	13
Goldfield Census County Division, Esmeralda County, Nevada	450	4.5	12
Caliente Census County Division, Lincoln County, Nevada	1,200	15	22
Small population centers			
Beatty (Nye County)	1,090	11	13
Caliente (Lincoln County)	1,130	15	22

a. Source: DIRS 176856-Bureau of Census 2003, all.
b. The state population is rounded to 2 million for consistent analysis.

3.2.15.3.2 American Indian Perspectives

Section 3.4 addresses American Indian interests in potential impacts to the environment along the Caliente rail alignment, including environmental justice.

3.3 Mina Rail Alignment

> The **region of influence** is the physical area that bounds the environmental, sociologic, economic, or cultural features of interest for analysis purposes.

This section describes the affected environment along the Mina rail alignment. The scope of the affected environment reflects the ***region of influence*** for each resource area. DOE expects that most potential impacts would occur within a certain distance from the centerline of the rail alignment and within the ***footprints*** of construction and operations support facilities. However, resource area regions of influence vary, depending on the nature and type of the resource. Each environmental resource section fully describes the region of influence for the resource. Table 3-78 summarizes the regions of influence for the Mina rail alignment analyzed in this Rail Alignment EIS.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 1 of 4).

Resource area	Region(s) of influence
Physical setting	All areas that would be affected by construction and operation of the proposed railroad. These areas include the nominal width of the rail line construction right-of-way, and the footprints of construction and operations support facilities beyond the nominal width of the construction right-of-way. See Section 3.3.1.1.
Land use and ownership	The nominal width of the construction right-of-way, including all private land (including patented mining claims), American Indian lands, and public land fully or partially within this area. Also includes the locations of construction and operations support facilities outside the nominal width of the construction right-of-way. See Section 3.3.2.1.
Aesthetic resources	The ***viewshed*** around all alternative segments, common segments, and proposed locations of construction and operations support facilities. DOE used a conservative region of influence extending 40 kilometers (25 miles) on either side of the centerline of the rail alignment. See Section 3.3.3.1.
Air quality and climate	A small portion of Churchill County near Hazen, Nevada, and Lyon, Mineral (including the Walker River Paiute Reservation), Esmeralda, and Nye Counties. See Section 3.3.4.1.
Surface-water resources	The nominal width of the construction right-of-way for most analyses. In cases where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage patterns could carry eroded soil, sedimentation, or spills downstream, the region of influence extends to 1.6 kilometers (1.0 mile) on either side of the centerline of the rail alignment. See Section 3.3.5.1.
Groundwater resources	***Aquifers*** that would underlie areas of proposed railroad construction and operations, portions of groundwater aquifers DOE would use to obtain water for construction and operations support and that would be affected by these groundwater withdrawals, and nearby springs that might be affected by such groundwater withdrawals. The horizontal extent of the region of influence varies depending on the particular aspects of the specific project activity. See Section 3.3.6.1.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 2 of 4).

Resource area	Region(s) of influence
Biological resources	DOE used two areas of assessment to describe the affected environment for biological resources: a region of influence and a study area. *Region of influence*: Generally, the nominal width of the construction right-of-way. For facilities that would be outside the nominal width of the construction right-of-way (such as quarries), the footprint of the proposed facility. *Study area*: A 16-kilometer (10-mile)-wide study area, extending 8 kilometers (5 miles) on either side of the centerline of the proposed rail alignment, for use in database and literature searches to ensure the identification of sensitive habitat areas near the Mina rail alignment and transient or migratory wildlife, particularly special status species, that could pass through the region of influence. See Section 3.3.7.1.
Noise and vibration	The nominal width of the construction right-of-way out to variable distances, depending on several analytical factors (***ambient noise*** level, train speed, number of trains per day, and number of rail cars). For construction and operations support facilities, the region of influence varies depending on the magnitude of noise that would be generated and ambient noise levels, which would affect how far away the noise might be heard. Therefore, the region of influence varies along the rail alignment. Also includes the locations of receptors that might be affected by noise, vibration, or both. See Section 3.3.8.1.
Socioeconomics	*Employment and income, population and housing, and public services:* Lyon, Mineral, Nye, Esmeralda, and Clark Counties, and the Walker River Paiute Reservation in Nevada. A second scenario includes Washoe county and Carson City. *Transportation resources:* Public roadways near the Mina rail alignment and the rail alignment itself. See Section 3.3.9.1.
Occupational and public health and safety	*Nonradiological region of influence* The region of influence for public nonradiological impacts includes: • The nominal width of the construction right-of-way • Public roads in Washoe, Douglas, Storey, Churchill, Lyon, Mineral, Esmeralda, and Nye Counties and the Walker River Paiute Reservation that the workforce would use during railroad construction and operations • The railroad construction and operations support facilities including access roads, water wells, and quarries where workers would perform construction, operations, or maintenance activities *Radiological region of influence* The region of influence for radiological impacts for incident-free transportation includes the area 0.8 kilometer (0.5 mile) on either side of the centerline of the Mina rail alignment. The region of influence for occupational radiological impacts for incident-free operation also includes the physical boundaries of railroad operations support facilities, where workers would perform operations involving ***casks*** and ***cask cars***. Railroad operations support facilities within the radiological region of influence include only the ***Staging Yard***, the ***Rail Equipment Maintenance Facility***, and the ***Cask Maintenance Facility*** because DOE anticipates that radioactive materials would be managed only at those facilities.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 3 of 4).

Resource area	Region(s) of influence
Occupational and public health and safety (continued)	For purposes of this Rail Alignment EIS, the affected environment for public radiological impacts includes: • Residents within the region of influence of the Mina rail alignment, including persons who live within 0.8 kilometer (0.5 mile) of either side of the centerline of the rail alignment. For the public radiological impact analysis, DOE evaluated four specific alignments: the alignment with the highest exposed population, the shortest alignment, the longest alignment, and the alignment with the lowest population. • Individuals at locations such as residences or businesses near the rail alignment. • Individuals within the region of influence for radiological impacts for potential public exposure related to accidents and sabotage. This includes the area 80 kilometers (50 miles) on either side of the centerline of the rail line. See Section 3.3.10.1.
Utilities, energy, and materials	*Regions of influence for utilities and energy* • Public water systems: The region of influence for public water systems is Lyon, Mineral, Esmeralda, and Nye Counties, communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions within Lyon and Churchill Counties. • Wastewater treatment: The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lyon, Mineral, Esmeralda, and Nye Counties and communities within those counties, and the Walker River Paiute Reservation. (Note: For wastewater treated using other methods [for example, on-site portable wastewater-treatment facilities], treated wastewater would be recycled, and there is no associated region of influence.) • Telecommunications: The region of influence for telephone and fiber-optic telecommunications is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Verizon. • Electricity: The region of influence for electric-power resources includes areas serviced by the southern Nevada electrical grid operated by Nevada Power Company; Sierra Pacific Power Company; and Valley Electric Association, Inc. *Regions of influence for materials* • The region of influence for cast-in-place concrete and ***subballast*** is limited to the State of Nevada. Subballast, sand, and gravel would be generated from ***overburden*** at quarries and ***borrow sites*** near the rail alignment. There is a high likelihood DOE would also find subballast, sand, and gravel along ***cuts*** for the proposed rail line on ***alluvial fans***. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate. • DOE would obtain ballast rock from potential quarry sites close to the construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase. • Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete could be procured and shipped from various national suppliers. Therefore, the region of influence for these materials is national.

Table 3-78. Regions of influence for environmental resource areas – Mina rail alignment (page 4 of 4).

Resource area	Region(s) of influence
Utilities, energy, and materials (continued)	*Regions of influence for materials* (continued) • The region of influence for cast-in-place concrete and subballast is limited to the State of Nevada. Subballast, sand, and gravel would be generated from overburden at quarries and borrow sites near the rail alignment. There is a high likelihood DOE would also find subballast, sand, and gravel along cuts for the proposed rail line on alluvial fans. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate. • DOE would obtain ballast rock from potential quarry sites close to the construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase. • Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete could be procured and shipped from various national suppliers. Therefore, the region of influence for these materials is national. See Section 3.3.11.1.
Hazardous materials and waste	*Use of hazardous materials and the generation of hazardous and nonhazardous wastes*: The nominal width of the construction right-of-way, and the locations of rail-line construction and operations support facilities beyond this area. *Disposal of low-level radioactive waste:* DOE low-level waste disposal sites, sites in ***Agreement States***, and U.S. Nuclear Regulatory Commission-licensed sites *Disposal of hazardous wastes*: The entire continental United States. *Disposal of nonhazardous waste*: Disposal facilities in Mineral, Nye, Esmeralda, and Clark Counties in Nevada. See Section 3.3.12.1.
Cultural resources	Two levels of coverage, based on the location from the rail alignment: • Level I. The first level of coverage is within the nominal width of the construction right-of-way, the area where ground disturbance could have direct or indirect impacts on cultural resources. • Level II. The second level of coverage is a 3.2-kilometer (2-mile)-wide area centered on the rail alignment. This area includes the area of potential disturbances that could have indirect impacts on cultural resources. See Section 3.3.13.1.
Paleontological resources	The nominal width of the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities. See Section 3.3.14.1
Environmental justice	An area encompassing the regions of influence for all other resource areas. Includes populations that could be affected by the project that have cultural or religious ties to the area. See Section 3.3.15.1.

3.3.1 PHYSICAL SETTING

This section describes physiography, geology, and soils along the Mina rail alignment. Characterization of the physical setting also identifies relationships to other resource areas described in this Rail Alignment EIS, such as aesthetics, land use, biological (vegetation) resources, and surface-water resources.

Section 3.3.1.1 describes the region of influence for physical setting along the Mina rail alignment; Section 3.3.1.2 describes the general physical setting and characteristics in the region of influence; and Section 3.3.1.3 describes the physical setting in more detail for the Mina rail alignment alternative segments and common segments.

3.3.1.1 Region of Influence

The region of influence for physical setting along the Mina rail alignment includes all areas that would be directly or indirectly affected by construction and operation of the proposed railroad. These areas include the nominal width of the rail line construction right-of-way, and the footprints of facilities outside the nominal width of the construction right-of-way.

3.3.1.2 General Setting and Characteristics

3.3.1.2.1 Physiography

The Mina rail alignment would cross the western Great Basin of the Basin and Range Physiographic Province. The terrain consists of relatively narrow mountain ranges separated by broad sediment-filled basins approximately 16 to 24 kilometers (10 to 15 miles) wide. The mountain ranges are mostly tilted, fault-bounded crustal blocks that are as much as 120 kilometers (75 miles) long. Mountain ranges typically rise from 910 to 1,520 meters (3,000 to 5,000 feet) above the adjacent valley floors. As shown in Figure 3-124, from north to south, a rail line along the Mina rail alignment would use gaps, passes, and valleys to cross or travel near the following mountain ranges: Terrill Mountains, Calico Hills, Monte Cristo Range, Clayton Ridge, Montezuma Range, and Goldfield Hills.

From north to south, the rail line would cross Campbell Valley, Sunshine Flat, Long Valley, Soda Spring Valley, Rhodes Salt Marsh, Columbus Salt Marsh, Big Smoky Valley, Montezuma Valley, Clayton Valley, Stonewall Flat, Lida Valley, Sarcobatus Flat, Oasis Valley, Crater Flat, and Jackass Flats (see Figure 3-124). All lowlands, except for Campbell Valley, Oasis Valley, Crater Flat, and Jackass Flats have interior drainage to ***playas*** or dry washes and are therefore closed basins. The design of the rail alignment accounts for the locations of the playas in these basins to avoid them. Section 3.3.5 describes surface-water resources in the Mina rail alignment region of influence.

> **Alluvial fan**: A low, outspread, relatively flat-to-gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream where it issues from a narrow mountain valley on a plain or break valley.
>
> **Playa**: A nearly level area at the bottom of a desert basin that does not drain to a river and is temporarily covered with water from heavy rains or snowmelts. Normally a dry lakebed that may contain water in response to seasonally high runoff.

Sediment in the valleys are composed of coarse to fine alluvial debris (boulders, cobbles, sand, silt, and clay) eroded from the adjacent mountains. Large alluvial fans, a common landform in the region, originate at the base of the mountains, and occasionally extend far into the valleys.

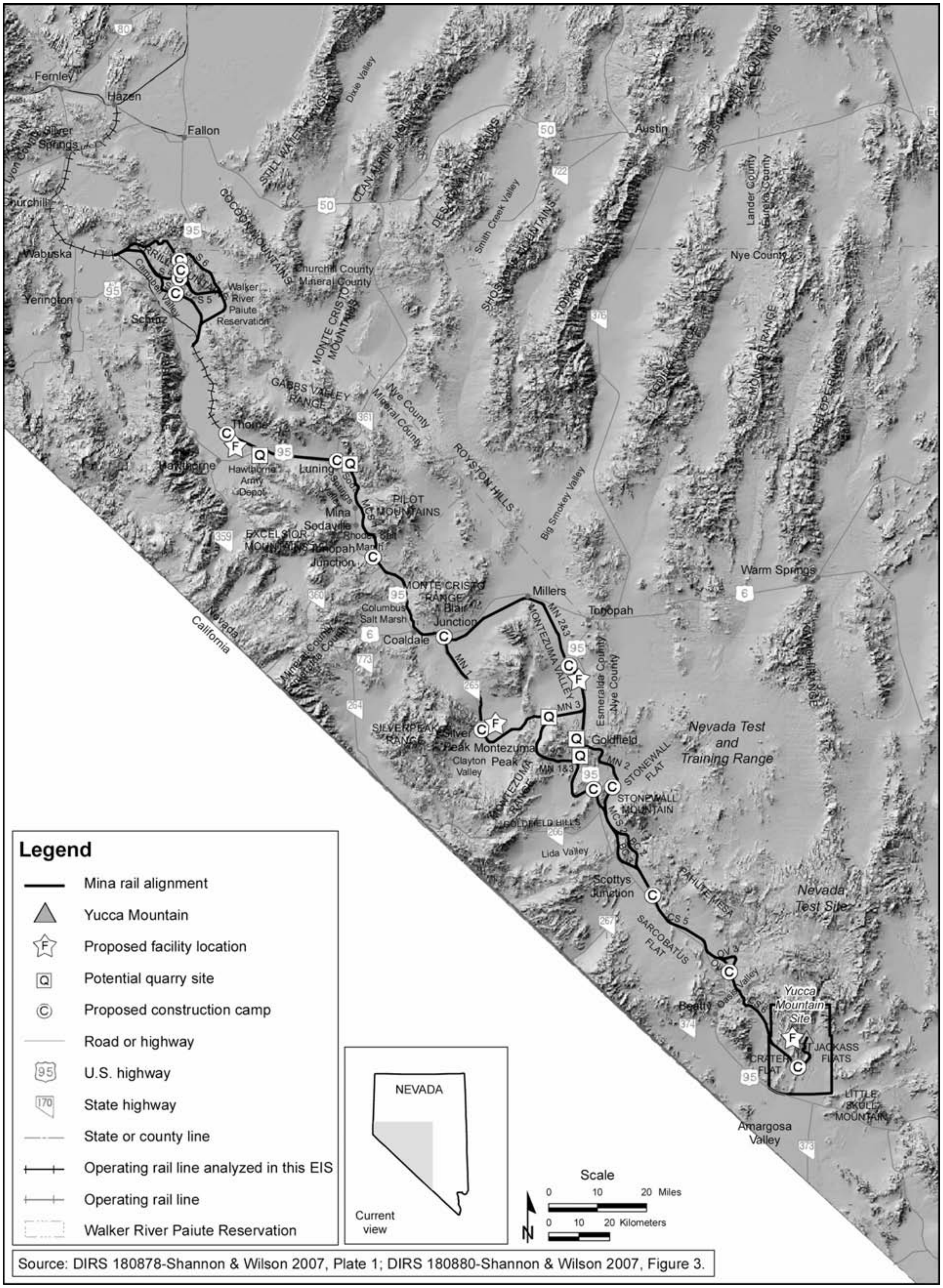


Figure 3-124. Physiographic setting along the Mina rail alignment.

Playas occur in the lowest parts of some valleys. After heavy rains or snowmelt, the lowlands can fill with water. Evaporation of this water over days or weeks leaves a variety of salts near the surface that limit the growth of vegetation. In some locations, where the surface water percolates at a sufficient depth, the water can enter deep saline aquifers. Valleys with playas are sometimes referred to as closed basins, because no surface water flows out of them.

Elevations along the Mina rail alignment range from approximately 980 meters (3,200 feet) above mean sea level at the base of Busted Butte on the west side of Jackass Flats to approximately 2,000 meters (6,500 feet) above mean sea level at an unnamed pass in the Montezuma Range (DIRS 176184-Shannon & Wilson 2006, Figure 3; DIRS 180880-Shannon & Wilson 2007, Figure 3).

3.3.1.2.2 Geology

This section summarizes regional geology along the Mina rail alignment. The geotechnical reports to support the preliminary design effort (DIRS 180878-Shannon & Wilson 2007, all; DIRS 180880-Shannon & Wilson 2007, all) provide a more detailed discussion of regional geology.

The Mina rail alignment would cross a region of complex stratigraphic and structural elements that includes major north-south trending basins and ranges and broad volcanic uplands. Table 3-79 provides a generalized stratigraphic description and lists rock sequences according to the geologic age during which they were deposited, and their locations from north to south along the Mina rail alignment. Table 3-79 also defines the geologic periods discussed in the geology sections of this Rail Alignment EIS.

North of the Montezuma Range, exposures consist of ***sedimentary rocks*** (such as carbonate) and ***volcanic rocks*** of Paleozoic age, as well as Tertiary volcanic flows and ash fall deposits. South of the Montezuma Range, only the Tertiary volcanic rocks are visible at the surface.

Soils in the valleys were primarily formed from late Tertiary and Quaternary and some Paleozoic debris eroded from neighboring mountains, wind-blown sand and silt, fine-grained lake deposits, evaporite deposits, and marsh and playa sediments. In some areas, alluvial fans are thin and overlie bedrock surfaces. Elsewhere, basin-fill sediments are more than 1,200 meters (4,000 feet) thick (DIRS 180878-Shannon & Wilson 2007, p. 14).

The oldest ***outcrops*** in the region are Precambrian Era ***metamorphic rocks***, which are exposed in hills west of Montezuma alternative segment 1 and west of Mina common segment 6. Other than these exposures, Precambrian bedrock is covered by younger rocks.

Metamorphic rocks are rocks in which the original mineralogy, texture, or composition has changed due to the effects of pressure, temperature, or the gain or loss of chemical components.

Sedimentary rocks are rocks formed by the accumulation of sediment in water or land. Sandstone, chert, limestone, dolomite, shale, siltstone, and mudstone are types of sedimentary rocks that are found in the Great Basin. They are differentiated by chemistry, deposition, and grain size.

Volcanic rocks are rocks that have been ejected at or near the earth's surface. Tuffs, lava flows, volcanic breccias, basalt, andesite, and rhyolite are types of volcanic rocks that are found in the Great Basin. They are differentiated by chemistry and texture.

During the late Paleozoic Era, the area was periodically covered by shallow seas to the east that generally deepened westward. Thick layers of limestone, shale, sandstone and some volcanic rocks, now exposed widely in the mountains along Mina common segment 1, are the remains of these Paleozoic seas (DIRS 180878-Shannon & Wilson 2007, p. 11).

Table 3-79. General stratigraphy – Mina rail alignment (page 1 of 2).

Geologic age[a]	Northern portion of the Mina rail alignment[b, c]	Northern portion of Mina common segment 1[b, d]	Southern portion of Mina common segment 1[b, e]	Montezuma alternative segments 1, 2, and 3[b, f]	Southern portion of the Mina rail alignment (southwest Nevada volcanic field)[g]
Cenozoic Era[h] (less than 65 Ma) -Quaternary Period (less than 1.6 Ma)	Stream channel and lake alluvium; wind-blown, playa, and basin-fill deposits.	Stream channel, lake, floodplain and fan alluvium; wind-blown, playa and basin-fill deposits.	Stream channel, lake, floodplain and fan alluvium; wind-blown and basin-fill deposits.	Stream channel and fan alluvium; dune, playa and landslide deposits; basalt flows and cinder cones.	Stream channel and floodplain alluvium; wind-blown, playa, and landslide deposits; fan alluvium; basin-fill deposits. Basalt flows.
Cenozoic Era (less than 65 Ma) -Tertiary Period (65 to 1.6 Ma)	Late Tertiary rocks include alluvial fan and landslide deposits; gravel; basalt and andesite lava flows; sedimentary and volcanic rocks; sedimentary breccia; conglomerate; and sandstone. No mid-Tertiary rocks. Early Tertiary rocks include dacite, rhyodacite, tuffs, and rhyolite dikes.	Late Tertiary rocks include alluvial, fan, landslide and gravel deposits, conglomerate, lava flows, dikes, fine grained lake deposits, stream alluvium, sandstone, lava flows, dikes, cinder cones, claystone. Mid-Tertiary rocks include lava flows, interbedded with tuffs, and other volcanic rocks. Early Tertiary rocks include tuff, sandstone, conglomerate, siltstone, shale and conglomerate and volcanic rocks.	Late Tertiary rocks include basalt lava flows, cinder cones, sandstone and conglomerate, tuff, basalt lava flows, andesite, breccia. Mid-Tertiary rocks include dacite and andesite to rhyodacite, tuff, tuff breccia, lava flows, and intrusive volcanic rocks. No early Tertiary rocks area exposed along this portion of the alignment.	Late Tertiary rocks include conglomerate and sandstone, basalt siltstone, claystone, tuff, volcanic and lava flows. Mid-Tertiary rocks include lava flows, and dykes, andesite breccia, silicic dykes, tuff, volcaniclastic, sandstone and shale. Early Tertiary rocks include sandstone and siltstone, conglomerate, sandstone and basalt flows, rhyolite, and ash fall tuff.	Silicic ash-flow tuffs; minor basalts. Predominantly volcanic rocks of the southwestern Nevada volcanic field.
Mesozoic Era (240 to 65 Ma)	Late Mesozoic rocks include granite, granodiorite and quartz monzonite, diorite, tonalite gabbro, hornfels, schist and marble. Early Mesozoic rocks include andesite lava flows, tuff, metamorphosed volcanoclastic rocks.	Granite, quartz monzonite, granodiorite, diorite, tonalite and serpentine, volcanic rocks, ***clastic***, volcaniclastic and carbonate sedimentary rocks. Metamorphosed marine and submarine sedimentary rocks, lava flows and flow breccia, tuff, hornfels, greywacke, argillite and limestone (such as marine volcanic and sedimentary rocks).	Late Mesozoic (Cretaceous) age rocks include quartz monzonite, granodiorite, and granite. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.	Late Mesozoic (Cretaceous) age rocks include granite, quartz monzonite, granodiorite, mafic and felsic dikes. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.	Granitic rocks of Late Mesozoic (Cretaceous) age occur. No early or mid-Mesozoic rocks are exposed along this portion of the alignment.

Table 3-79. General stratigraphy – Mina rail alignment (page 2 of 2).

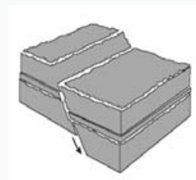
Geologic age[a]	Northern portion of the Mina rail alignment[b, c]	Northern portion of Mina common segment 1[b, d]	Southern portion of Mina common segment 1[b, e]	Montezuma alternative segments 1, 2, and 3[b, f]	Southern portion of the Mina rail alignment (southwest Nevada volcanic field)[g]
Paleozoic Era (570 to 240 Ma)	Rocks of this age are not exposed in the region.	Submarine lava flows, volcanic clast sedimentary rock, and conglomerate. Limestone, dolomite chert, chert-clast sandstone, and chert pebble conglomerate. Sandstone, fine-grained clastic rocks, quartzite, hornfels, siltstone, and shale. Early Paleozoic (Ordovician and Cambrian) rocks are shale, siltstone, claystone, limestone, marble, and metamorphosed sedimentary rocks.	Dolomite chert, chert-clast sandstone and chert pebble conglomerate. Fine-grained clastic rocks, conglomerate, limestone, quartzite, and partially altered mafic volcanic rocks.	Rocks of Middle and Late Paleozoic age are not exposed along this portion of the alignment. Early Paleozoic (Ordovician and Cambrian) rocks are shale, siltstone, claystone, limestone, marble, and metamorphosed sedimentary rocks.	Alternating marine and terrestrial sediments comprised mostly of shale, quartzite, limestone, and dolomite.
Precambrian Era (greater than 570 Ma)	Rocks of this age are not exposed along this portion of the alignment.	Rocks of this age are not exposed along this portion of the alignment.	Rocks of this age are not exposed along this portion of the alignment.	Claystone, siltstone, fine-grained sandstone, sandy limestone, dolomite, and slightly metamorphosed sedimentary rocks.	Conglomerate, quartzite, sandstone, shale, dolomite, limestone, chert, and diabase overlie old ***igneous*** and metamorphic rocks that form the crystalline "basement."

a. Ma = approximate years ago in millions.
b. Source: DIRS 180880-Shannon & Wilson 2007, Table 2 and Table 3.
c. Includes Wassuk Range, Walker River Basin, and Whiskey Flat.
d. Includes Candelaria and Goldfield Hills, Excelsior Mountains, Columbus and Rhodes Salt Marshes, Soda Spring Valley, Pilot Mountain, Gabbs Valley, and Gibbs Range.
e. Includes Monte Cristo Range.
f. Includes Montezuma Range, Clayton Ridge, Paymaster Ridge, Palmetto Mountains, Silver Peak Mountains, Mineral Ridge, Weepah Hills, Big Smoky Valley, Goldfield Hills, Malpais Mesa, Mt. Jackson Ridge, Montezuma and Lida Valleys, and Lone Mountain.
g. Includes Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, Rock Valley, and Yucca Flat. Source: DIRS 176184-Shannon & Wilson 2006, Tables 2 and 3.
h. The Cenozoic Era consists of both the Quarternary and the Tertiary periods.

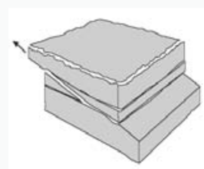
In Mineral County, off-shore sedimentation continued throughout the Mesozoic era, before ending with new tectonic movement (DIRS 180878-Shannon & Wilson 2007, pp. 11 to 12).

Faulting is movement of the earth's crust that produces relative displacement of adjacent rock masses along a fracture. Generally, the fracture is referred to as a fault.

Splay faults are minor faults that branch off of a primary fault, or interconnect to form a fault zone.



A **normal fault** is a fault where the block above an inclined fault has moved down relative to the other block.



A **thrust fault** is a fault that occurs when squeezing forces push the block above an inclined fault up in relation to the other block.

Source: DIRS 155970-DOE 2002, Figure 3-9.

Major east-west compression occurred periodically in the Great Basin between about 350 million and 65 million years ago (DIRS 169734-BSC 2004, p. 2-16). This compression moved large sheets of old rock great distances upward and eastward over young rocks along ***thrust faults*** to produce mountains. Most of the thrust ***fault*** traces have eroded away; however, there is evidence of thrust motion in the Garfield Hills area, where Triassic rocks overlie Jurassic rocks (DIRS 180878-Shannon & Wilson 2007, p. 14). Range-bounding ***normal faults***, which have developed in response to ***crustal extension*** over approximately the last 20 million years, are conspicuous features in this part of Nevada and are especially visible in parts of Nye County. These faults have surface traces that form distinctive segments 5 to 30 kilometers (3.1 to 19 miles) long (DIRS 174214-Kleinhampl and Ziony 1985, p. 144). Although generally coincident with the range fronts, in places these normal faults, and shorter ***splay faults*** radiating outward from these normal faults, extend into adjacent valleys where they are buried by recent alluvial deposits. Both the exposed and buried parts of active faults could be capable of rupturing the surface.

Crustal extension in the region, which began about 20 million years ago, is still occurring (DIRS 176184-Shannon & Wilson 2006, p. 12). By about 11.5 million years ago, present-day mountains and valleys were well developed. Evidence for recent, continuing crustal extension is based on Holocene-age (approximately the last 10,000 years) faults, recurring ***earthquakes***, and geothermal features. The Holocene-age faults are visible in many valleys in Mineral, Esmeralda, and Nye Counties that the proposed rail line would cross (Figure 3-125).

Evidence of crustal extension is seen in the Walker-Lane Structural Belt, a 96-kilometer (60-mile)-wide deformation zone that parallels the Nevada-California border from Las Vegas to northern California. The belt includes generally northwest-trending faults that were active within the last 20 million years (DIRS 180878-Shannon & Wilson 2007, p. 16). The earthquakes along the western section of the Great Basin are primarily connected to ruptures along surface or buried faults in the Walker-Lane Belt (DIRS 180878-Shannon & Wilson 2007, p. 17). Section 3.3.1.2.2.1 provides more information on ***seismic*** activity along the Mina alignment.

The southwestern Nevada volcanic field is a volcanic plateau that developed between 16 and 7 million years ago, with the greatest eruptions occurring between 14 and 11 million years ago (DIRS 176184-Shannon & Wilson 2006, p. 11). The volcanic field encompasses common segment 5, the Oasis Valley alternative segments, and common segment 6 (Sarcobatus Flat, Pahute Mesa, Oasis Valley, Crater Flat, Yucca Mountain, Jackass Flats, Rock Valley, and Yucca Flat).

The field has a complex history of volcanism and deformation (DIRS 169734-BSC 2004, pp. 2-4 through 2-15). Eruption of 17 ash-flow ***tuff*** sequences and lava flows occurred from at least seven large, overlapping ***caldera*** complexes to form the southwestern Nevada volcanic field.

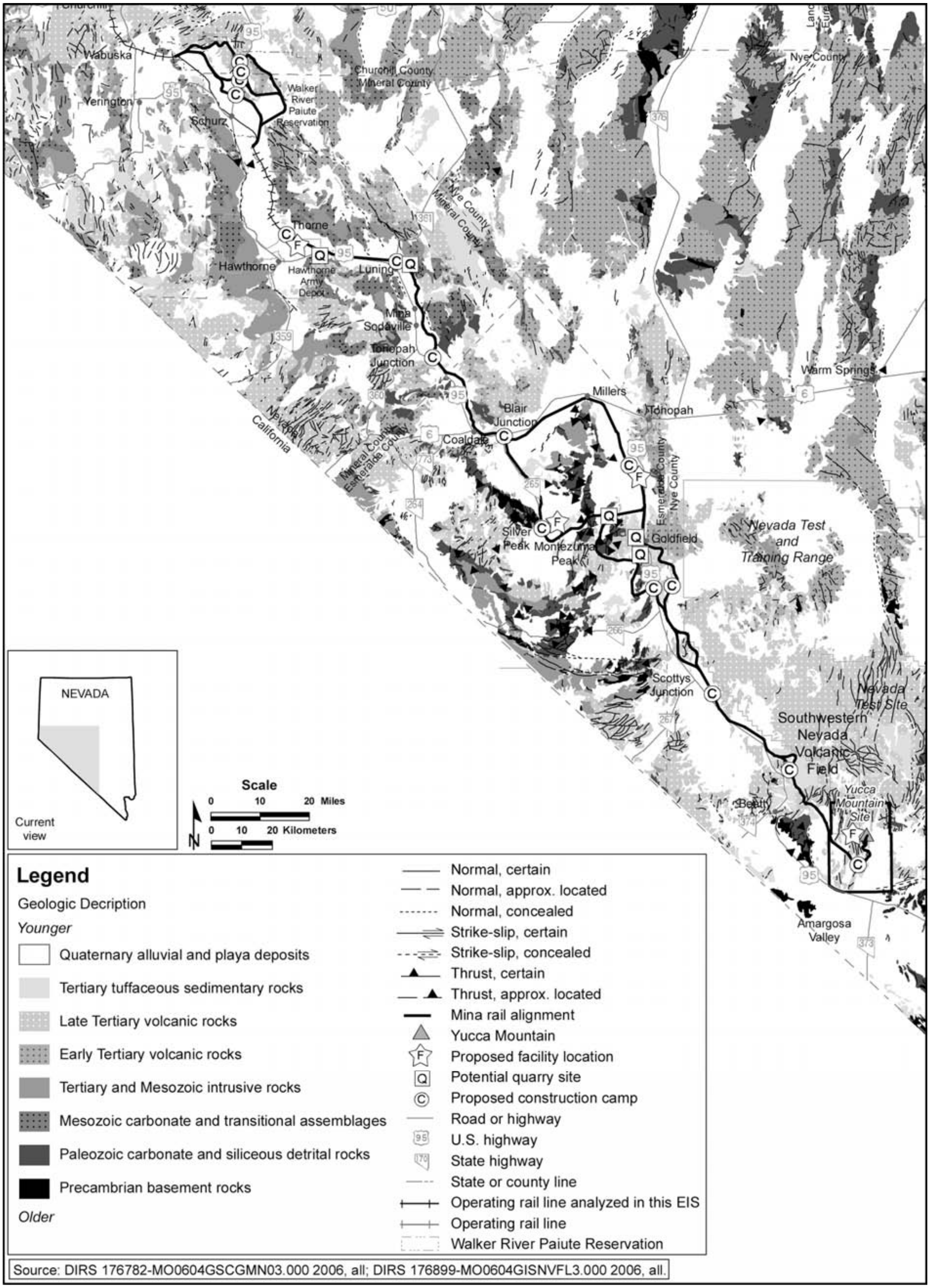


Figure 3-125. Geologic setting along the Mina rail alignment.

The youngest caldera-forming events associated with this feature occurred between 7.5 and 7.6 million years ago with eruptions southeast of Mina common segment 2 (DIRS 180878-Shannon & Wilson 2007, p. 13). The mid-Tertiary eruptions deposited ash-fall and volcanic-ash flows with minor lava flows and reworked materials. Only Tertiary and younger rocks are exposed in the southwestern Nevada volcanic field area.

There are cinder cones (a type of volcano formed by ejected cinders) south of Blair Junction in Big Smoky Valley, the northwest corner of Clayton Valley, and Oasis Valley. The ***basalt*** flows and associated material ejected from volcanoes are dated approximately between 1.6 million years and 10,000 years old (DIRS 180878-Shannon & Wilson 2007, p. 29; DIRS 176184-Shannon & Wilson 2006, pp. 25 and 26).

3.3.1.2.2.1 Faulting and Seismic Activity. Historically, there have been numerous earthquakes in the Great Basin region as a result of the ongoing crustal extension (see Figure 3-126). Consistent with geologic evidence, the historical record of Holocene-age ***seismicity*** (occurring within the last 10,000 years) suggests that seismic activity was concentrated in the western part of the Great Basin (DIRS 180878-Shannon & Wilson 2007, p. 16 and Plate 4). Modern earthquakes in the area predominantly occur at depths of 2 to 12 kilometers (1.2 to 7.4 miles) below Earth's surface (DIRS 169734-BSC 2004, p. 4-35).

The western Great Basin contains many Quaternary fault traces; however, there are few instances of surface rupture within the last 10,000 years (DIRS 180878-Shannon & Wilson 2007, p. 16). These faults are characterized by discontinuous scarps (vertical displacement along a fault), from surface displacement. Studies of Holocene faults have calculated slip rates of 0.01 to 0.1 millimeter (0.000039 to 0.0039 inch) per year, with a surface-rupturing recurrence of approximately 100 years (DIRS 176905-Workman et al. 2002, p. 18). Studies of fractures other than ***block-bounding faults*** around Yucca Mountain determined that fault displacements of about 0.1 centimeter (0.039 inch) would have an exceedance ***probability*** of once every 100,000 years (DIRS 169734-BSC 2007, p. 4-64).

Figure 3-126 shows the number and locations of earthquakes of magnitude 3.0 and greater on the Richter scale based on available historical and recorded data from 1852 to 2004. Most of the earthquakes around the Mina rail alignment fall within a magnitude range of 3.0 to 3.9, the range that most people start to feel ground shaking (DIRS 180969-USGS 2006, all). As magnitude increases, the potential for damage from ground shaking also increases. The highest concentration of earthquakes, large and small, along the Mina rail alignment occur in the northern portion of Mina common segment 1, centered around Garfield Hills and Soda Spring Valley.

There have been many seismic events with a magnitude 5.0 or larger on the Richter scale within 30 kilometers (19 miles) of the proposed rail alignment, several occurring on the Nevada Test Site north of Yucca Mountain. Most seismic events on the Nevada Test Site are associated with historical underground testing, not natural ***faulting***. Seismic activity from man-made tests has not activated local faults (DIRS 169734-BSC 2004, pp. 4-33 and 4-35). There is another cluster of earthquakes around the northern portion of the Mina rail alignment, in the mountains around Soda Spring Valley. This seismic activity is believed to be connected to stretching along the Walker Lane Structural Belt (DIRS 180878-Shannon & Wilson 2007, pp. 16 and 17). The closest major earthquake to the rail alignment was a magnitude 6.3 magnitude event in 1959 near Schurz. In 1932, there was a magnitude 7.2 earthquake near Cedar Mountain that caused cracking in some structures. A 1992 earthquake near Little Skull Mountain is the largest recorded earthquake in the vicinity of Yucca Mountain. The magnitude 5.6 event was apparently triggered by a magnitude 7.3 earthquake which occurred 20 hours earlier at Landers, California, 300 kilometers (190 miles) southwest of Yucca Mountain (DIRS 169734-BSC 2004, pp. 4-38 and 4-39). Since 1978, DOE has monitored seismic activity in the area around Yucca Mountain to pinpoint seismic events (DIRS 155970-DOE 2002, p. 3-32). In the area around the Mina rail alignment, earthquakes with a magnitude of 6.1 to 6.4 are predicted to have a return period of 2,500 years (DIRS 174296-Shannon & Wilson 2005, p. 14).

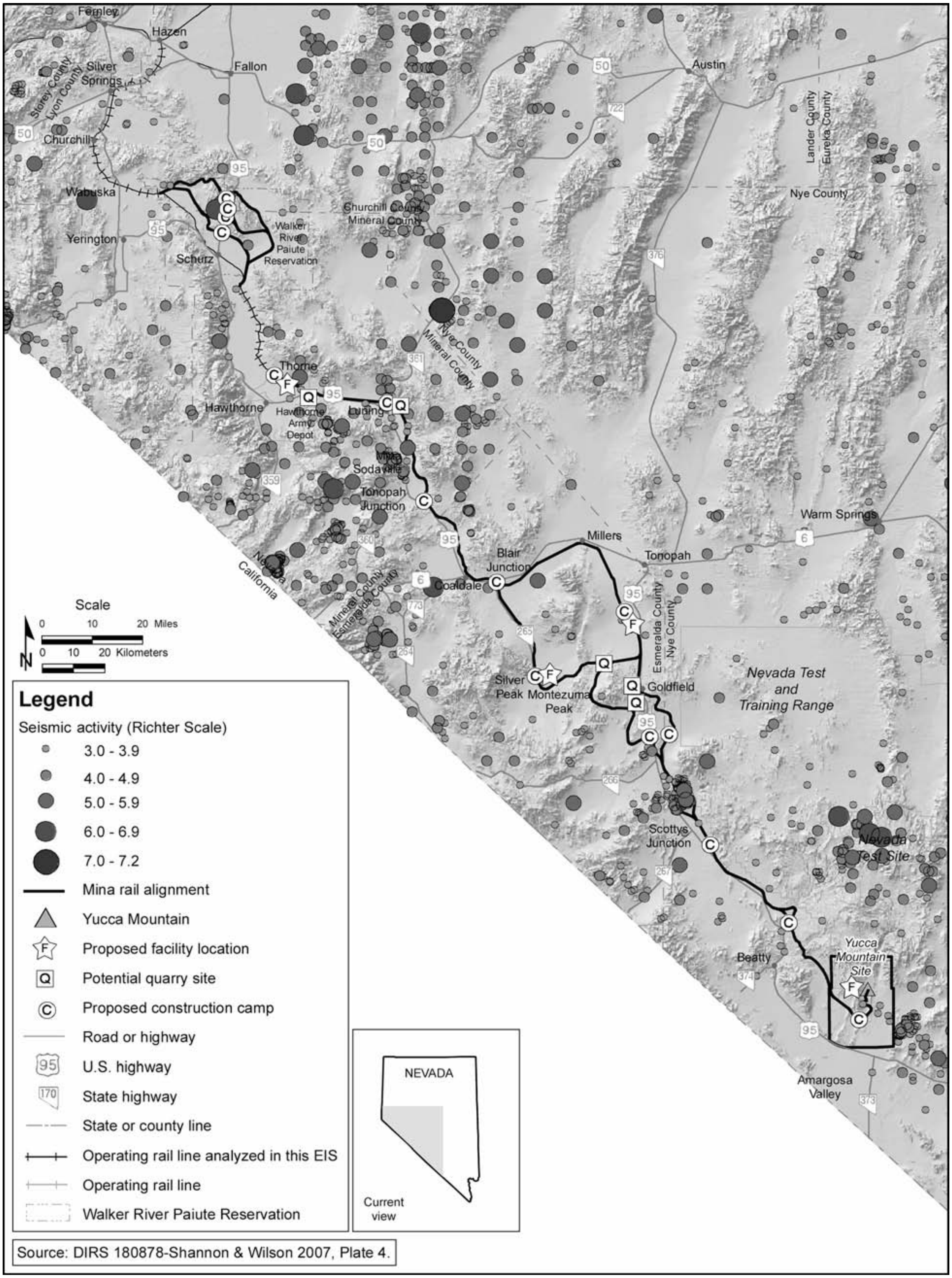


Figure 3-126. Seismic activity in Nevada along the Mina rail alignment from 1852 to 2004.

Through the National Earthquake Hazard Reduction Program, national and regional shaking-hazard maps are used to determine the probability of seismic-related damage based on regional earthquake occurrence rates and how far the shaking travels horizontally (DIRS 174194-USGS 2005, all). These maps are used to meet modern seismic design provisions for the construction of buildings, bridges, highways, and utilities. Shaking-hazard maps, also known as peak acceleration maps, show the levels of horizontal shaking that have a certain probability of being exceeded in a 50-year period (see Figure 3-127). When an earthquake occurs, the forces caused by the shaking can be measured as a percentage of the constant known as *g,* which is the acceleration of a falling object due to gravity. The resulting map uses contour lines to show the amount of shaking a location would experience during any area earthquake, regardless of its distance to the epicenter.

The predicted peak horizontal accelerations tend to decrease from northwest to southeast along the Mina rail alignment. The northern portion of the Mina rail alignment shows a 2-percent probability of exceeding a peak horizontal acceleration of 50-percent *g* within a 50-year period (Figure 3-127) and a 10-percent probability of exceeding a peak horizontal acceleration of 25-percent *g* within a 50-year period (DIRS 174296-Shannon & Wilson 2005, Figure 3). In other words, the Mina rail alignment would experience shaking of 50-percent *g* or more from a seismic event with a return period of approximately 2,500 years (DIRS 174296-Shannon & Wilson 2005, p. 14). Peak horizontal acceleration of 10-percent *g* is considered to be capable of minor structural damage in normal buildings, while 50-percent *g* could cause damage to most structures.

3.3.1.2.2.2 Mineral and Energy Resources. For more than 100 years, parts of the western Great Basin have produced substantial amounts of base and precious metals, particularly gold and silver (DIRS 180882-Shannon & Wilson 2007, pp. 5 and 6). Parts of the Mina rail alignment, especially in the vicinity of the Goldfield Mining District, have been intensely mined and have extensive surface and underground mine workings. Energy resources reported along and near the rail alignment include low-temperature geothermal water. Section 3.3.2, Land Use and Ownership, describes ***mining districts*** and associated land claims along the Mina rail alignment in more detail.

3.3.1.2.2.3 Potential Sources of Construction Materials. As described in Chapter 2, there would be local sources for some construction materials. The estimated quantity of ***ballast*** required for construction of a rail line along the Mina rail alignment would range from 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). DOE has identified five potential ballast quarry locations along the Mina rail alignment with sufficient topographic and geologic characteristics to accommodate excavation and preparation facilities. Figures 2-29 through 2-33 show the potential quarry sites along Mina common segment 1 and Montezuma alternative segments 1, 2, and 3. The topography and geology of potential ballast quarry sites are described in more detail in the discussion of the alternative segment or common segment with which they are associated.

The amount of material excavated from cuts would not equal the fill requirements to construct the rail alignment. Therefore, borrow pits would need to be excavated to supplement the difference in subballast. There is also a high likelihood the Department would find suitable sands and gravels on the alluvial fans along the rail alignment for this use. Section 3.3.11, Utilities, Energy, and Materials, discusses the regional supply chains for other construction materials.

3.3.1.2.3 Soils

DOE used soil survey databases from the U.S. Department of Agriculture, Natural Resources Conservation Service (DIRS 176781-MO0603GSCSSGEO.000), to identify soil types and characteristics along the Mina rail alignment. Approximately 95 percent of the project area has been surveyed. However, soil surveys around the Nevada Test and Training Range have not been completed.

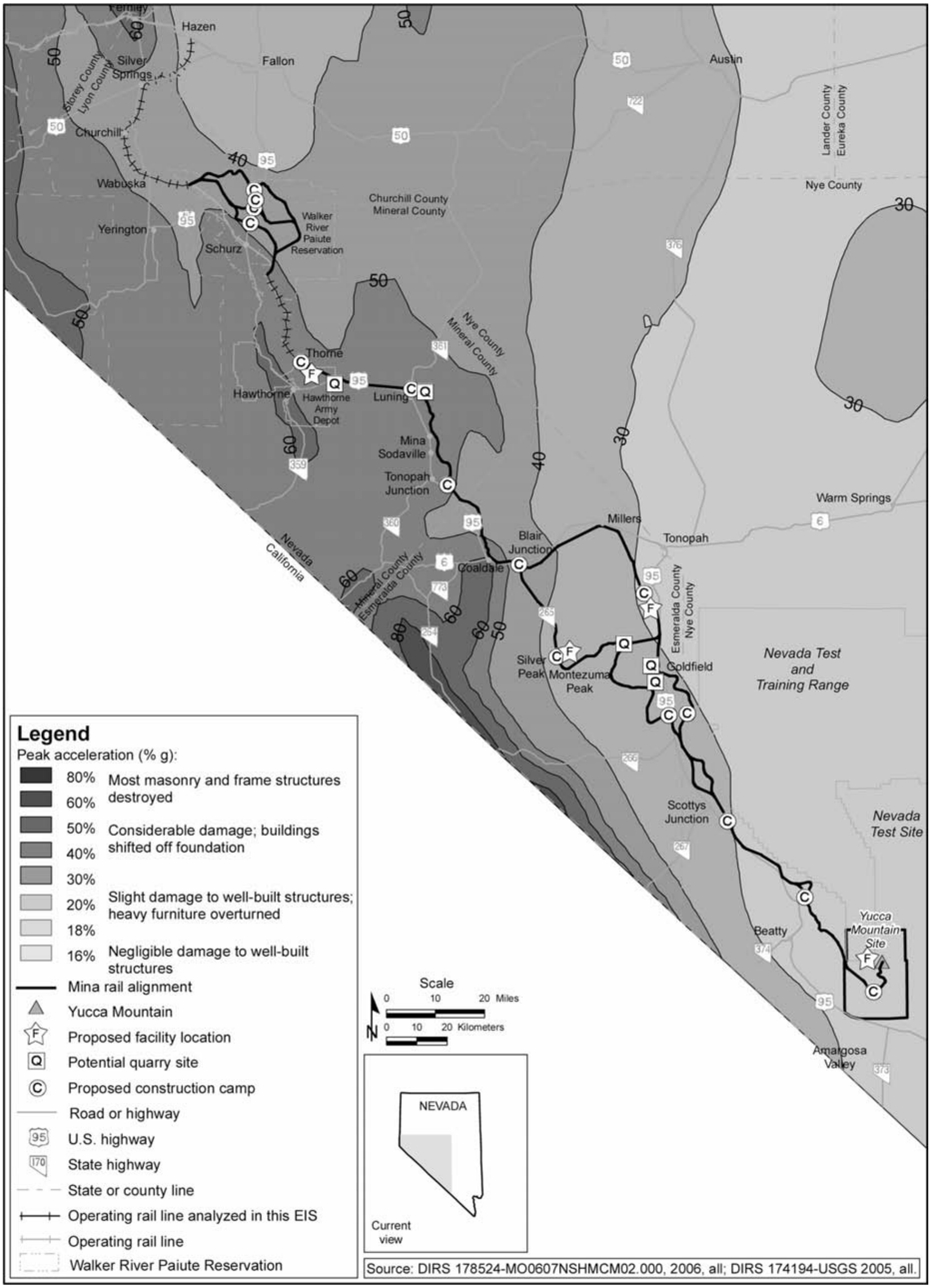


Figure 3-127. Seismic hazards along the Mina rail alignment: peak acceleration (percent *g*) with 2-percent probability of exceedance in 50 years.

In areas where soils data are not available, DOE does not consider the unavailable data critical to the design and construction of a railroad along the Mina rail alignment, because soils are expected to be similar to those already surveyed. In addition, as part of the design, DOE would place geotechnical borings along the entire rail alignment to obtain site-specific soils data.

This Rail Alignment EIS identifies the specific soil characteristics relevant to proposed railroad construction and operations. From a potential impact perspective, soil designated as supporting ***prime farmland*** is considered one of the relevant characteristics. The Natural Resources Conservation Service (DIRS 181427-NRCS 2007, Part 622.04(a)) defines prime farmland as:

> Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or ***alkalinity***, an acceptable content of salt and sodium, and few or no rocks. Its soils are ***permeable*** to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding.

The prime farmland soil label is applied to the soil types and associations that the National Resources Conservation Service identifies as satisfying this definition. Less than 0.1 percent, or about 0.14 square kilometer (35 acres), of the Mina rail-alignment construction right-of-way would contain soils classified as prime farmland (see Figure 3-128). All of the prime farmland soils that the Mina rail alignment would cross are found on the Walker River Paiute Reservation, which contains 5.5 square kilometers (1,400 acres) of prime farmland soils. Lyon, Churchill, Mineral, and Nye Counties contain 299 square kilometers (74,000 acres), 407 square kilometers (100,000 acres), 44 square kilometers (11,000 acres), 610 square kilometers (150,000 acres), respectively, soils classified as prime farmland (DIRS 176781-MO0603GSCSSGEO.000). Esmeralda County has none. The amount of prime farmland soils within the Mina rail alignment construction right-of-way would consist of 2.6 percent of the total prime farmland soils on the Walker River Paiute Reservation but less than 0.01 percent of the total prime farmland soils on the Walker River Paiute Reservation, and in Lyon, Churchill, Mineral, and Nye Counties. DOE has also contacted the Nevada Natural Resource Conservation Service office to collaborate on the identification of prime, unique statewide, or locally important farmland along the alignment. This correspondence is further described in Section 4.3.1.2.1.3, and in the individual segment discussions in Section 4.3.1.2.2.

Table 3-80 lists the prime farmland and quantity of soils with other characteristics along the Mina rail alignment. The table lists the percentage of the area within the nominal width of the construction right-of-way that contains soils with a particular characteristic. In some locations along the rail alignment, DOE would occupy and disturb less of the construction right-of-way to avoid sensitive environmental resources and private property. Because different combinations of alternative segments and common segments would be different lengths and have different disturbed areas, DOE judged the impacts from soil erosion based on the acreage of specific soil types that would be affected by construction-related disturbance. Section 4.3.1.2.1.3 provides a more detailed discussion of how railroad construction and operations could affect topsoil.

Other soil characteristics that are particularly relevant to proposed railroad construction and operations are classified on Table 3-80 as ***erodes easily*** and ***blowing soil***. Soil with either of these characteristics can be quite susceptible to erosion. As seen in Table 3-80, these soil types are found in similar amounts within each group of alternative segments.

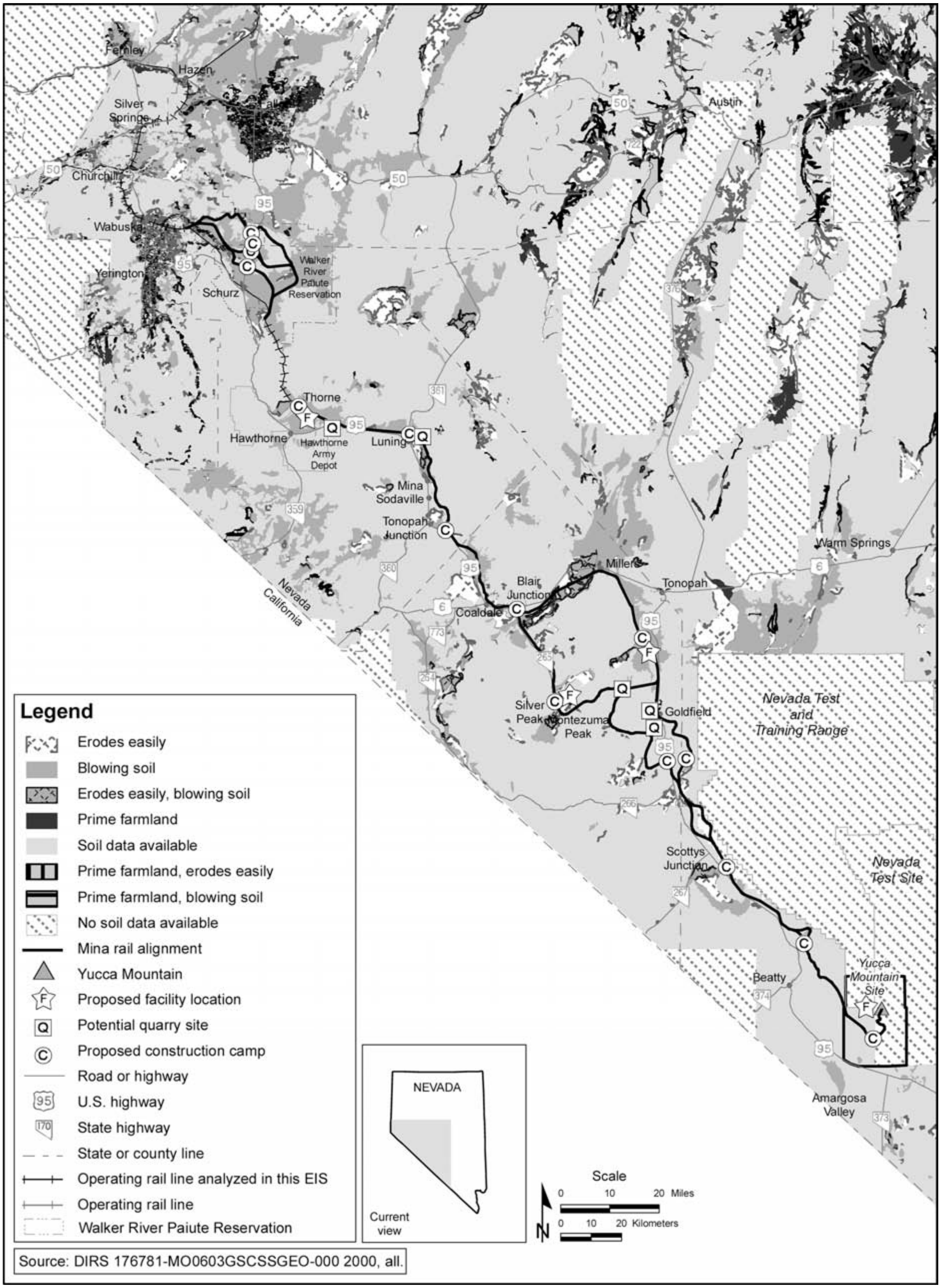


Figure 3-128. Soils with prime farmland, erodes easily, and blowing soil characteristics along the Mina rail alignment.

Table 3-80. Percent of soil characteristics within the Mina rail alignment construction right-of-way.[a]

Rail line segment	Percent prime farmland	Percent blowing soil	Percent erodes easily	Percent soil survey coverage[b]
Union Pacific Railroad Hazen Branchline[c]	NA	NA	NA	NA
Department of Defense Branchline North[c]	NA	NA	NA	NA
Schurz alternative segment 1	d	83	4.7	100
Schurz alternative segment 4	d	69	4.8	100
Schurz alternative segment 5	d	63	2.9	100
Schurz alternative segment 6	d	51	2.9	100
Department of Defense Branchline South[f]	e	39	e	100
Mina common segment 1	e	39	7.9	100
Montezuma alternative segment 1	e	5.2	15	100
Montezuma alternative segment 2	e	33	13	100
Montezuma alternative segment 3	e	26	10	100
Mina common segment 2	e	e	100	100
Bonnie Claire alternative segment 2	e	e	27	18
Bonnie Claire alternative segment 3	e	e	25	77
Mina common segment 5	e	2.6	e	74
Oasis Valley alternative segment 1	e	13	e	100
Oasis Valley alternative segment 3		4.8	e	100
Mina common segment 6	e	e	e	74

a. Source: DIRS 176781-MO0603GSCSSGEO.000.
b. There are data gaps for Nye County around the Nevada Test and Training Range because those soil surveys have not been completed.
c. Soil survey is not described because there would be no surface disturbance along this portion of the rail alignment. NA = not applicable.
d. Amount is less than 1 percent.
e. Characteristic not present. Soil percentages do not add up to 100 percent.
f. Soil characteristics are identified because DOE would establish a construction camp and build a siding along this branchline.

The erodes easily characteristic is a measure of the susceptibility of bare soil to be detached and moved by water. These soils, which tend to contain relatively high amounts of silts and ***loams***, tend to erode easily when disturbed. Approximately 19 percent of the entire Mina rail alignment has soils with this characteristic (DIRS 176781-MO0603GSCSSGEO.000).

The blowing soil characteristic is based on the soil survey classification of susceptibility of a given soil to wind erosion. This classification method uses eight groupings. Soils assigned to Group 1 are the most susceptible to wind erosion and those assigned to Group 8 are the least susceptible. Soils listed in Table 3-80 with the blowing soil characteristic are those assigned to erodibility Group 1 or 2 (DIRS 181427-NRCS 2007, Exhibit 618-16). The blowing soil characteristic identifies areas where fine-textured, sandy materials predominate and where uncontrolled soil disturbance could result in increased wind erosion. Depending on the combination of alternative segments and common segments, between 23 and 26 percent of the entire Mina rail alignment would have soils with the blowing soil characteristic (DIRS 176781-MO0603GSCSSGEO.000). Figure 3-128 identifies the locations of prime farmland, erodes easily, and blowing soils.

3.3.1.3 Setting and Characteristics along Alternative Segments and Common Segments

3.3.1.3.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska)

There would be no new construction along the Union Pacific Railroad Hazen Branchline. Therefore, DOE has not characterized the physical setting in this area.

3.3.1.3.2 Department of Defense Branchline North (Wabuska to the Boundary of the Walker River Paiute Reservation)

Figure 3-129 shows this existing rail line. DOE would build a passing ***siding*** adjacent to the existing rail line on previously disturbed land within the existing right-of-way. Therefore, the Department has not characterized the physical setting in this area.

3.3.1.3.3 Schurz Alternative Segments

3.3.1.3.3.1 Physiography. The Schurz alternative segments would be in the Walker River Basin, northeast of the Wassuk Range.

There is an existing rail line (in this Rail Alignment EIS, called the Department of Defense Branchline through Schurz), which connects Department of Defense Branchlines North and South (see Figure 3-130). The branchline travels along the southern edge of Campbell Valley, along the eastern side of the Wassuk Range, through the town of Schurz on the Walker River Paiute Reservation, and terminates at Hawthorne.

Each of the Schurz alternative segments would start at the north end of Campbell Valley and end near Gillis Canyon (see Figure 3-130). In flat locations, the alternative segments would travel along a similar path, and divert around hilly terrain.

Schurz alternative segment 1 would run through Sunshine Flat and travel east of the Weber Reservoir through the Walker River Paiute Reservation. Schurz alternative segment 4 would also cross Sunshine Flat, traveling north of the Calico Hills. Schurz alternative segment 4 would then curve along the southern edge of the Terrill Mountains and travel along an unnamed valley. Schurz alternative segment 5 would travel along the southern edge of the Desert Mountains (elevation 2,040 meters [6,700 feet] above mean sea level), then southeast through Long Valley (elevation 1,300 meters [4,300 feet] above mean sea level), between the Calico Hills and Terrill Mountains, and through the unnamed valley at the southern edge of the Walker River Paiute Reservation. Schurz alternative segment 6 would also travel along the southern edge of the Desert Mountains, and southeast through Long Valley, then curve northeast around the Terrill Mountains, west of the Rawhide Flats, and then down through the unnamed valley before terminating at Gillis Canyon.

3.3.1.3.3.2 Geology. All of the Schurz alternative segments would cross a variety of recent alluvial fans, wind-blown and river deposits, playas, Tertiary sedimentary rocks, basalt, ash-fall deposits, and Mesozoic granite bedrock. Sections of the bedrock in this area have been altered with intrusive volcanic veins, resulting in variable concentrations of commercial minerals. Metallic and nonmetallic minerals of variable quantity and quality have been identified in the surrounding mountains. Surveys and drill cores have identified an iron-rich ore called the Hottentot prospect within Calico Hills (DIRS 180882-Shannon & Wilson 2007, pp. 29 and 30). To construct any of the Schurz alternative segments, DOE would use ***alluvium*** within the nominal construction right-of-way as fill materials, but otherwise would not excavate construction materials.

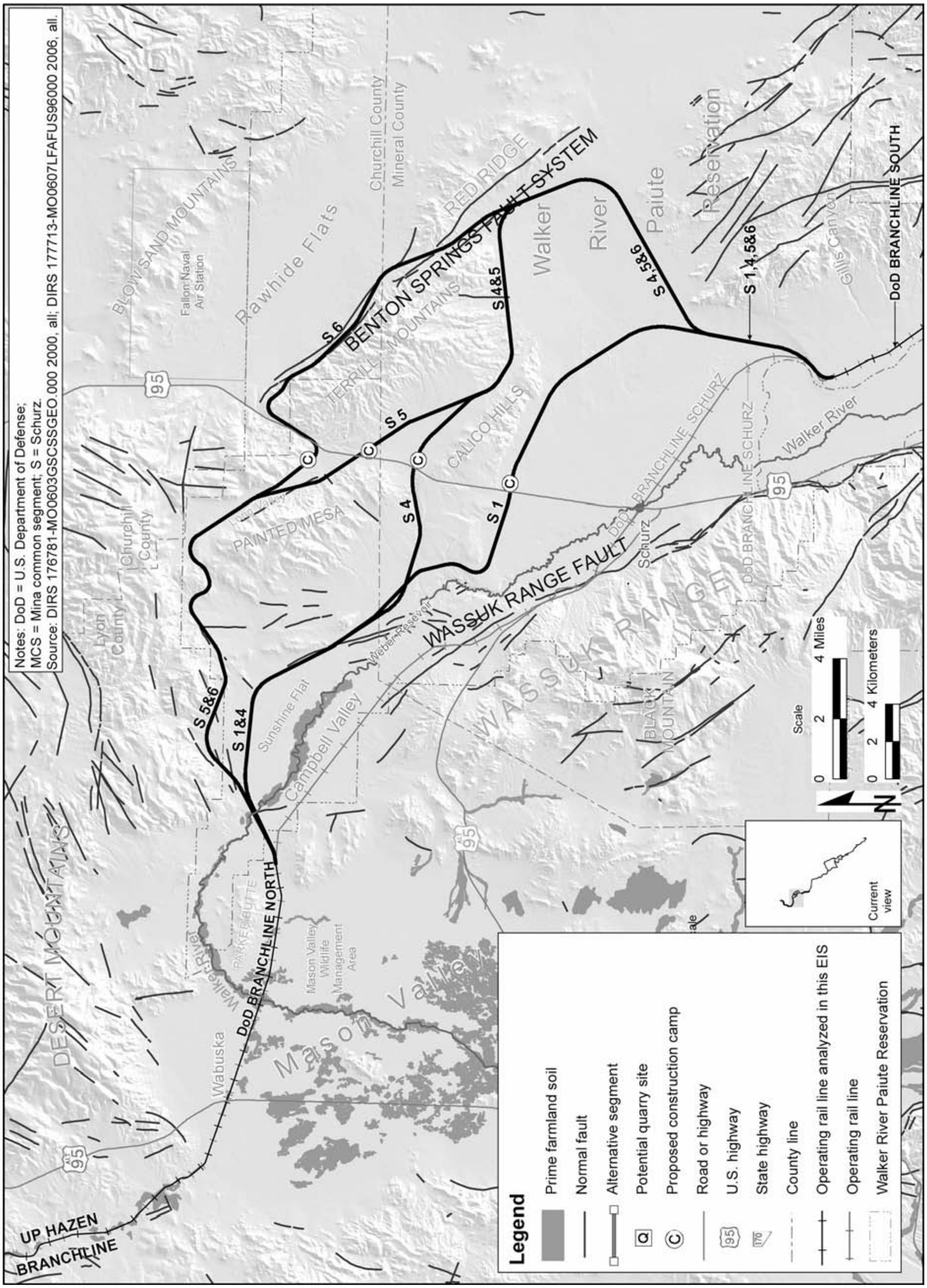


Figure 3-129. Physiographic features of common segments and alternative segments in map area 1.

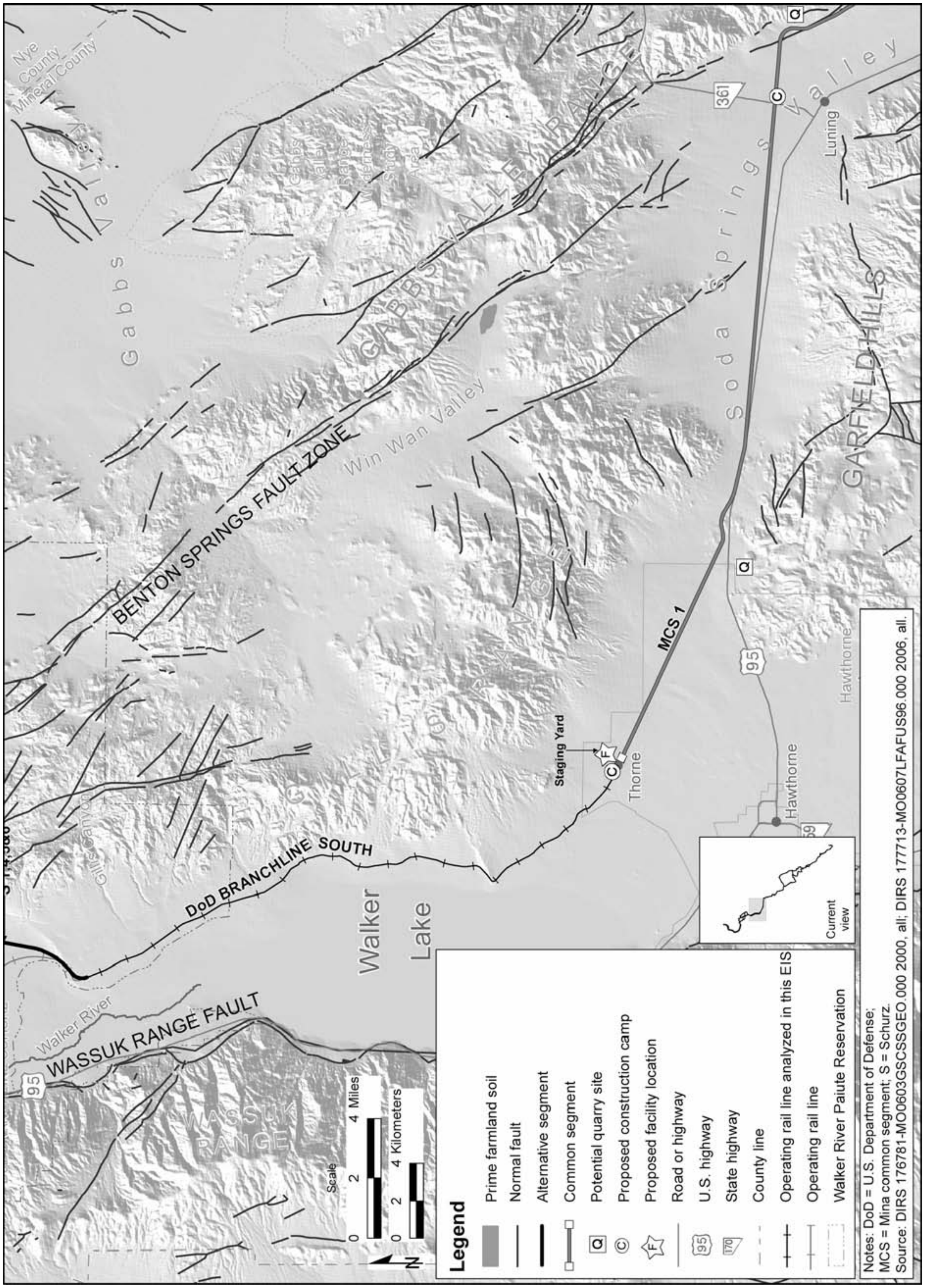


Figure 3-130 Physiographic features of common segments and alternative segments in map area 2.

There are both metallic minerals and nonmetallic minerals of variable quality and quantity in the surrounding mountains (DIRS 180882-Shannon & Wilson 2007, pp. 22, 31, and 32). Geothermal resources include warm springs and steam wells that are found approximately 14 kilometers (8.5 miles) west of the beginning of the Schurz alternative segments. A geothermal power plant and biodiesel plant use energy heat from the steam wells in Wabuska. Section 3.3.2, Land Use and Ownership, provides additional information about the mining districts around the Schurz alternative segments.

All four Schurz alternative segments would cross a small normal fault, and Schurz alternative segments 1 and 4 would cross another linear fault, both of which are part of the Wassuk Range Fault System. This fault system is a series of north-trending faults along the eastern edge of the Wassuk Range. The Walker River Basin was formed during the Quaternary as the western edge of the valley downslipped along the fault system. Schurz alternative segment 6 would cross northern-tracing faults along the eastern edge of the Terrill Mountains. These faults could be correlated with the Benton Springs Fault system to the southeast (DIRS 181849-Sawyer 1999, all). There has been one magnitude 6.3 earthquake, one magnitude 5.0 earthquake, and three of magnitude 4.0 earthquakes in the vicinity of the Schurz alternative segments (see Figure 3-127). The magnitude 6.3 earthquake occurred in 1959, approximately 2.3 miles to the east of Schurz alternative segment 1 (DIRS 180878-Shannon & Wilson 2007, p. 17).

3.3.1.3.3.3 Soils. Soils along the Schurz alternative segments occur on ***fan piedmonts***, ***fan remnants***, ***fan skirts***, ***sand sheets***, wind-blown sand, dunes, river valleys, lake plains, and closed valley sediments. They are derived from mixed alluvium, sand sheets, wind-blown and lake deposits, and reworked sedimentary deposits.

The Schurz alternative segments each contain more than 50 percent blowing soils. Schurz alternative segment 1 contains the most blowing soils (83 percent of the alternative segment). Schurz alternative segment 6 contains the least blowing soils (51 percent of the alternative segment). All of the Schurz alternative segments have lower quantities of erodes easily soils, ranging from Schurz alternative segments 5 and 6 at 2.9 percent each, to Schurz alternative segment 4 at 26 percent. Each of the Schurz alternative segments contains less than 1 percent prime farmland soils (see Table 3-80).

Fan piedmonts, fan remnants, and **fan skirts** refer to locations within a large alluvial fan. Fan piedmonts refer to the area along the base of a mountain slope. Fan remnants refer to parts of an older alluvial fan that remain after erosion has removed most of the fan. Fan skirts refer to the area along the base of the alluvial fan in a valley.

Sand sheets are large, irregularly shaped, commonly thin, surficial mantles of windblown sand that lack the discernible slip faces that are common on dunes.

3.3.1.3.4 Department of Defense Branchline South (Boundary of the Walker River Paiute Reservation to Thorne)

One construction camp (number 17) would be located at the south end of Department of Defense Branchline South where it would connect with Mina common segment 1. The construction camp would be on the Hawthorne Army Depot and would not require additional road construction. Approximately 39 percent of the soils in the proposed construction camp footprint are considered blowing soils. DOE would also build a siding within the construction right-of-way. Aside from the camp and the siding, there would be no surface disturbance along this portion of the Mina rail alignment. Therefore, DOE has not characterized the physical setting in this area.

3.3.1.3.5 Mina Common Segment 1 (Gillis Canyon Area to Blair Junction)

3.3.1.3.5.1 Physiography. Mina common segment 1 would travel south of the Gillis Range through Soda Spring Valley, with the Gabbs Valley Range to the north and east and Garfield Hills to the west (see Figure 3-131). The common segment would pass to the east of Rhodes Salt Marsh between the

Excelsior Mountains and Pilot Mountains, and then to the east of Columbus Salt Marsh between Candelaria Hills and the Monte Cristo Range (see Figure 3-131). Elevations along this common segment generally range from 1,300 meters (4,300 feet) above mean sea level at Rhodes Salt Marsh to 1,500 meters (4,900 feet) above mean sea level at the lower valley floors of the Monte Cristo Range. The location of the common segment would avoid existing sand dunes in the Soda Spring Valley and playa deposits in the Rhodes and Columbus Salt Marshes.

3.3.1.3.5.2 Geology. Mina common segment 1 would primarily cross sedimentary material including alluvial fan, wind-blown, basin-fill, lake deposits, and playas in addition to old basalt flows, sedimentary rocks, and locally altered sedimentary and volcanic bedrock.

Most of the hills surrounding Mina common segment 1 are part of local mining districts, due to the many types of minerals found in the bedrock within the mountain ranges. Historically, gold, silver, lead, copper, iron, uranium, thorium, manganese, turquoise, calcium carbonate, and halite have been mined or documented in the surrounding mountains (DIRS 180882-Shannon & Wilson 2007, pp. 38, 40 and 41, 44, 60, 64, and 79). The rail line would travel along the valleys, avoiding the calcium carbonate and salt deposits around the playas. It would not cross or approach energy or geothermal resources.

DOE has identified two potential quarry sites along Mina common segment 1. The Garfield Hills quarry would mine basalt at the beginning of Mina common segment 1 in the northern edge of the Garfield Hills. The Gabbs Range quarry would be on the northeastern edge of the Soda Spring Valley where the rail line would turn south. The quarry would mine granite from a foothill at the base of the Gabbs Valley Range.

There are several northwest-trending Quaternary faults in the mountains north of Mina common segment 1. The Gabbs Valley Range, Pilot Mountains, and Soda Spring Valley are all bounded by the Benton Spring Fault. In 1932, there was a magnitude 7.2 earthquake to the northeast of Mina common segment 1 at Cedar Mountain. There have been numerous other earthquakes greater than magnitude 3.0 in the northeastern corner of Soda Spring Valley; however, the number and magnitude of earthquakes decreases farther south around the Monte Cristo Range.

3.3.1.3.5.3 Soils. Soils along Mina common segment 1 consist primarily of alluvial fan deposits comprising sorted sand and gravels, and occasionally overlie shallow bedrock made up of recent volcanic material. Deposits of calcium carbonate in the form of calcrete are also occasionally found within the soils. The common segment would avoid playa deposits in the area of Rhodes Salt Marsh and Columbus Salt Marsh. Approximately 39 percent of Mina common segment 1 is made up of blowing soils and 7.9 percent of the soils have the erodes easily characteristic. There are no prime farmland soils along Mina common segment 1.

3.3.1.3.6 Montezuma Alternative Segments

3.3.1.3.6.1 Physiography. Montezuma alternative segment 1 would travel southeast from Blair Junction, through Clayton Valley, and within a pass between Paymaster Ridge and Clayton Ridge (Figures 3-132 and 3-133). The alternative segment would then turn south through an unnamed valley, then cross the Montezuma Range in an unnamed pass and switchback between the Goldfield and Cuprite Hills. Elevations along Montezuma alternative segment 1 would range from 1,300 meters (4,300 feet) at Clayton Valley to 1,980 meters (6,500 feet) above mean sea level at the south end of the Montezuma Range.

Montezuma alternative segment 2 would travel from Blair Junction northeast through Big Smoky Valley, around Lone Mountain, southeast through Montezuma Valley, and would weave through the Goldfield Hills, with elevations ranging from 1,500 meters (4,900 feet) at Montezuma Valley to 1,950 meters (6,400 feet) above mean sea level at Goldfield Hills.

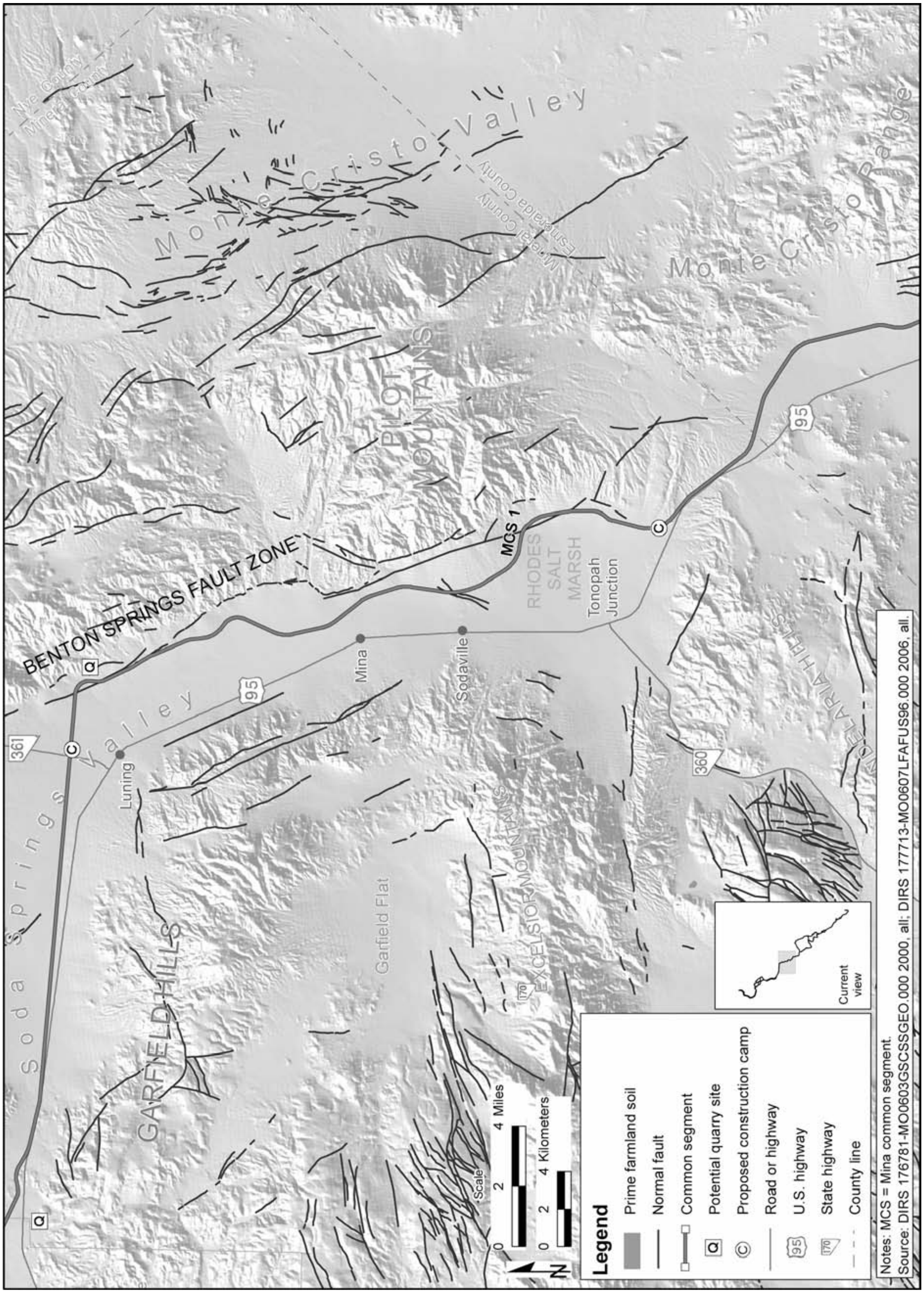


Figure 3-131. Physiographic features of common segments and alternative segments in map area 3.

Montezuma alternative segment 3 would travel from Blair Junction northeast through Big Smoky Valley, around Lone Mountain, southeast through Montezuma Valley, and then cross west near the north end of Montezuma Range. Montezuma alternative segment 3 would continue south through an unnamed valley and cross the Montezuma Range in an unnamed pass and switchback between the Goldfield and Cuprite Hills. The elevations ranges along Montezuma alternative segment 3 would be the same as Montezuma alternative segment 2, with the low point in Montezuma Valley and the high point at Goldfield Hills.

3.3.1.3.6.2 Geology. All of the Montezuma alternative segments would cross a combination of recent alluvial and playa deposits overlying Quaternary volcanic rocks, Mesozoic granite, and Cambrian limestone bedrock. A variety of metallic minerals (silver, gold, and copper; iron and hematite) have been mined in Lone Mountain, Silver Peak, Montezuma Range, and the Cuprite and Goldfield Hills. All of the Montezuma alternative segments would travel through valleys near a range that contains either active or historic mining operations. Montezuma alternative segments 1 and 3 would also cross the Montezuma Range, and Montezuma alternative segment 2 would cross through the Goldfield Hills, where gold, silver, and zeolilte have been mined since 1900.

In addition to the metallic minerals identified within the mountains surrounding the Montezuma alternative segments, there are nonmetallic minerals in the valleys. Montezuma alternative segment 1 would cross Clayton Valley and approach the town of Silver Peak. Minerals such as alum, native sulfur, and kaolinite have been found in Clayton Valley, and a large-scale brine facility in Silver Peak extracts lithium from salt-rich aquifer water. There are warm springs in the Silver Peak area; however, at present, they are not used as an energy resource. In the Cuprite Hills, at the end of the Montezuma alternative segments, there is a large geothermal system with multiple warm heat-flow wells, also not currently used as geothermal resources (DIRS 180882-Shannon & Wilson 2007, Plate 3). Section 3.3.2, Land Use and Ownership, describes the history and extent of the regional mining districts in more detail.

DOE has identified several potential quarry sites along the Montezuma alternative segments. The North Clayton Quarry would be along the northern tip of the Montezuma Range, and would serve either Montezuma alternative segment 1 or 3. The quarry would mine granite from the bottom of the ridge, moving up as additional rock is quarried. The Malpais Mesa Quarry would be on the northwestern edge of the Goldfield Hills and would be accessed by Montezuma alternative segment 1 or 3. This quarry would mine basalt from the bowl-shaped cliff. Potential quarry ES-7, on the northern edge of Malpais Mesa, would serve Montezuma alternative segment 2.

The mountain ranges in this area are typically bounded on one side by linear, north-trending faults. Montezuma alternative segment 1 would cross the Clayton Valley Fault Zone, Paymaster Ridge Fault Zone, Montezuma Range Fault Zone, and Cuprite Hills Fault Zone. These faults are primarily late Quaternary in age. Montezuma alternative segment 2 would cross the Cuprite Hills Fault Zone along the northern edge of the Goldfield Hills. Montezuma alternative segments 2 and 3 would cross the Lone Mountain Fault Zone along the northern edge of the Lone Mountain foothills. Some of the faults associated with this fault zone were active within the last 15,000 years (DIRS 181852-Sawyer and Anderson 1999, all). Seismic activity in the area around the Montezuma alternative segments is limited to a magnitude 5.0 earthquake west of Lone Mountain, and several magnitude 3.0 earthquakes in the immediate vicinity of Lone Mountain and along the Cuprite Hills (see Figure 3-126).

3.3.1.3.6.3 Soils. Soils along the Montezuma alternative segments vary based on their location and the source bedrock. The alternative segments would cross soils consisting of alluvial deposits on fan skirts, fan remnants, and fan piedmonts; sand sheets and basins; and alluvial flats. The soils are derived from mixed alluvium, wind-blown sand, and volcanic sedimentary (limestone) rocks.

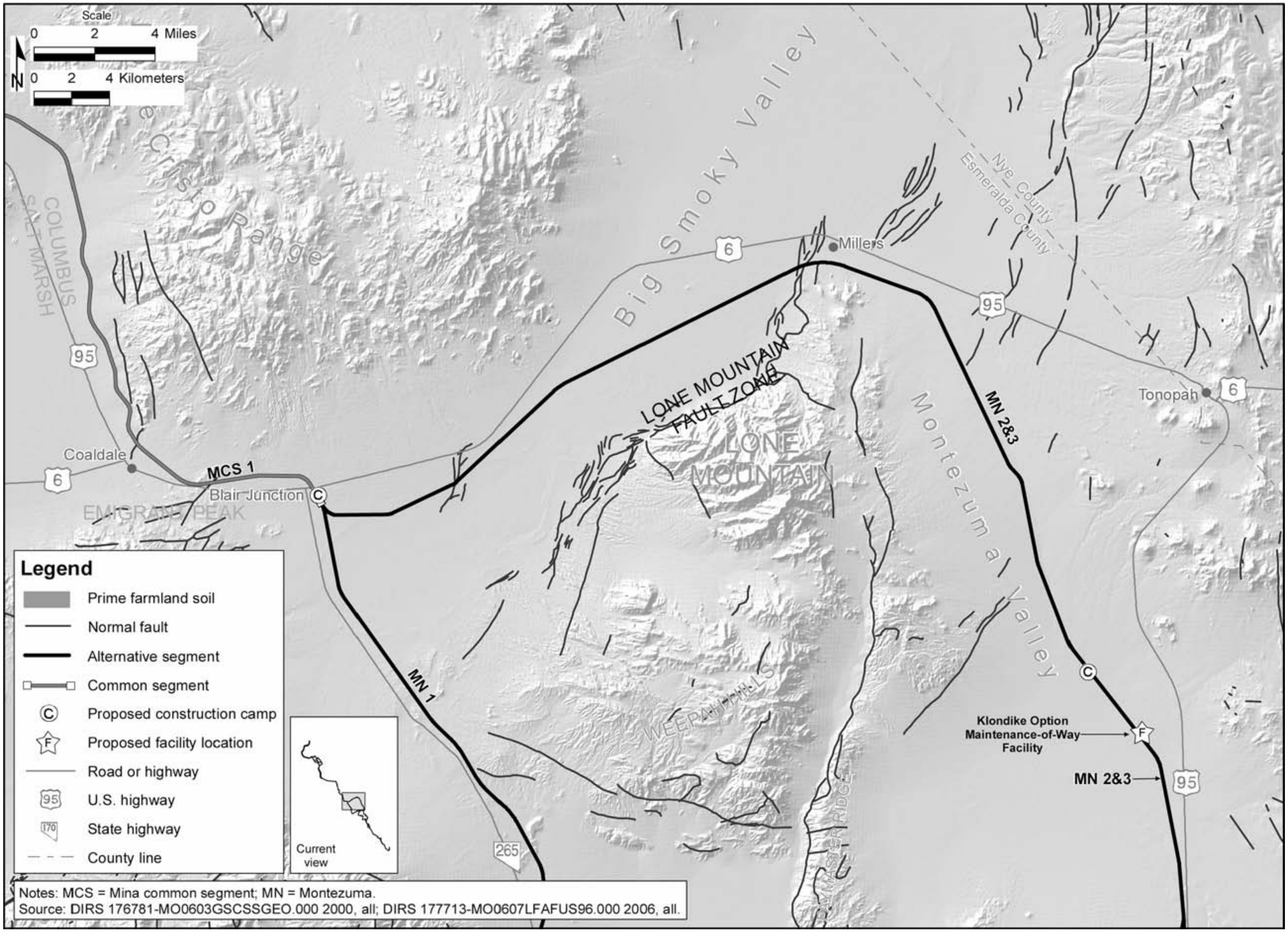


Figure 3-132. Physiographic features of common segments and alternative segments in map area 4.

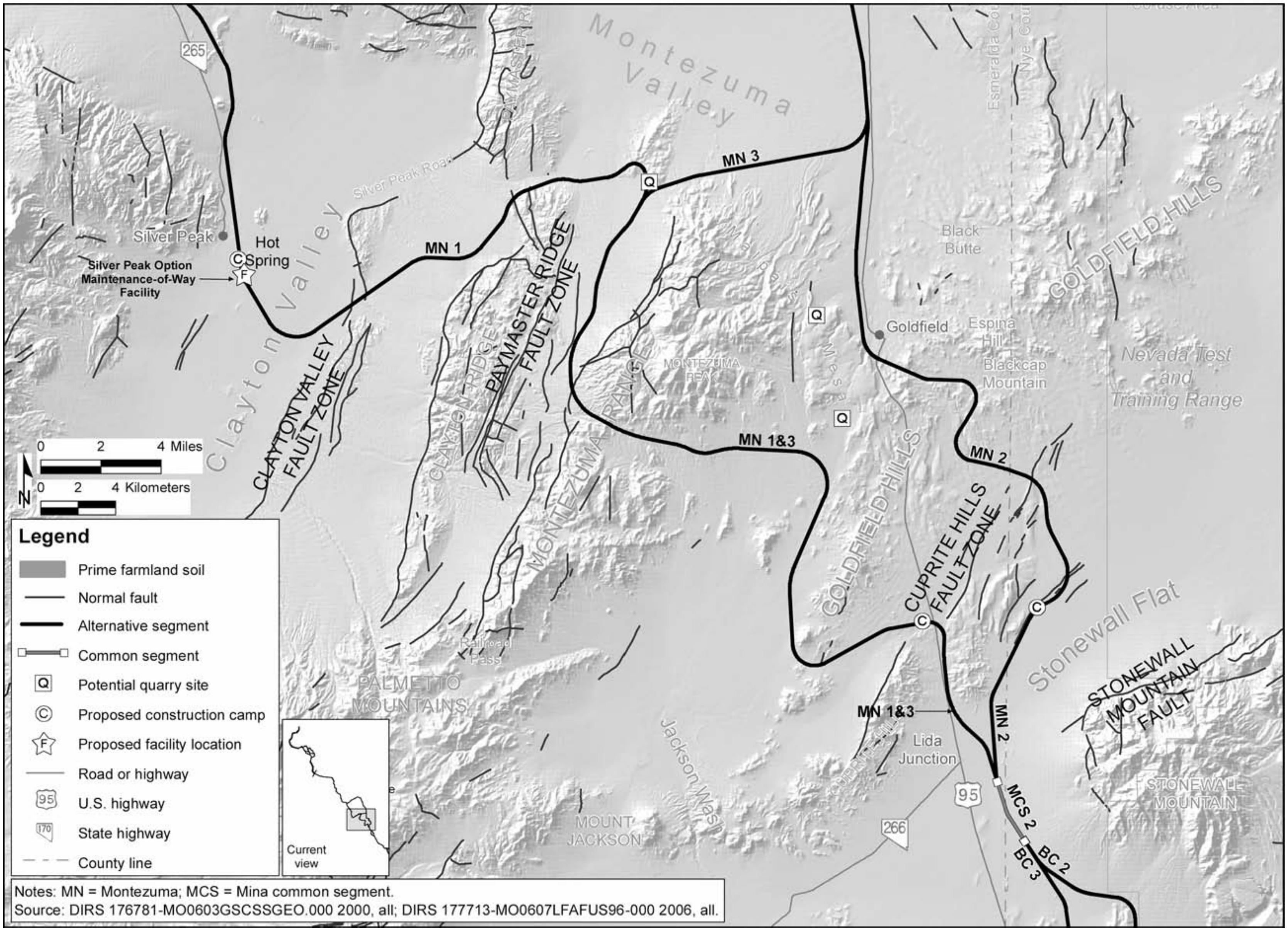


Figure 3-133. Physiographic features of common segments and alternative segments in map area 5.

In some locations along Montezuma alternative segments 1 and 3, thin soils derived from volcanic, sedimentary, or limestone material overlie the mountain bedrock. Along all of the alternative segments, the soils are considered well drained to excessively drained.

There are no prime farmland soils in Esmeralda County, the location of most of the length of the Montezuma alternative segments. Other soil characteristics are variable, depending on their position in the valley (see Table 3-80). Montezuma alternative segment 2 would contain the most blowing soils (33 percent), while Montezuma alternative segment 1 would contain only 5.2 percent. However, Montezuma alternative segment 1 would contain the most erodes easily soils (15 percent), and Montezuma alternative segment 3 would contain the least (10 percent).

3.3.1.3.7 Mina Common Segment 2 (Stonewall Flat Area)

3.3.1.3.7.1 Physiography. Mina common segment 2 would cross Lida Valley, a depression with numerous alkali flats (see Figure 3-133), at an elevation of approximately 1,430 meters (4,700 feet) above mean sea level. Stonewall Mountain is a prominent feature that would border the common segment on the east.

3.3.1.3.7.2 Geology. Through the Stonewall Flat area, Mina common segment 2 would mostly cross fan and stream-channel alluvium filling a ***graben*** (a depression between normal faults) formed by the northerly-trending Stonewall Mountain Fault.

There has been some seismic activity around the Cuprite Hills and at Stonewall Mountain within the past 150 years (see Figure 3-126).

There are metallic minerals, including copper, silver, and gold along this common segment. The deposits occur in sedimentary and volcanic rocks that have been altered by hot fluids. Quartz veins are also mined for silica. Drilling in the Cuprite Hills suggests the existence of a large geothermal system in the area, with multiple warm heat-flow wells drilled in the Cuprite Hills; however, at present, these are not used as geothermal resources (DIRS 180882-Shannon & Wilson 2007, Plate 3). Except for alluvium, the common segment would not cross rocks suitable for construction.

3.3.1.3.7.3 Soils. Soils along Mina common segment 2 are derived from alluvium and occur on fan piedmonts and fan skirts (DIRS 176781-MO0603GSCSSGEO.000). All of the soils are considered to be easily erodible. There are no blowing soils or prime farmland soils along the segment.

3.3.1.3.8 Bonnie Claire Alternative Segments

3.3.1.3.8.1 Physiography. The physiography of the Bonnie Claire area is characterized by the southern boundary of Lida Valley and the northern portion of Sarcobatus Flat, which are depressions with numerous alkali flats. Pahute Mesa is to the east of the alternative segments; Stonewall Mountain is to the northeast (see Figure 3-134). Bonnie Claire alternative segment 2 would pass to the east of an unnamed 1,500-meter (4,900-foot)-high bedrock knoll that separates Sarcobatus Flat and Lida Valley; Bonnie Claire alternative segment 3 would pass this knoll to the west (DIRS 176184-Shannon & Wilson 2006, Figure 3). Elevations in this area range from about 1,250 to 1,400 meters (4,100 to 4,600 feet) above mean sea level.

3.3.1.3.8.2 Geology. The Bonnie Claire alternative segments would cross the eastern portion of the southwestern Nevada volcanic field. Bonnie Claire alternative segment 3 would cross a mixture of young volcanic rocks and ash-flow sedimentary rocks, while Bonnie Claire alternative segment 2 would primarily cross alluvium on the western edge of Sarcobatus Flat (DIRS 176184-Shannon & Wilson 2006, Table 5).

The two alternative segments would bypass a sequence of interconnected unnamed faults. These faults are not well studied, although recent seismic activity has been recorded in the area. In 1999, there was a magnitude 5.3 earthquake in the area between the Bonnie Claire alternative segments. As seen in Figure 3-126, many aftershocks were recorded in the area, most between magnitudes 2.0 and 3.5. Since then, earthquakes immediately around the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 176184-Shannon & Wilson 2006, Plate 4).

Metallic minerals such as gold and copper have been found within the volcanic rocks around the Bonnie Claire alternative segments. The Wagner Mining District is in this area, and is discussed in more detail in Section 3.3.2, Land Use and Ownership.

There are no known energy or geothermal resources in the area surrounding the Bonnie Claire alternative segments, and other than gravel and alluvial materials present on the floor of Lida Valley, the Bonnie Claire alternative segments would not cross any known mineral deposits.

3.3.1.3.8.3 Soils. Soils along Bonnie Claire alternative segments 2 and 3 are derived from alluvium and ***colluvium***, and are found on hills, alluvial fan piedmonts, and fan skirts. Soils are mainly identified for Bonnie Claire alternative segment 3, because soil data are not available for the area around the Nevada Test and Training Range.

Soils with the erodes easily characteristic comprise 27 and 25 percent of the soils along Bonnie Claire alternative segments 2 and 3, respectively. Available data do not indicate any soils with the blowing soil or prime farmland characteristic.

3.3.1.3.9 Common Segment 5 (Sarcobatus Flat Area)

3.3.1.3.9.1 Physiography. The physiography of common segment 5 consists of most of Sarcobatus Flat. Pahute Mesa would be to the northeast (see Figure 3-134). Coba Mountain is a prominent feature in the area that extends from common segment 5 to the southwest (see Figure 3-135). Rail alignment elevations in the Sarcobatus Flat area would range from 1,200 to 1,250 meters (3,900 feet to 4,100 feet) above mean sea level.

3.3.1.3.9.2 Geology. Common segment 5 would cross Quaternary alluvium and mid-Tertiary ash-flow tuffs, minor lava flows, and reworked materials associated with the southwestern Nevada volcanic field. The common segment would not cross Quaternary faults (see Figures 3-134 and 3-136). Commercial minerals found within the area include gold and silver (DIRS 173841-Shannon & Wilson 2005, pp. 51 and 52). Additionally, an actively mined, relatively large gravel pit at the alluvial fan boundary between Pahute Mesa and Sarcobatus Flat would be within 0.8 kilometer (0.5 mile) of the rail alignment in this area.

Geothermal occurrences in Sarcobatus Valley include one warm spring and one hot well, which would be about 0.20 kilometer (0.12 mile) from the rail alignment.

3.3.1.3.9.3 Soils. Area soils are derived from alluvial deposits and are well drained. They occur on alluvial flats and fan piedmonts. Soils with the blowing soil characteristic comprise about 2.6 percent of the soils. There are no soils along common segment 5 with the erodes easily or prime farmland characteristics.

3.3.1.3.10 Oasis Valley Alternative Segments

3.3.1.3.10.1 Physiography. Oasis Valley alternative segments 1 and 3 would be in Oasis Valley, which is incised by the Amargosa River, an ***ephemeral stream***, and tributary washes (see Figure 3-135).

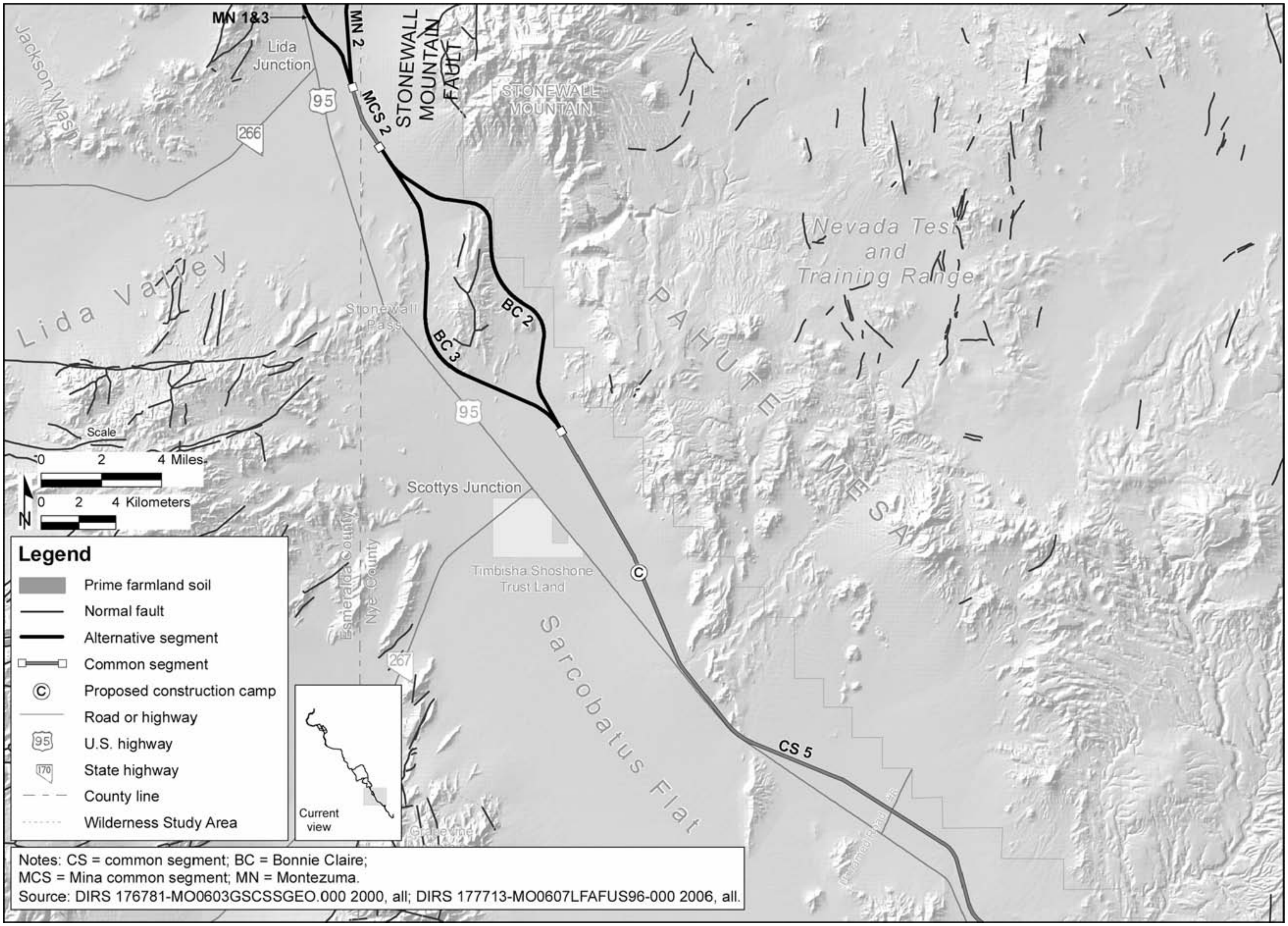


Figure 3-134. Physiographic features of common segments and alternative segments in map area 6.

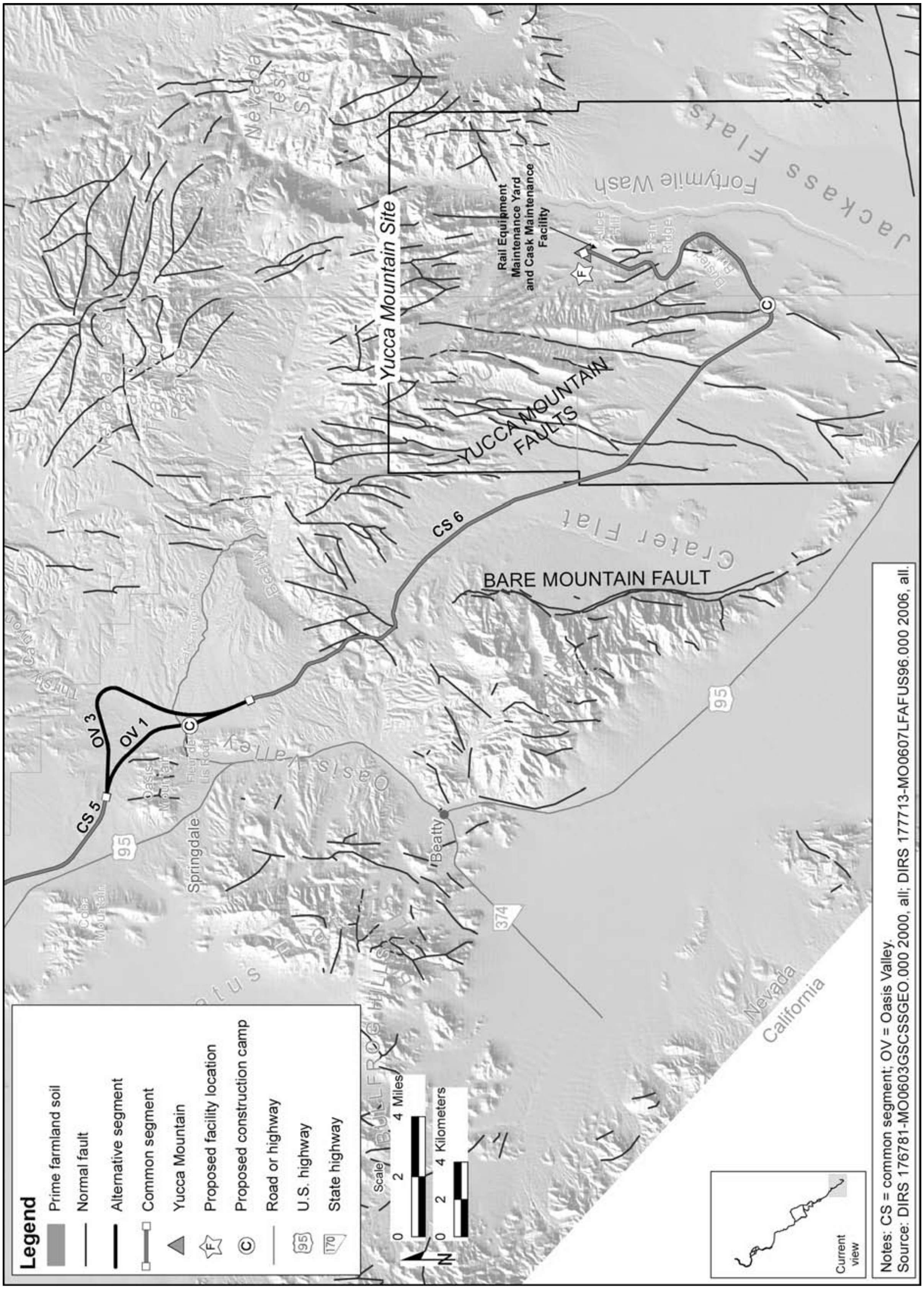


Figure 3-135. Physiographic features of common segments and alternative segments in map area 7.

Elevations range from about 1,200 to 1,300 meters (3,900 to 4,200 feet) above mean sea level. At the northwest end, the alternative segments would cross alluvial fans extending from Pahute Mesa on the north and Oasis Mountain (in Bullfrog Hills) on the south.

3.3.1.3.10.2 Geology. The two Oasis Valley alternative segments would cross sedimentary rocks overlain in part by recent sediment from alluvial fans and Amargosa River floodplain deposits. Small outcrops of young volcanic rocks from the southwestern Nevada volcanic field area are also exposed. The rail alignment would not cross Quaternary faults, commercial mineral operations, geothermal resources or materials suitable for construction purposes.

3.3.1.3.10.3 Soils. Soils along Oasis Valley alternative segments 1 and 3 are derived from alluvium and are well drained to somewhat excessively drained. Soils occur on fan skirts and fan piedmonts. Oasis Valley 1 contains approximately 13 percent soils with the blowing soil characteristic, while Oasis Valley 3 contains approximately 5.3 percent of blowing soils. There are no prime farmland or erodes easily soils along either of the Oasis Valley alternative segments.

3.3.1.3.11 Common Segment 6 (Yucca Mountain Approach)

3.3.1.3.11.1 Physiography. The physiography of common segment 6 is characterized by Beatty Wash, Crater Flat, and several ridges and valleys that make up Yucca Mountain, Busted Butte, and Jackass Flats (see Figure 3-135). The common segment would go around the east side of Busted Butte, with Fortymile Wash and most of Jackass Flats to the east. North of Busted Butte, it would cross a series of washes and valleys flanked by multiple ridges, where it would terminate near Yucca Mountain. Rail alignment elevations would range from about 1,300 meters (4,300 feet) at Tram Ridge to 1,000 meters (3,300 feet) above mean sea level at the base of Busted Butte (DIRS 176184-Shannon & Wilson 2006, Figure 3, Sheets 70 and 71).

3.3.1.3.11.2 Geology. This area is in the southern edge of the southwestern Nevada volcanic field. Common segment 6 would cross a variety of alluvial deposits and sedimentary rocks, and young volcanic rocks. Faults in the area increase in number closer to the Yucca Mountain uplands. The fault traces generally trend to the north, including the Bare Mountain Fault and the eastern and western Yucca Mountain fault groups. Displacements along faults are characterized in terms of the amount of movement per seismic event. For the set of block-bounding faults of primary significance to the ***Yucca Mountain Site***, these surface values range from 0 to 1.7 meters (0 to 5.6 feet) per event (DIRS 155970-DOE 2002, Table 3-8).

DOE has monitored seismic activity at the Nevada Test Site since 1978. The largest recorded earthquake within 50 kilometers (30 miles) of Yucca Mountain was the Little Skull Mountain earthquake in 1992 (DIRS 169734-BSC 2004, p. 4-34 and Figure 4-19), which had a magnitude of 5.6 (DIRS 169734-BSC 2004, p. 4-38). DOE buildings at the Nevada Test Site were damaged and there was also damage in Beatty, Amargosa Valley, and Mercury, Nevada. DOE would continue to monitor the seismic activity around Yucca Mountain with an array of monitoring stations spread throughout the area.

The bedrock around Mina common segment 6 contains metallic minerals such as gold and silver, and nonmetallic deposits, including fluorspar and silica (DIRS 173841-Shannon & Wilson 2005, pp. 38 to 45). There are also several hot springs around the Beatty Wash area, some of which are used by a hotel (DIRS 173841-Shannon & Wilson 2005, Plate 1).

3.3.1.3.11.3 Soils. Soils along common segment 6 occur on fan piedmonts, skirts, and fan remnants. The soils derived from Tertiary volcanic rocks and Quaternary alluvium are well drained to somewhat excessively drained. Soils on alluvial flats are derived from lake deposits and are well drained. None of the soils along common segment 6 contain prime farmland, blowing soil, or soils with the erodes easily characteristic.

3.3.2 LAND USE AND OWNERSHIP

This section describes the affected environment for land use and ownership along and adjacent to the Mina rail alignment. At the recommendation of the U.S. Bureau of Land Management (BLM; a cooperating agency in the preparation of the this Rail Alignment EIS), DOE organized this section by types of land uses rather than by rail alignment segments to enable the reader to quickly review topics of interest to them. The section provides an overview of land uses on private, American Indian, and public lands. The BLM, DOE, and the Department of Defense manage public land the Mina rail alignment would cross. The uses of public land discussed in detail in this section include grazing (within BLM-designated ***grazing allotments***), mineral and energy extraction, and recreation. This section also discusses land access and existing utility rights-of-way.

Section 3.3.2.1 describes the region of influence for land use and ownership; Section 3.3.2.2 describes private land, including relevant land-use plans; Section 3.3.2.3 describes American Indian land; Section 3.3.2.4 describes public lands, BLM ***resource management plans***, and project-related land ***withdrawals***; and Section 3.3.2.5 describes the general environmental setting and land-use characteristics along the Mina rail alignment.

Other sections of this Rail Alignment EIS describe additional subjects related to land use. Section 3.3.1, Physical Setting, describes farmland and prime farmland; Section 3.3.7, Biological Resources, describes wild horse and burro ***herd management areas***; and Section 3.3.11, Utilities, Energy, and Materials addresses utilities. Section 3.4 describes American Indian interests and concerns related to the Proposed Action.

3.3.2.1 Region of Influence

The region of influence for land use and ownership is the nominal width of the rail line construction right-of-way, and includes all private land (including patented mining claims), American Indian lands, and public land that would be fully or partially within the construction right-of-way. The land use and ownership region of influence also includes the locations of proposed railroad construction and operations support facilities outside the nominal width of the construction right-of-way.

Although the railroad operations right-of-way would be smaller than the construction right-of-way, DOE evaluated the construction right-of-way as the basis for identifying potential land-use impacts because:

- It provides a more conservative estimate of the amount of land that would be utilized than the operations right-of-way, providing an upper bound for analysis.
- The construction phase encompasses the most intensive land use in terms of noise, human activity, and disruptions to land access.
- The construction right-of-way footprint would be the basis for the initial right-of-way applications submitted to the BLM for the project.

3.3.2.2 Private Land

Private lands in Mineral, Esmeralda, and Nye Counties are either clustered in towns and along highways, or are widely scattered. Private lands make up a very small portion of these counties. Figure 3-136 provides an overview of privately owned lands near the Mina rail alignment.

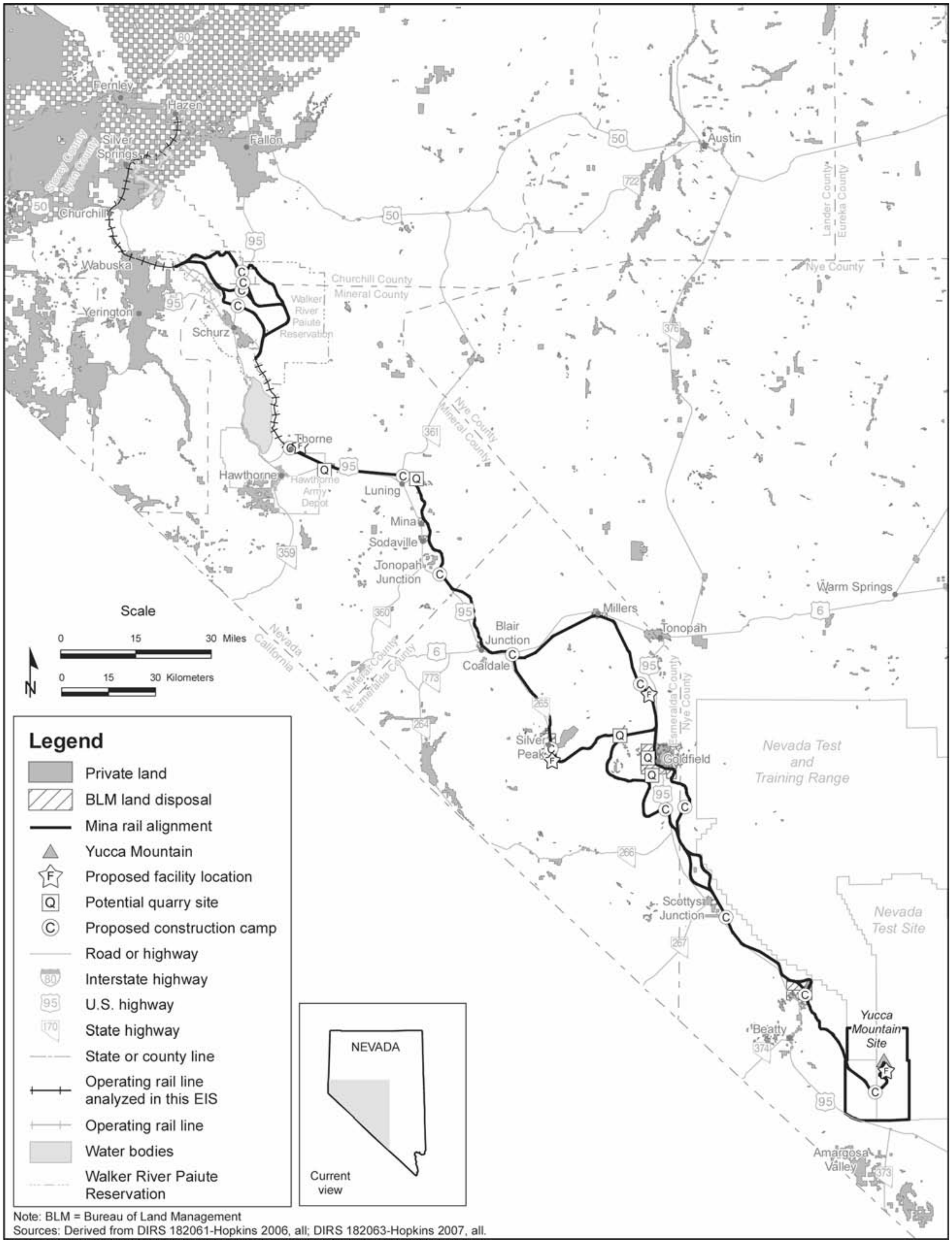


Figure 3-136. Private land along the Mina rail alignment.

3.3.2.2.1 County Land-Use Plans

The Mina rail alignment would cross parts of Churchill, Lyon, Mineral, Esmeralda, and Nye Counties. County plans that could affect land use along the rail alignment include the *Churchill County Master Plan* (DIRS 180482-Churchill County 2005, all), the *Esmeralda County Master Plan* (DIRS 176770-Duval et. al. 1976, all) and *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all).

3.3.2.2.1.1 Churchill County. In Churchill County, the northernmost section of the Mina rail alignment would be the existing Union Pacific Railroad Hazen Branchline. A portion of Schurz alternative segment 6 would cross land within Churchill County, although entirely within the Walker River Paiute Reservation. Therefore, there would be no construction activities that could affect land use and ownership within lands under the jurisdiction of Churchill County, and its master plan would not apply to the Mina rail alignment.

3.3.2.2.1.2 Lyon County. A portion of the Union Pacific Railroad Hazen Branchline, all of Department of Defense Branchline South, and 0.6 kilometer (0.4 mile) of the western portions of the Schurz alternative segments lie within Lyon County. Lyon County is in the process of updating its 1990 Comprehensive Master Plan and the process will last through 2008. However, the Mina rail alignment would travel on existing railroad, within the Walker River Paiute Reservation, or on BLM-administered land for its entire length through Lyon County. Because there would be no new railroad construction on land under Lyon County jurisdiction, the Lyon County master plan would not apply to the Mina rail alignment.

3.3.2.2.1.3 Mineral County. Mineral County covers more than 9,900 square kilometers (3,800 square miles), of which 81.3 percent is controlled and managed by the federal government. The Walker River Paiute Reservation is at the very northern end of Mineral County. In the Hawthorne area, the Department of Defense has large land holdings used for storage of conventional weapons. In Hawthorne, land uses are mixed, with primarily commercial and residential developments on the highway corridor. In Mina and Luning, the predominant land uses are small tourist commercial and residential (DIRS 180702-Mineral County Nuclear Projects Office 2005, p. 30). While there are zoning designations within Hawthorne, Walker Lake, Mina, and Luning (DIRS 180702-Mineral County Nuclear Projects Office 2005, pp. 26 to 29), there are no county master plans or town land-use plans in Mineral County that would apply to the Mina rail alignment.

3.3.2.2.1.4 Esmeralda County. The BLM manages more than 92 percent of the approximately 9,000 square kilometers (3,600 square miles) in Esmeralda County. Two percent of the land in Esmeralda County is National Forest land, and a small portion of the county falls within Death Valley National Park. Less than 5 percent of the land in the county is privately owned. The two most heavily populated areas in Esmeralda County at the issuance of the *Esmeralda County Master Plan* were Goldfield and Silver Peak (DIRS 176770-Duval et. al. 1976, p. 25). Goldfield is the county seat for Esmeralda County; there are no incorporated cities in the county. Under the *Esmeralda County Master Plan*, land use has been divided into three basic categories: multiple use, agriculture, and urban expansion. The multiple-use category is suggested for those areas where federal or state ownership is expected to remain. Grazing, mining and prospecting, and recreation activities are recommended under the multiple-use concept. The plan also recommends that residential and commercial development be concentrated in the existing communities of Goldfield and Silver Peak, where public facilities can be most economically concentrated (DIRS 176770-Duval et. al. 1976, p. 73).

3.3.2.2.1.5 Nye County. Nye County has an area of approximately 47,000 square kilometers (18,000 square miles) and is the largest county in Nevada. The federal government manages almost 93 percent of the county's land. Federally owned or managed lands in Nye County include the Nevada Test and

Training Range, the Nevada Test Site, BLM-administered public land, a portion of Death Valley National Park, and portions of the Humboldt-Toiyabe National Forest. Private lands in Nye County are used for residential, commercial, and industrial purposes largely, but not exclusively, within the boundaries of unincorporated towns, and agricultural and mining uses both inside and outside these towns. The *Nye County Comprehensive Plan* guides growth and development, but is not equivalent to a zoning ordinance, nor does it regulate the use of land. However, the Nye County Board of Commissioners may choose to enact a zoning ordinance or other growth-management mechanisms to accomplish certain objectives of the plan. The plan also serves as a framework for local land-use plans and other growth-management mechanisms (DIRS 147994-McRae 1994, all).

3.3.2.2.2 Local Land-Use Planning

The initial design phase for the Mina rail alignment emphasized avoiding private land, which is generally concentrated near towns. While distinct town boundaries are not always available, DOE believes the rail alignment would not fall within Hawthorne, Luning, Mina, Sodaville, Tonopah Junction, Coaldale, Blair Junction, Millers, Silver Peak, Klondike, Ralston, Lida Junction, Scottys Junction, Springdale, or Beatty, which would be the towns or places closest to the rail alignment. A portion of Montezuma alternative segments 2 and 3 would pass through private lands to the south of Millers, but this very small town does not have zoning or land-use plans.

Montezuma alternative segment 2 would also pass through Goldfield. Goldfield, an unincorporated town, is the county seat for Esmeralda County. The Goldfield census county division encompasses an area of more than 3,900 square kilometers (1,500 square miles) (DIRS 176855-U.S. Census Bureau 2003, p. 5). During its most prominent mining period at the beginning of the 20th Century, a number of passenger and freight railroad lines served Goldfield. The Goldfield Historic District, listed on the *National Register of Historic Places* in 1982 and entered onto the *Nevada State Register of Historic Places* on December 7, 2005, is in Goldfield and roughly bounded by Fifth Street, Miner Avenue, Spring Street, Elliot Street, and Crystal Avenue (DIRS 176854-National Register of Historic Places 1982, all). Although there is no zoning plan for Goldfield, the historic nature of its buildings and features are generally protected by the designation of its historic district. The Goldfield Historic District would be about 0.7 kilometer (0.4 mile) northwest of the Montezuma alternative segment 2 construction right-of-way.

3.3.2.2.3 Private Parcels

Table 3-81 lists the number of privately owned parcels of land that are within the construction right-of-way of each Mina rail alignment segment. Figures 3-137 through 3-143 show privately owned land along the Mina rail alignment segments.

Table 3-81. Private land that would be within or intersect the Mina rail alignment construction right-of-way.

Rail line segment[a]	Number of parcels	Area of parcels (square kilometers)[b]
Mina common segment 1	1	0.21
Montezuma alternative segment 2	34	0.24
Montezuma alternative segment 3	1	0.01
Oasis Valley alternative segment 1	1	0.04

a. No other segments would intersect private land.
b. To convert square kilometers to acres, multiply by 247.10.

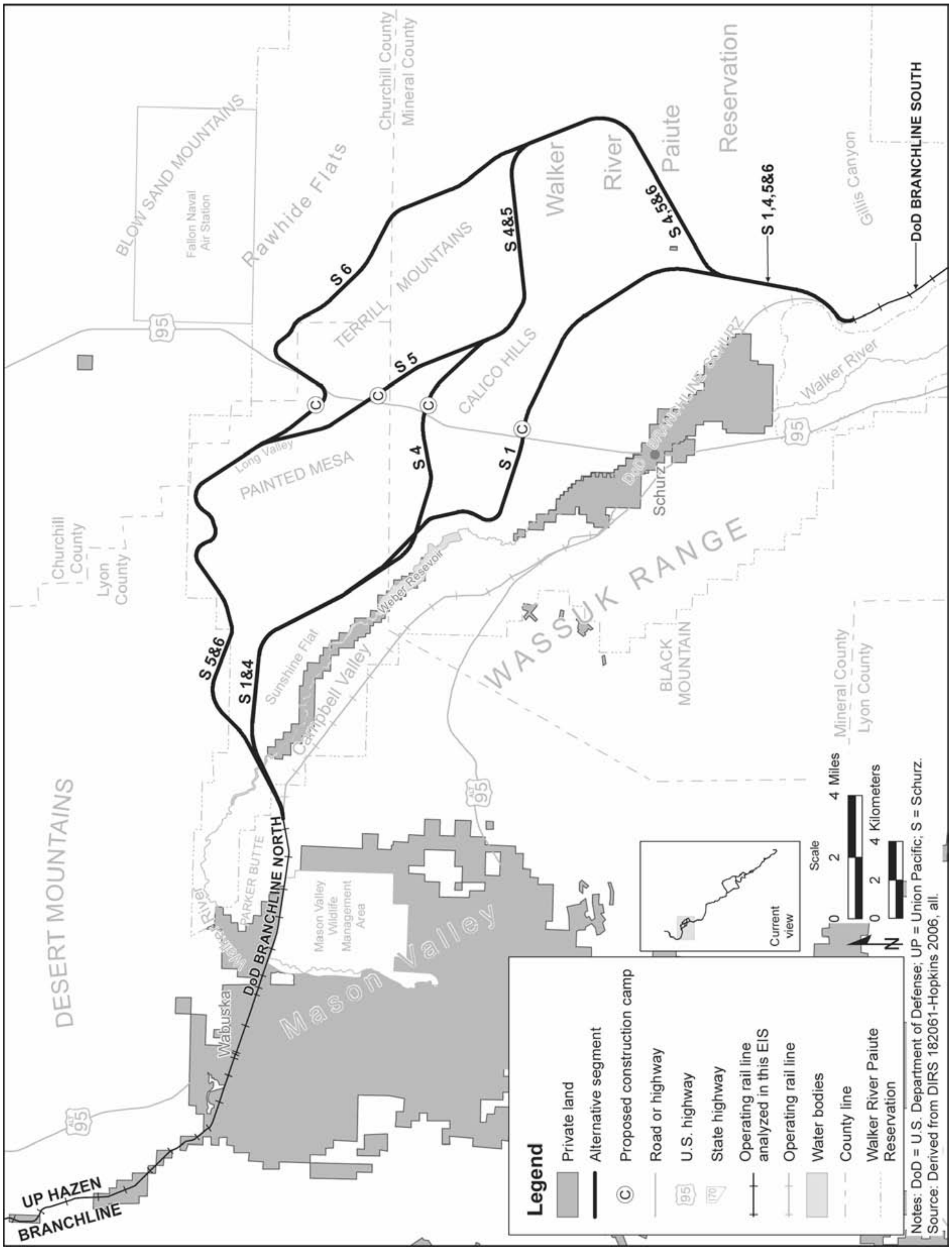


Figure 3-137. Private land within map area 1.

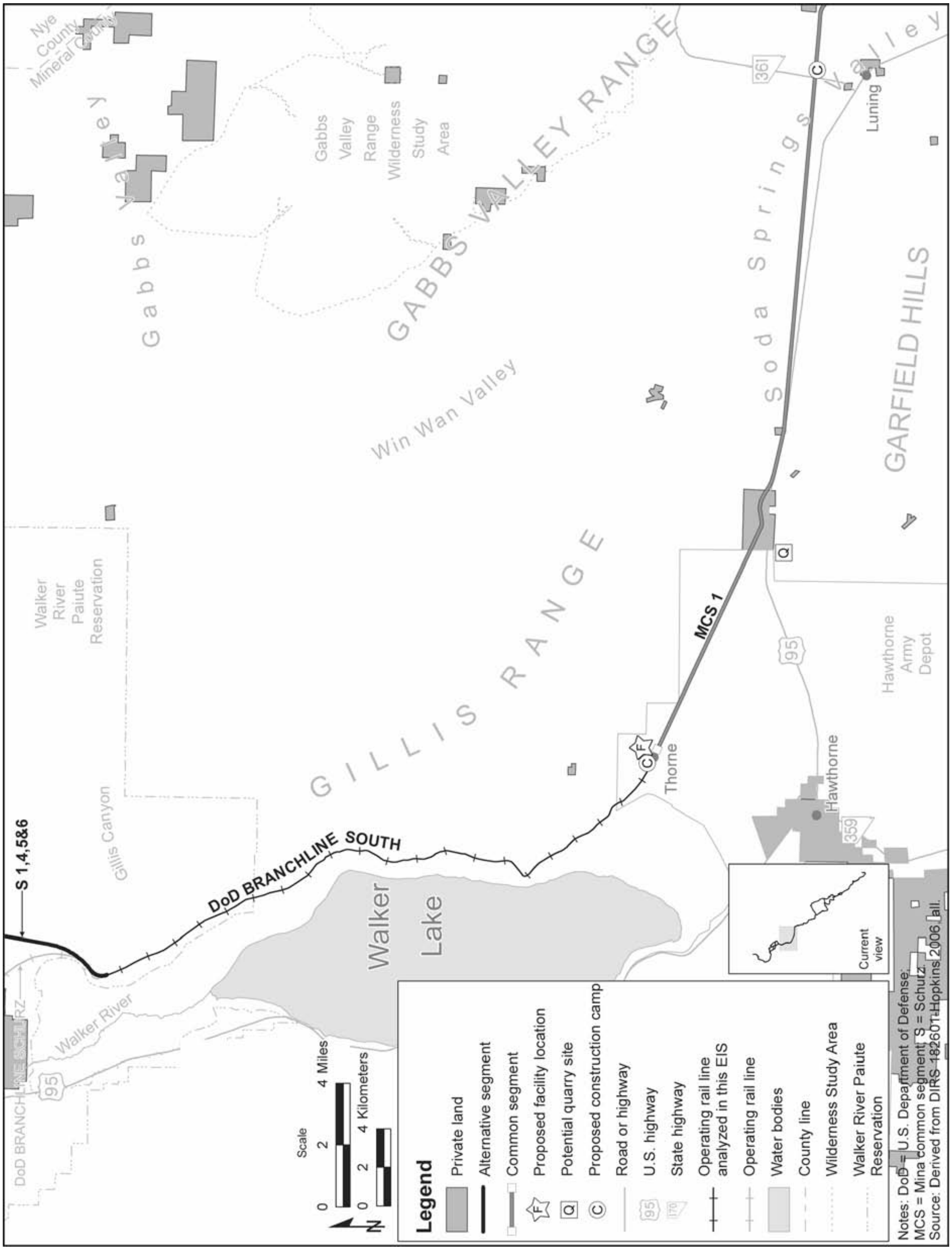


Figure 3-138. Private land within map area 2.

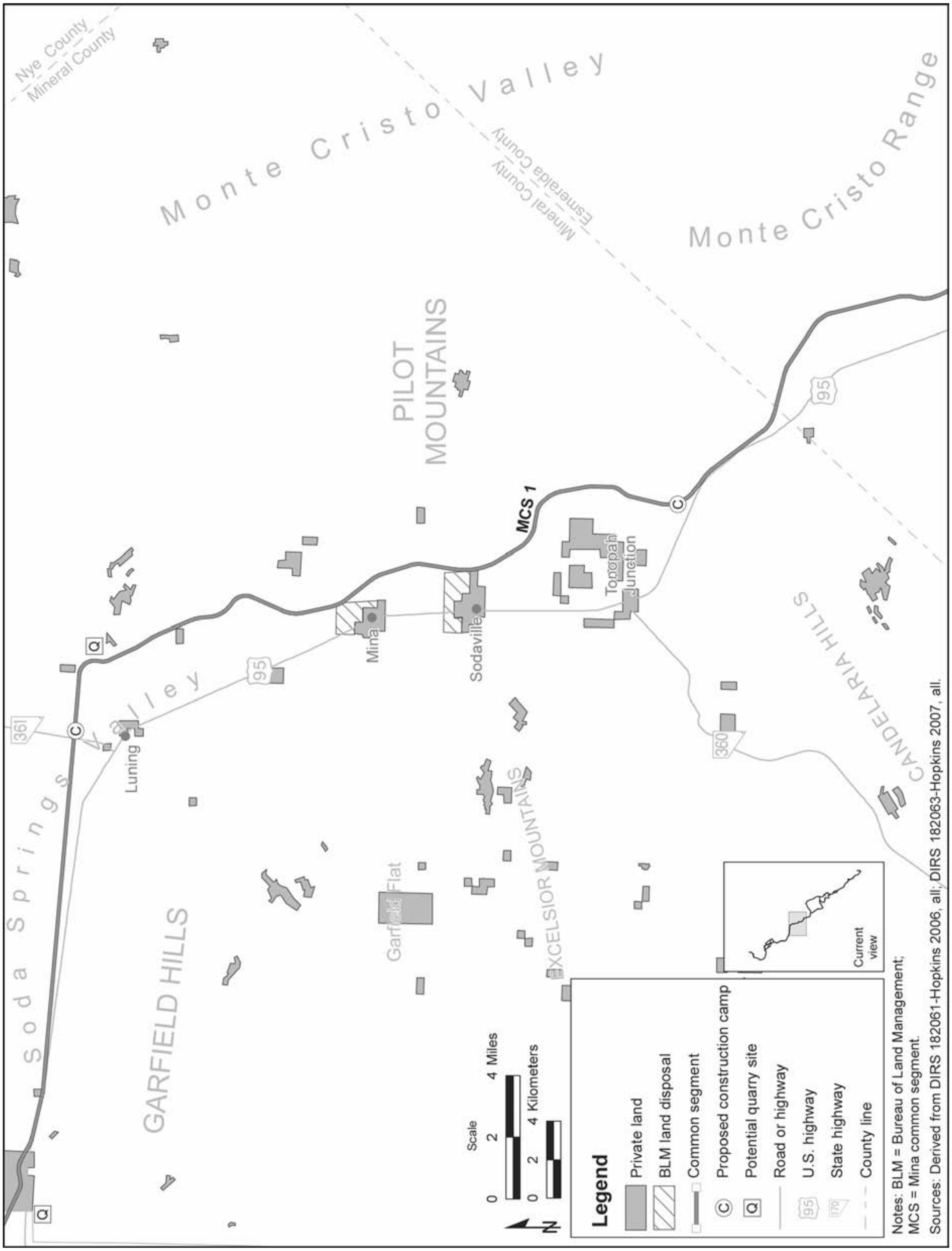


Figure 3-139. Private land within map area 3.

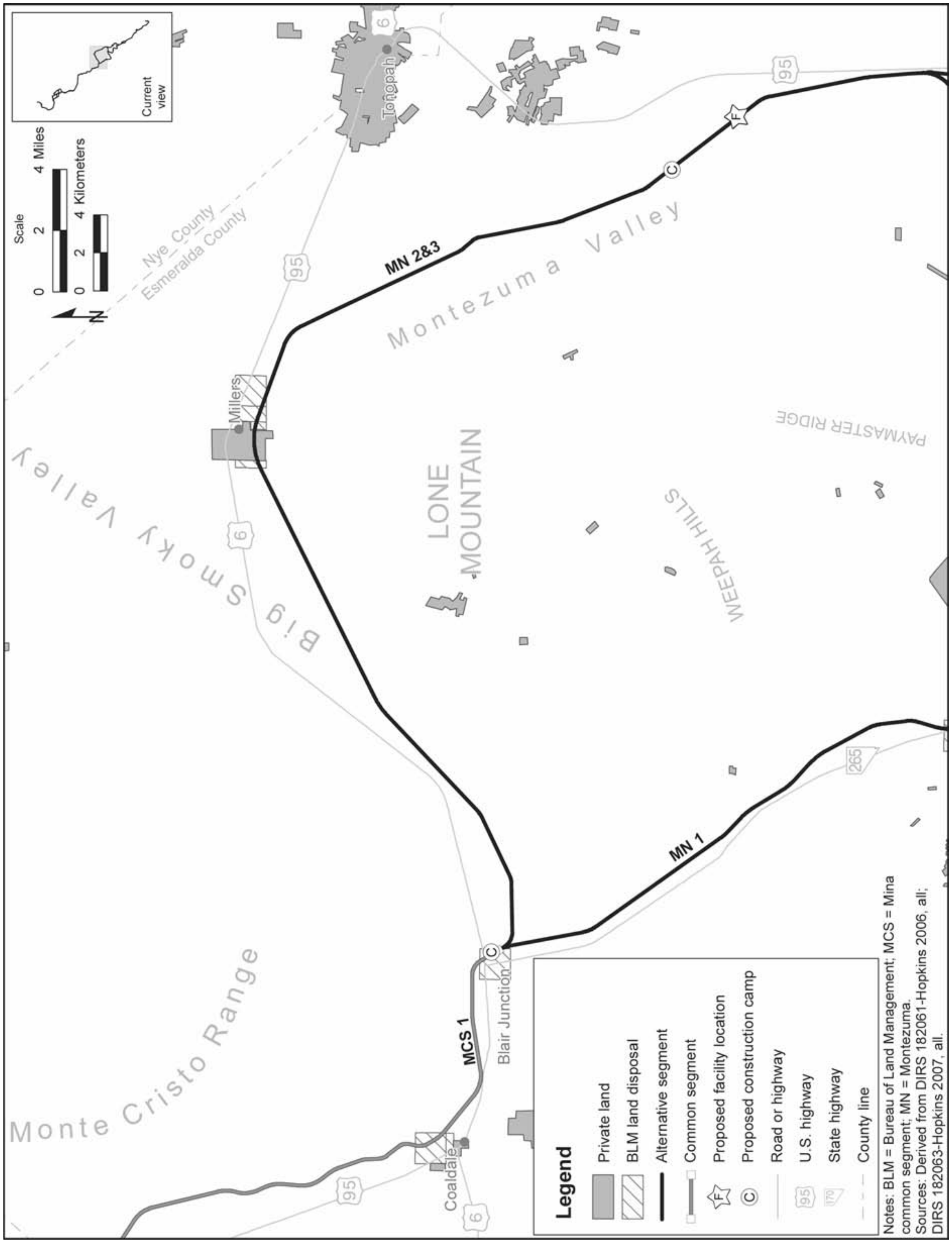


Figure 3-140. Private land within map area 4.

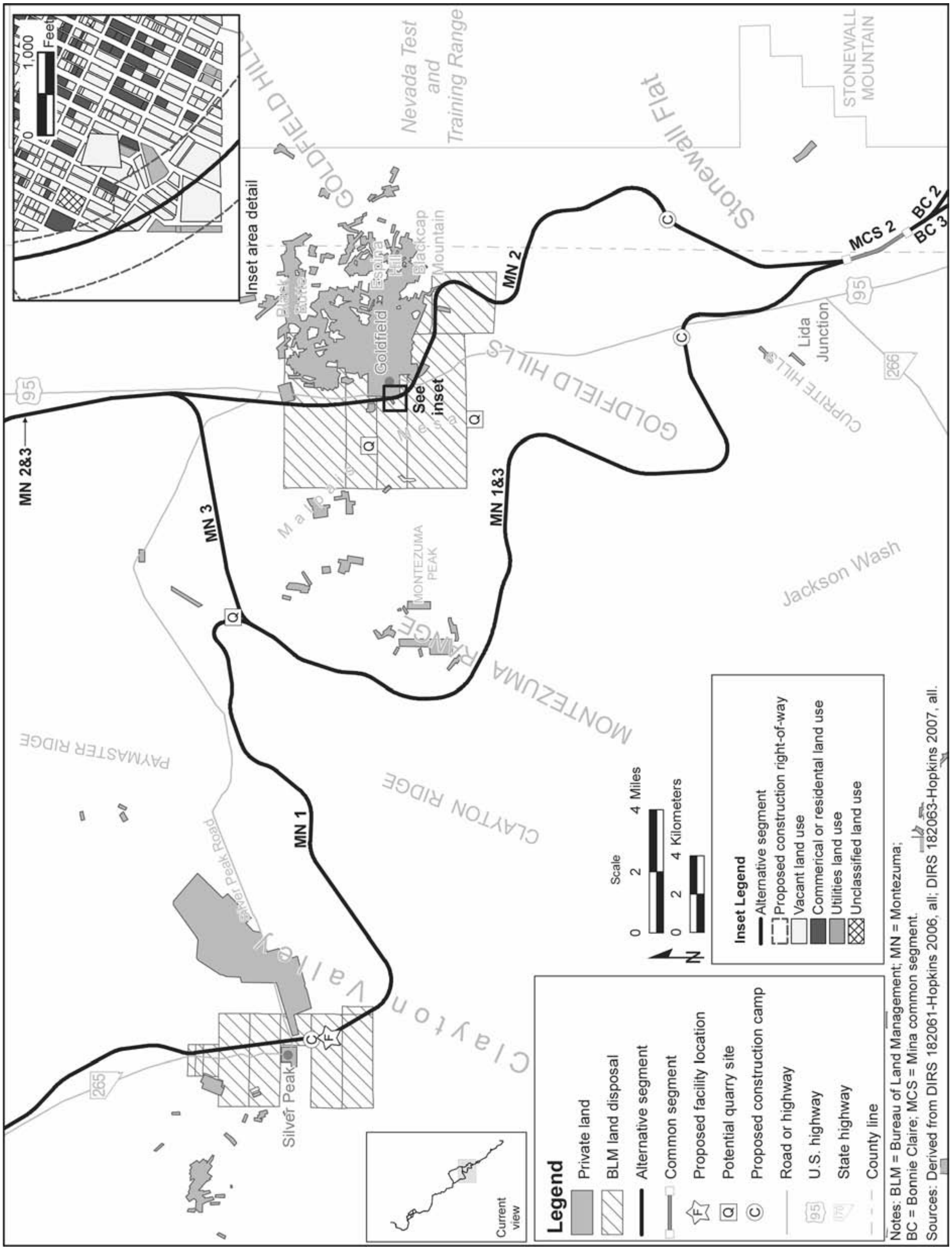


Figure 3-141. Private land within map area 5.

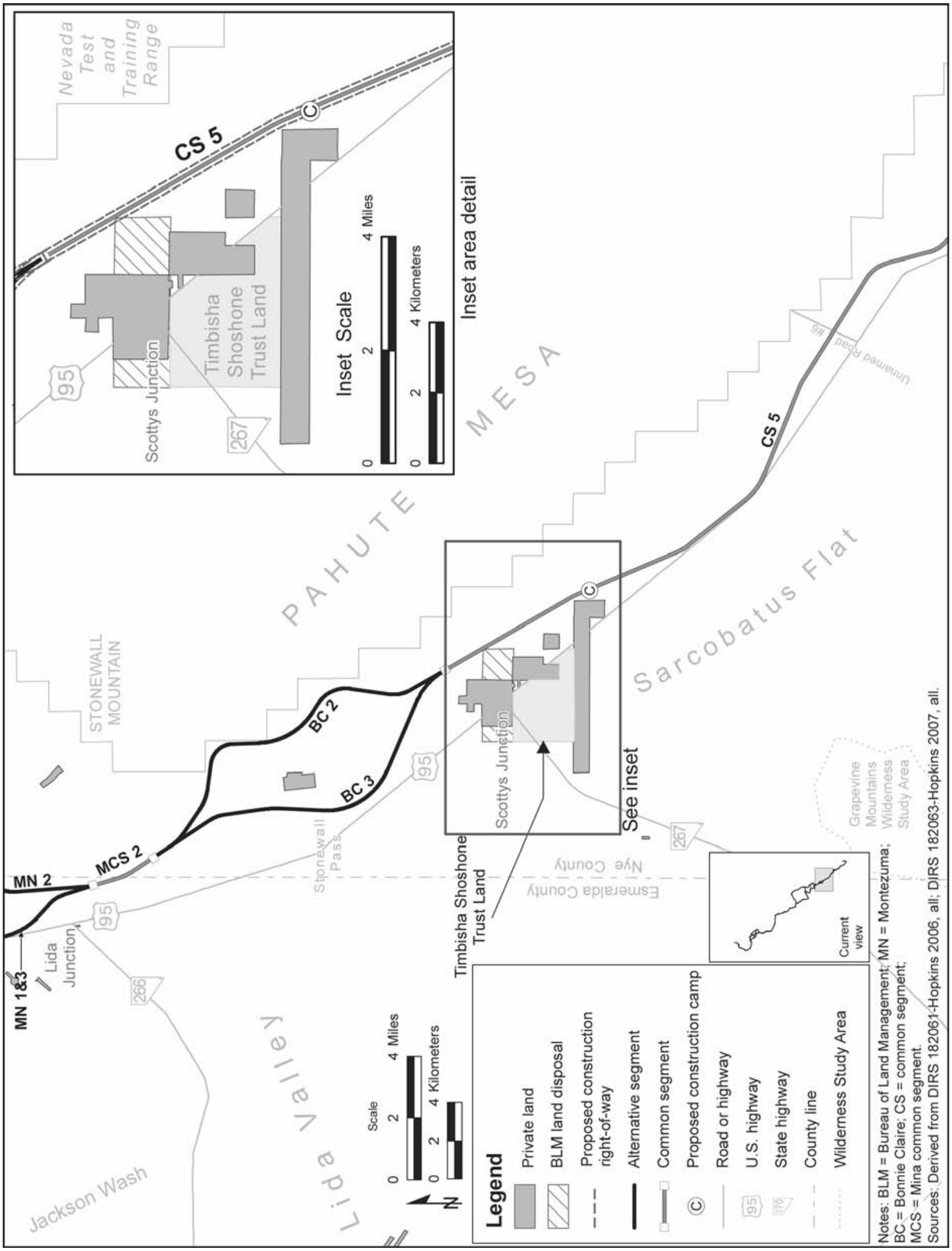


Figure 3-142. Private land within map area 6.

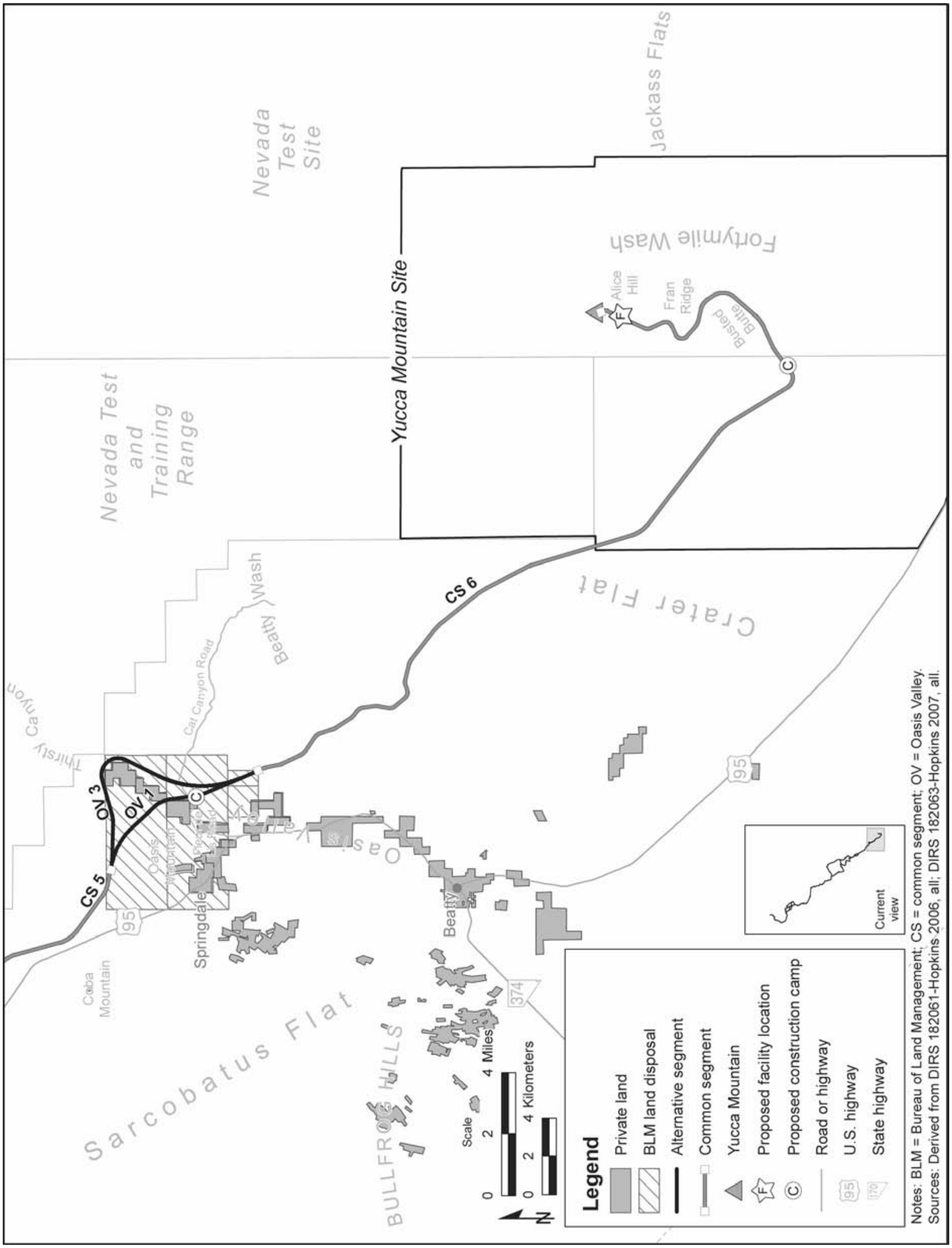


Figure 3-143. Private land within map area 7.

3.3.2.3 American Indian Land

3.3.2.3.1 Walker River Paiute Reservation

The Walker River Paiute Reservation is 68 kilometers (42 miles) south of Fallon and 37 kilometers (23 miles) east of Yerington (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1). The Reservation consists of 1,308 square kilometers (323,200 acres) of land across Churchill, Lyon, and Mineral Counties (DIRS 182302-Miller Ecological Consultants 2005, p. 3-50).

The Reservation was established on November 29, 1859, by letter from the Indian Affairs Commissioner to the General Land Office requesting that land from sale or settlement for Indian use in the northeastern part of the Walker River Valley, including the Walker River Reservation, be established. The constitution of the Walker River Paiute Tribe was finalized on March 26, 1937 (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1).

At present, 8.5 square kilometers (2,100 acres) of Reservation land is used for agriculture (primarily alfalfa and grass hay) (DIRS 182302-Miller Ecological Consultants 2005, p. 3-50). More than 50 percent of the Reservation is rangeland. Small ranching businesses manage livestock, primarily cattle (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 2). The town of Schurz, the only town on the Reservation, consists of private property with residential and business uses. The Department of Defense operates a branchline across the Reservation, through Schurz. The Weber Dam and Reservoir are also on Reservation land.

The Walker River Paiute Tribe divides land into 0.08-kilometer (20-acre) allotments (DIRS 180447-Emm, Lewis, and Breazeale n.d., p. 1). Many of the allotments have multiple owners through inheritance (182302-Miller Ecological Consultants 2005, p. 3-49). There is no adopted land-use plan for the Reservation, although the Tribal Council in effect controls land-use decisions (DIRS 182302-Miller Ecological Consultants 2005, p. 3-49).

Table 3-82 summarizes the distances and areas of existing and proposed rail line segments within the Walker River Paiute Reservation.

Table 3-82. Distances of existing and proposed rail line segments through the Walker River Paiute Reservation.

Segment	Approximate distance through the Reservation (kilometers)[a]	Approximate area of Reservation land that would be within the rail line construction right-of-way (square kilometers)[b]
Existing Department of Defense Branchline through Schurz (existing rail to be removed as part of the Proposed Action)	44	Not applicable
Schurz alternative segment 1	51	3.4
Schurz alternative segment 4	65	4.7
Schurz alternative segment 5	66	5.0
Schurz alternative segment 6	64	5.3

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert square kilometers to acres, multiply by 247.10.

3.3.2.3.2 Timbisha Shoshone Trust Land

The Timbisha Homeland Act transferred into trust 31.4 square kilometers (7,754 acres) of land for the Timbisha Shoshone Tribe. The land is not contiguous; it is made up of five separate parcels in California and Nevada. The parcel near Scottys Junction covers approximately 11.3 square kilometers (2,800 acres).

During the public scoping period for this Rail Alignment EIS, the Timbisha Shoshone Tribe requested that DOE alter the rail alignment to avoid their land (DIRS 174558-Sweeney 2004, all). The segment nearest the Timbisha Shoshone Trust Land near Scottys Junction, common segment 5, would be more than 3 kilometers (2 miles) east.

3.3.2.4 Public Land

Several agencies manage public lands near or encompassing the Mina rail alignment, including the BLM, DOE, and the Department of Defense. The Walker River Paiute Tribal Council manages Walker River Paiute Reservation lands.

Based on the construction right-of-way of the longest possible Mina rail alignment, the BLM manages 113.3 square kilometers (28,000 acres) of the land the rail line would cross, the Department of Defense manages 4.6 square kilometers (1,145 acres), the Walker River Paiute Tribe manages 5.3 square kilometers (1,315 acres), DOE manages 4.1 square kilometers (1,020 acres), and up to 0.45 square kilometer (71 acres) is privately owned.

The Mina rail alignment would travel through the Walker River Paiute Reservation. The Reservation does not have a land-use plan. The Mina rail alignment would also travel through the Hawthorne Army Depot. The Depot does not have a master plan but its land use is governed in part by its draft Integrated Natural Resource Management Plan (DIRS 181899-Hawthorne Army Depot, all).

3.3.2.4.1 BLM-Administered Land

Approximately 89 percent of the lands along the Mina rail alignment are BLM-administered public lands. Therefore, the proposed railroad project would in large part be subject to BLM land use plans. The BLM manages public lands under the multiple-use concept, which balances the present and future needs of the American people. The BLM implements this concept through resource management plans, which are long-range, comprehensive land-use plans intended to provide for multiple uses and identify planning objectives and policies for designated areas. Resource management plan objectives are implemented through activity plans, such as allotment management plans and wildlife ***habitat*** management plans. BLM resource management plans that apply to the Mina rail alignment are included in the following:

- *Carson City Field Office Consolidated Resource Management Plan* (Carson City Consolidated Resource Management Plan (DIRS 179560-BLM 2001, all)
- *Tonopah Resource Management Plan and Record of Decision* (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)
- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

The northern segments of the Mina rail alignment would pass through public lands covered by the Carson City Consolidated Resource Management Plan. After the Mina rail alignment would cross from Mineral County into Esmeralda County, the land would be covered by the Tonopah Resource Management Plan. A portion of common segment 6 would pass through lands covered by the Las Vegas Resource Management Plan. Table 3-83 lists the distances each Mina rail alignment segment would pass through lands administered by the various BLM districts.

Table 3-83. Mina rail alignment crossing distances within each BLM resource management plan area.

Rail line segment	Carson City District/ Resource Management Plan area (kilometers)[a,b]	Battle Mountain District/Tonopah Resource Management Plan area (kilometers)	Las Vegas District/Resource Management Plan area (kilometers)
Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North[c]	69	0	0
Schurz alternative segment 1	51	0	0
Schurz alternative segment 4	65	0	0
Schurz alternative segment 5	71	0	0
Schurz alternative segment 6	72	0	0
Department of Defense Branchline South	35	0	0
Mina common segment 1	85	35	0
Montezuma alternative segment 1	0	120	0
Montezuma alternative segment 2	0	120	0
Montezuma alternative segment 3	0	140	0
Mina common segment 2	0	3	0
Bonnie Claire alternative segment 2	0	20	0
Bonnie Claire alternative segment 3	0	20	0
Common segment 5	0	40	0
Oasis Valley alternative segment 1	0	10	0
Oasis Valley alternative segment 3	0	14	0
Common segment 6	0	38	13
Total rail alignment distance by BLM district (shortest to longest alignment)	240 to 261	266 to 290	13

a. To convert kilometers to miles, multiply by 0.62137.
b. Individual segment lengths are rounded to two significant figures.
c. Within boundary but not under jurisdiction.

To construct and operate the proposed railroad along the Mina rail alignment, DOE would apply for a BLM ***right-of-way grant***. Section 503 of the Federal Land Policy and Management Act (43 United States Code [U.S.C.] 1761) provides for designation of right-of-way corridors and encourages the utilization of common rights-of-way to minimize environmental impacts and the proliferation of separate rights-of-way. BLM policy is to encourage prospective applicants to locate their proposals within existing corridors. Resource management plans describe these corridors and right-of-way avoidance areas – areas for which the BLM would avoid granting new rights-of-way unless there are no other options. ***Areas of Critical Environmental Concern*** are generally considered right-of-way avoidance areas.

Resource management plans also designate areas of potential land disposal within their management areas. Therefore, BLM in consultation with DOE must assess whether a railroad along the Mina rail alignment would conflict with or adversely affect land disposal plans. Section 203(a) of the Federal Land Policy and Management Act allows for public land to be sold (disposed of) if it meets one of the following criteria:

> **Areas of Critical Environmental Concern** are places within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, and other natural systems, or processes or to protect life and safety from natural hazards (DIRS 181386-BLM 2001, p. 2).

- The land is difficult or uneconomic to manage as a part of the public lands.
- The land is not suitable for management by another federal department or agency.
- The land was acquired for a specific purpose and it is no longer required for that, or any other, federal purpose.
- Disposal of the land will serve important public objectives that can be achieved prudently or feasibly only if the land is removed from public ownership and these objectives outweigh other public objectives or values that will be served by maintaining the land in federal ownership.

Sections 3.3.2.4.1.1 through 3.3.2.4.1.3 describe the planning areas and objectives of the applicable Resource Management Plans in relation to lands and realty, corridors, and access and recreation.

3.3.2.4.1.1 Carson City Consolidated Resource Management Plan. The BLM Carson City Field Office administers more than 21,000 square kilometers (5.28 million acres) of federal public land in 11 counties in western Nevada and eastern California. Relevant management objectives related to land tenure adjustments, corridors, and access are listed below (DIRS 179560-BLM 2001, all).

- Lands and realty
  - Designate for potential future disposal approximately 750 square kilometers (180,000 acres) of BLM-administered public lands including lands that are difficult and uneconomic to manage (such as scattered parcels south of Hawthorne and in Smith and Mason Valleys, and checkerboard lands near Fernley, Silver Springs, and the Carson Sink [a large playa in northwestern Nevada, formerly the terminus of the Carson River]); land that would support community expansion (such as land west of Yerington; land surrounding Luning, Mina, Sodaville, Fallon, Gabbs, Reno, and Verdi; lands east of Montgomery Pass, near Honey Lake Valley and Dixie Valley); lands with possible agricultural potential (such as Smith Valley, Mason Valley, Honey Lake Valley, and Edwards Creek); and lands along the East Walker River identified for exchange to benefit BLM programs (DIRS 179560-BLM 2001, p. LND-3). The Mina common segment 1 construction right-of-way would overlap the eastern edge of disposal areas near Mina and Sodaville.
  - Transfer of land from federal ownership is subject to the following provision: mineral rights will be reserved to the United States unless there are no known mineral values in the land or the proposed non-mining development of the land is of more value than the minerals and the reservation of mineral rights interferes with such proposed non-mining development (DIRS 179560-BLM 2001, p. LND-7).
  - Rights-of-way will be reserved where appropriate to provide public access prior to disposal of public lands (DIRS 179560-BLM 2001, p. LND-7).
  - When public lands are disposed of or devoted to a public purpose that precludes livestock grazing, the permittee and lessee will be given 2 years prior notification, except in the cases of emergency (for example, military defense requirements in time of war, natural disasters, and

national emergency needs) before their grazing permit and grazing lease and grazing preference may be cancelled in whole (DIRS 179560-BLM 2001, pp. LND-7 and 8).

- Livestock permits would be adjusted, if necessary, to reflect decreases in public land forage available for livestock grazing use within an allotment as a result of land tenure adjustments (DIRS 179560-BLM 2001, p. LND-8).
- Applicants for major rights-of-way shall submit a plan of development prior to issuance of a land-use authorization that addresses specific construction, operation, maintenance, or termination features that will satisfactorily mitigate the impacts (DIRS 179560-BLM 2001, p. LND-8).

- Corridors
  - Provide for an east-west and north-south network of right-of-way corridors in the Field Office area of jurisdiction (DIRS 179560-BLM 2001, p. ROW-1).
  - Designate 1,104 kilometers (686 miles) of rights-of-way, which include existing transmission lines, and identify 351 kilometers (218 miles) of planning corridors. All corridors are 3 kilometers (2 miles) wide and private lands are not included in these corridors (DIRS 179560-BLM 2001, p. ROW-1).
  - Within the Walker Resource Area, designate a corridor (C-F) following the existing major powerline from the Fort Churchill Power Plant to southern Nevada. Portions of this route also contain U.S. Highway 95, a railroad, telephone, and other power lines (DIRS 179560-BLM 2001, p. ROW-2).
  - Future right-of-way corridors will be evaluated on a case-by-case basis, but should be as consistent as possible with the Western Regional Corridor Study (DIRS 179560-BLM 2001, p. ROW-3).
  - Existing roads and trails will be used whenever possible during construction (DIRS 179560-BLM 2001, p. ROW-4).
- Access and recreation
  - All public lands under Carson City Field Office jurisdiction are designated open to off-highway vehicle use unless they are specifically restricted or closed. Off-highway vehicle use will be eliminated through or in the immediate vicinity of any surface-water source, such as a spring or seep; in any ***riparian*** area associated with meadows, marshes, springs, seeps, ponds, lakes, reservoirs or streams; in any channel bank or streambed of a ***perennial stream***; or in a threatened or endangered plant location (DIRS 179560-BLM 2001, p. REC-7).
  - Off-highway vehicle access is restricted to designated trails and roads on the west side of Walker Lake (DIRS 179560-BLM 2001, p. REC-3).
  - Special Recreation Management Area designation will be maintained for Walker Lake (DIRS 179560-BLM 2001, p. REC-5).
  - The following plans will be followed for recreation activities and planning: Walker Lake Recreation Management Plan (December 1979); and Recreation Project Plan for Walker Lake (April 1992) (DIRS 179560-BLM 2001, p. REC-8).
- Minerals and energy

  Public lands in the area of jurisdiction are open to mineral and energy development activity, although within the Walker Planning Area, about 45 square kilometers (11,000 acres) are either segregated against mineral entry under the Classification and Multiple Use Act or withdrawn from mineral entry by the formal withdrawal process (DIRS 179560-BLM 2001, p. MIN-1).

3.3.2.4.1.2 Tonopah Resource Management Plan. Located in south-central Nevada in Nye and Esmeralda Counties, the Tonopah Planning Area encompasses approximately 25,000 square kilometers (6.1 million acres) of public land and approximately 670 square kilometers (165,000 acres) of private land. Significant resources and program emphases include locatable minerals, livestock grazing, wild horses and burros, realty, cultural resources, and wildlife (DIRS 173224-BLM 1997, p. 1). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below.

- Lands and realty
  - Discretionary disposal of approximately 274 square kilometers (68,000 acres) of public land (DIRS 173224-BLM 1997, p. 2). Approximately 91 square kilometers (230,000 acres) have been identified for potential disposal in the vicinity of the Goldfield, about 2 square kilometers (5,800 acres) have been identified for potential disposal near Scottys Junction, and approximately 160 square kilometers (39,000 acres) have been identified for potential disposal near Beatty (acreage based on GIS data) (DIRS 181617-Hopkins 2007, all).

    Mina common segment 1 would intersect two parcels designated for disposal at Coaldale Junction and one parcel at Blair Junction. Montezuma alternative segment 1 would intersect nine parcels designated for disposal near Silver Peak. Montezuma alternative segments 2 and 3 would intersect four parcels at Millers, and Montezuma alternative segment 2 would intersect six parcels at Goldfield.
- Corridors
  - Approximately 1,100 kilometers (670 miles) designated for transportation and utility corridors in the planning area (DIRS 173224-BLM 1997, p. 2).
  - Rights-of-way allowed (if compatible with values) on approximately 600 square kilometers (149,000 acres) (DIRS 173224-BLM 1997, p. 2). (There are no right-of-way exclusion areas within the Mina rail alignment region of influence.)
  - Designated right-of-way corridors within the planning area will be 5 kilometers (3 miles) wide except where there are topographic constraints. Grants for rights-of-way are still required for facilities placed within designated corridors. Designation of a corridor does not mean that future rights-of-way are restricted to corridors, nor does it mean that the BLM has committed to approving all right-of-way applications within corridors (DIRS 173224-BLM 1997, p. A-38).
- Access and recreation
  - Vehicles unrestricted on 77 percent of the planning area.
  - Vehicles limited to existing roads and trails in primitive and semi-primitive non-motorized and semi-primitive motorized areas.
  - Designates seven Special Recreation Management Areas (DIRS 173224-BLM 1997, p.2)

3.3.2.4.1.3 Las Vegas Resource Management Plan. The Las Vegas Resource Management Plan provides a comprehensive framework for managing approximately 13,000 square kilometers (3.3 million acres) of public lands in Clark County and the southern portion of Nye County administered by the BLM Las Vegas Field Office. Significant resources and program emphases in the plan include threatened and ***endangered species***; land disposal actions; wilderness management; wildlife habitat; special status species; riparian areas; forestry and vegetative products; livestock grazing; wild horses and burros; land acquisition priorities; rights-of-way; cultural resources; hazardous materials management; recreation; utility corridors; and minerals (DIRS 176043-BLM 1998, p. 2). Relevant land-use management objectives related to land and realty, corridors, and access are summarized below (DIRS 176043-BLM 1998, Appendix A, pp. 16-18).

- Land and realty
  - Dispose of approximately 710 square kilometers (175,000 acres) of public lands through sale, exchange or recreation and public-purpose patent to provide for the orderly expansion and development of southern Nevada.
  - All public lands within the planning area, unless otherwise classified, segregated or withdrawn, and with the exception of Areas of Critical Environmental Concern and ***Wilderness Study Areas***, are available for land-use leases and permits at the discretion of the BLM.
  - Terminate or modify any unused, outdated, or unnecessary classifications/segregations and withdrawals on public lands to reduce the area of segregation in the plan area.
  - Acquire private lands to enhance the recovery of special status species, protect valuable resources, and facilitate the management of adjacent BLM lands.
- Corridors

  All Areas of Critical Environmental Concern and all lands within 0.4 kilometer (0.25 mile) of significant caves, exclusive of any designated corridors, are designated as right-of-way avoidance areas. (There are no Areas of Critical Environmental Concern within the Mina rail alignment region of influence; the closest area is 135 kilometers [84 miles] south of common segment 6.)
- Access and recreation
  - Ensure that a wide range of recreation opportunities are available for recreation users in concert with protecting the natural resources on public lands that attract users.
  - Provide opportunities for off-road vehicle use while protecting wildlife habitat, cultural resources, hydrological and soil resources, non-motorized recreation opportunities, natural and aesthetic values, and other uses of the public land.

The Las Vegas Proposed Resource Management Plan/Final Environmental Impact Statement briefly mentions the Yucca Mountain Project in sections titled “Income and Employment” and “Social Setting, Attitudes, and Values.” In the Income and Employment section the document notes that there could be population growth in Amargosa Valley as a result of construction and operation of the Yucca Mountain Project. In the Social Setting, Attitudes, and Values section the document notes that people residing in Las Vegas (urbanites) expressed a higher concern than people residing in rural locations about wildlife and ***ecosystem*** values when recording their ***risk*** assessment for the proposed Yucca Mountain Project in a 1995 social research survey conducted by the University of Nevada Las Vegas (DIRS 176043-BLM 1998, pp. 3-81 and 3-82).

3.3.2.4.1.4 Project-Related Public Land Withdrawals. The BLM announced Public Land Order 7653 on December 28, 2005 (70 *Federal Register* [*FR*] 76854). The Order withdrew 1,249 square kilometers (308,600 acres) of public lands within the Caliente rail corridor from surface and mining entry for 10 years to allow DOE to evaluate the lands for the potential construction, operation, and maintenance of the proposed railroad to Yucca Mountain. The withdrawal applies only to BLM-administered public lands. The withdrawal area extends approximately 0.8 kilometer (0.5 mile) from either side of the centerline of the proposed rail alignment. The actions covered by this withdrawal meet the BLM definition of ***casual use*** as set forth in 43 Code of Federal Regulations (CFR) 2801.5. On January 10, 2007, the BLM announced that DOE had filed an application requesting a second land withdrawal (72 *FR* 1235). The Department filed the application to cover post-scoping changes in the Caliente rail alignment and to address the addition of the Mina rail alignment. The application requested the withdrawal of an additional 842 square kilometers (208,037 acres) of public lands from surface and mineral entry and the location of new mining claims through December 27, 2015, so DOE could evaluate the lands for the potential construction, operation, and maintenance of a railroad to Yucca Mountain. Chapter 6 of this EIS includes detailed information about the land withdrawal process.

The BLM granted DOE a right-of-way reservation (N-47748) for Yucca Mountain ***site characterization*** activities (DIRS 102218-BLM 1988, all). This reservation comprises 210 square kilometers (52,000 acres). The land in this reservation is open to public use, with the exception of about 20 square kilometers (5,000 acres) near the site of the proposed repository that were withdrawn in 1990 from the mining and mineral leasing laws to protect the physical integrity of the repository block. The lands in this reservation not withdrawn from the mining and mineral leasing laws contain a number of ***unpatented mining claims*** (DIRS 155970-DOE 2002, p. 3-9). This existing right-of-way reservation would be the basis for the planned land withdrawal for the Yucca Mountain Site, as described in the *Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1), where the land would transfer from BLM administrative responsibility to DOE control.

Withdrawal: Withholding an area of federal land from settlement, sale, location, or surface entry under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program.

Casual use: Activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements. Examples of casual use include surveying, marking routes, and collecting data to use to prepare grant applications.

Right-of-way: The public lands the BLM authorizes a holder to use or occupy under a grant.

Grant: Any authorization or instrument (for example, easement, lease, license, or permit) the BLM issues under Title V of the Federal Land Policy and Management Act (43 U.S.C. 1761 *et seq*.).

Mineral Entry: The land is not available for the location of mining claims because the land has been withdrawn from the operation of the General Mining Law.

Surface Entry Closure: An action that would lead to the title of the land leaving the United States, including appropriation of any non-federal interest or claim (other than mining claims), land sales, any public land disposal action.

Sources: DIRS 176452-DOE 2005; 43 CFR 3809.5.

3.3.2.4.2 Department of Defense-Managed Land

3.3.2.4.2.1 Nevada Test and Training Range. The U.S. Department of Defense administers the Nevada Test and Training Range, which the U.S. Air Force uses for training. The Mina rail alignment would not cross onto the Nevada Test and Training Range. Detailed information about current and future uses of the Nevada Test and Training Range is available in the *Proposed Nevada Test and Training Range Resource and Management Plan and Final Environmental Impact Statement* (DIRS 178103-BLM 2003, all).

Most of the airspace above the Nevada Test and Training Range is “restricted” (DIRS 103472-USAF 1999, 3.1-2). Restricted airspace consists of areas where nonparticipating aircraft are subject to restriction during scheduled periods when hazardous activities are being performed. Restricted areas designated as joint use by the Federal Aviation Administration allow air traffic control to route nonparticipating aircraft through this airspace when it is not in use or when appropriate separation can be provided. Those areas not designated as joint use cannot be accessed by either non-participating civil or military aircraft at any time (DIRS 103472-USAF 1999, p. 3.1-3).

Restricted area R-4807A is designated joint use and land beneath it is comprised of an electronic battlefield with numerous tactical targets and manned electronic combat threat simulators. Portions of the Mina rail alignment that would be on land below R-4807A include portions of common segment 5; the

Oasis Valley alternative segments 1 and 2; and a portion of common segment 6 (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6).

Restricted area R-4808S is controlled by DOE for Nevada Test Site activities and is designated joint use. The Federal Aviation Administration Los Angeles Air Route Traffic Control Center also uses R-4808S for civil aircraft overflights (DIRS 103472-USAF 1999, pp. 3.1-3, 3.1-4, and 3.1-6). A portion of common segment 6 would be on land below R-4808S as it approached the Yucca Mountain Site.

3.3.2.4.2.2 Hawthorne Army Depot. The Depot extends over approximately 600 square kilometers (150,000 acres). The northwest land area consists of approximately 180 square kilometers (45,000 acres) used primarily for military training. The industrial, administration, and housing area is centrally located and consists of about 1.3 square kilometers (330 acres). The remaining acreage (approximately 400 square kilometers [102,000 acres]) consists of active military storage and ordnance demilitarization areas (DIRS 181899-Hawthorne Army Depot, p. v). The active military areas consist of unimproved areas that service the magazine and warehouse, and areas used for rifle ranges, test ranges, and open burn/open detonation areas. These areas are surrounded by a large buffer zone of unimproved land, and on the northeast side, by Walker Lake.

There are two mining claims within the Depot. Mining activities are highly regulated, and claim holders are required to provide advance coordination of work on the claims and must be escorted at all times. The mines are not being mined and claim holders obtain access only to make minimal improvements required to continue the claims' active status (DIRS 181899-Hawthorne Army Depot, pp. vi and vii).

At present, there are no agricultural outleases and livestock grazing is prohibited because of mission security issues, environmental considerations, and the need for strict water-quality controls (DIRS 181899-Hawthorne Army Depot, p. 2-8). There are recreational areas on Mount Grant and at Walker Lake. The Depot maintains a line of security buoys across the lake to restrict access from the lake to the south shore (DIRS 181899-Hawthorne Army Depot, pp. 2-7 and 2-16).

The Union Pacific Railroad has a trackage rights agreement with the Department of Defense to operate trains from the Fort Churchill Siding across the Walker River Paiute Reservation to the Thorne Siding at the Depot on Department of Defense track. The Thorne Siding receives approximately one train a month (DIRS 180222-BSC 2006, p. 28).

DOE would construct approximately 11.5 kilometers (7 miles) of new rail line (Mina common segment 1) within the active military area of the Depot. The Department would also construct a Staging Yard, which would occupy 0.20 square kilometer (50 acres) of land on the Depot, north of the existing rail line.

3.3.2.4.3 DOE-Managed Land, Nevada Test Site

Portions of common segment 6 and some railroad operations facilities would be on Nevada Test Site land (see Figure 3-142), which DOE administers. Detailed information about current and future uses of the Nevada Test Site is available in *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all). As discussed previously, land that makes up the proposed Yucca Mountain Site would be withdrawn and transferred to DOE control. Currently, a Memorandum of Agreement between the DOE National Nuclear Security Administration and the Office of Civilian Radioactive Waste Management allows the use of about 235 square kilometers (58,000 acres) on the Nevada Test Site for Yucca Mountain Project activities.

3.3.2.5 General Environmental Setting and Land-Use Characteristics

Major public land uses along the Mina rail alignment include grazing, mineral and energy extraction, and recreation. The rail alignment would cross numerous public roads and trails that provide access to public and private land and would cross BLM-authorized rights-of-way for utilities.

3.3.2.5.1 BLM Grazing Allotments

The Taylor Grazing Act of 1934 (43 U.S.C. 315-3160), as amended, authorizes the Federal Government to issue permits for grazing livestock in grazing districts to settlers, residents, and other livestock owners for an annual payment of reasonable fees. An applicant who owns a base property or controls a water source may apply to the BLM for a lease or permit to use public lands for the grazing of livestock. The BLM grazing administration regulations (43 U.S.C. 4100.0-5) define a base property as land that has the capability to produce crops or forage that can be used to support authorized livestock for a specified period of the year, or water that is suitable for consumption by livestock and is available and accessible to livestock when the public lands are used for livestock grazing. The grazing allotments are leased or permitted for 10 years and may be renewed under specific circumstances.

Livestock permitted on grazing allotments include cattle, sheep, goats, horses, and burros. Cattle and sheep are the typical livestock grazed within the Mina rail alignment region of influence. The grazing lease or permit specifies the types and numbers of livestock based on the property acreage, the period of use, and the amount of use in ***animal unit months***. The intent of assigning animal unit months is to allow grazing on public lands without exceeding the capacity of the allotment to sustain livestock (43 CFR Part 4100).

Animal unit month: A standardized unit of measurement of the amount of forage necessary for the complete sustenance of one animal for 1 month; also, a unit of measurement of grazing privileges that represents the privilege of grazing one animal for 1 month (43 CFR Part 4100).

Depending on the combination of common segments and alternative segments, the Mina rail alignment and its support facilities would cross up to 12 active grazing allotments, and 3 inactive allotments (Columbus Salt Marsh, Montezuma, and one labeled Unused) (Figures 3-144 through 3-151). Tables 3-84 and 3-85 list information about grazing allotments within the Mina rail alignment region of influence. Access to a water source is an essential requirement for livestock grazing in the high ***desert*** of Nevada. In accordance with the Nevada State Water Law, the State Engineer in the Nevada Division of Water Resources may issue permits for water rights to applicants who can demonstrate a beneficial use for the water. Once permitted, water rights are treated as property rights and can be bought and sold (DIRS 178301-State of Nevada n.d., all). Because water rights greatly influence the uses and value of land in this generally ***arid*** region, any impacts to water rights could directly impact land use. (See Section 3.3.6 for a description of ***groundwater*** resources.)

It is essential to provide adequate water for livestock within reasonable distances of grazing areas. Stockwater is water that is physically diverted from the natural water course or storage of water for use by livestock or wildlife. There are several methods for developing stockwater, including spring developments; wells, ponds, or dugouts; and pipelines with a trough or tank for storage. Table 3-85 lists stockwater features within the Mina rail alignment region of influence.

3.3.2.5.2 Mineral and Energy Resources

3.3.2.5.2.1 Mineral Resources. Commercial prospecting for minerals of value began in southern Nevada in the mid-1800s and continues to the present. Minerals currently mined include metallic and nonmetallic minerals. Gold and silver are the most important metallic minerals.

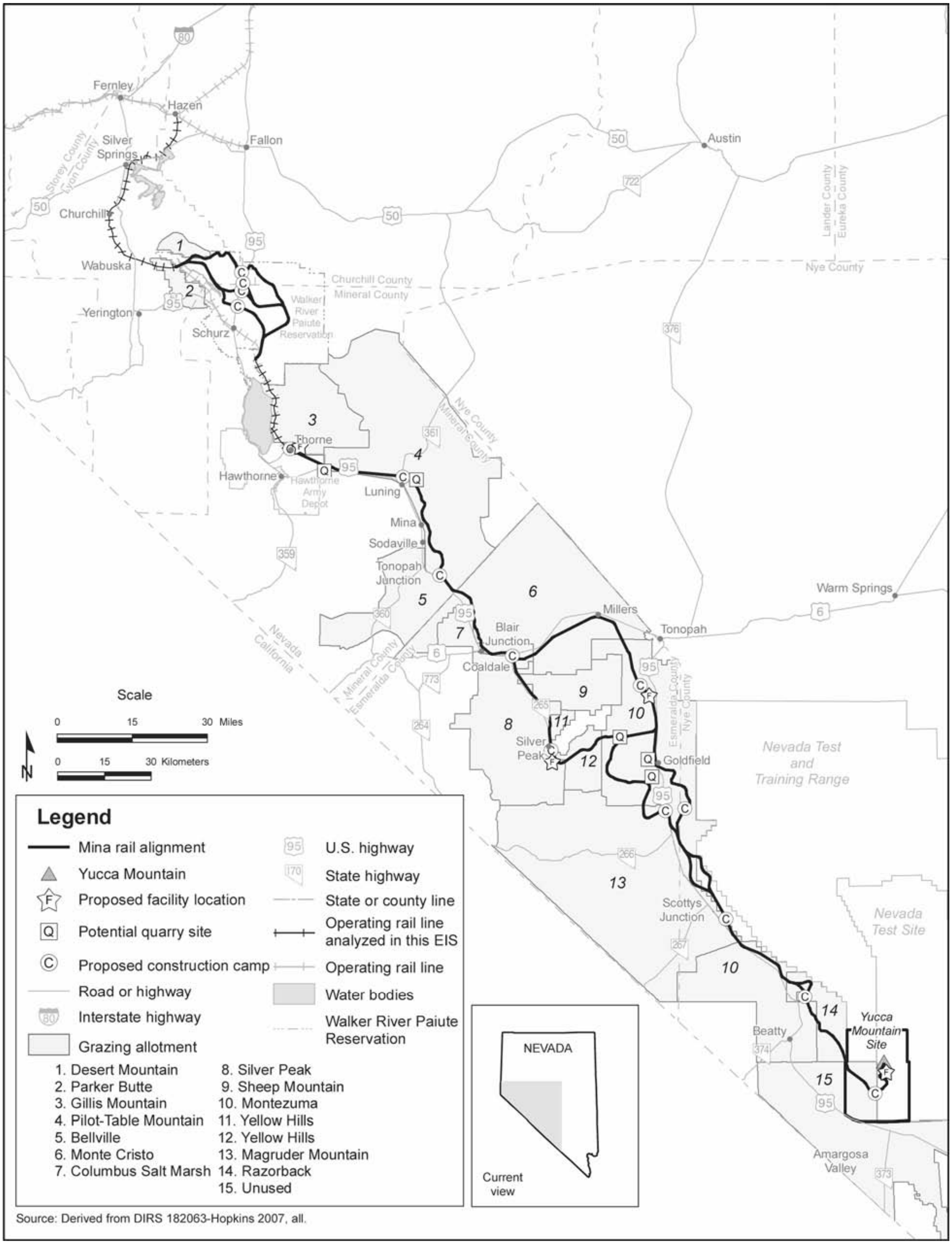


Figure 3-144. Grazing allotments along the Mina rail alignment.

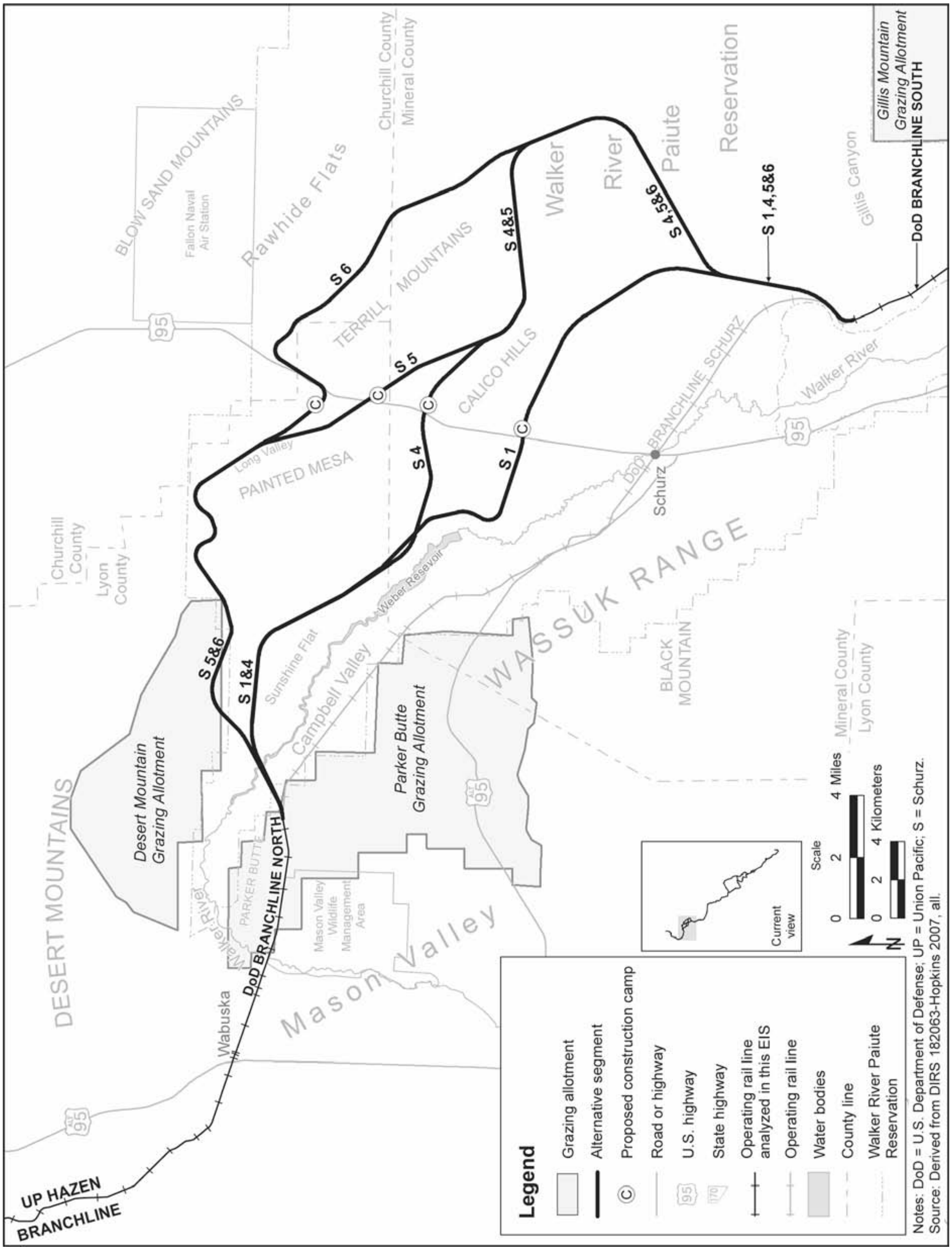


Figure 3-145. Grazing allotments with stockwater features within map area 1.

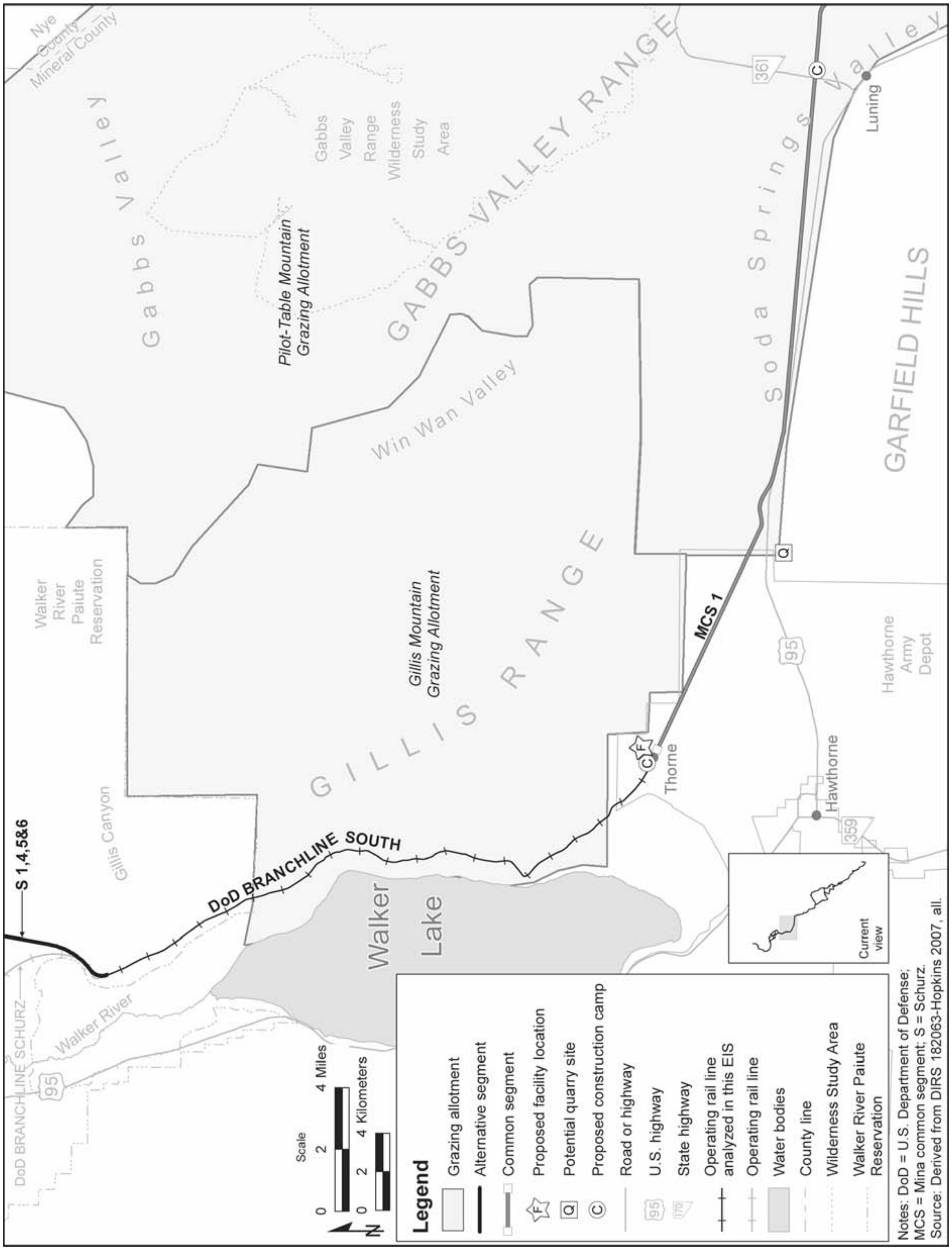


Figure 3-146. Grazing allotments with stockwater features within map area 2.

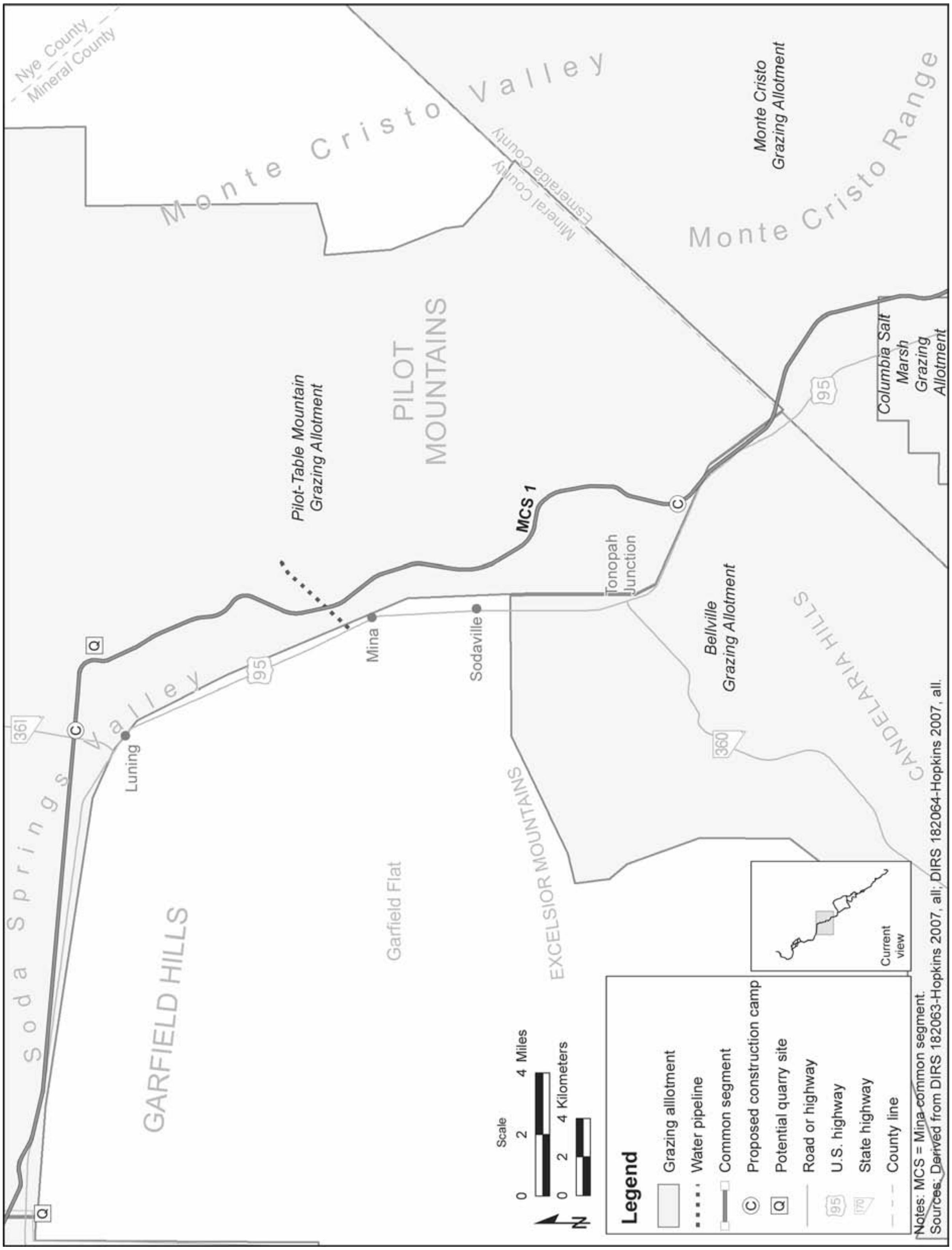


Figure 3-147. Grazing allotments with stockwater features within map area 3.

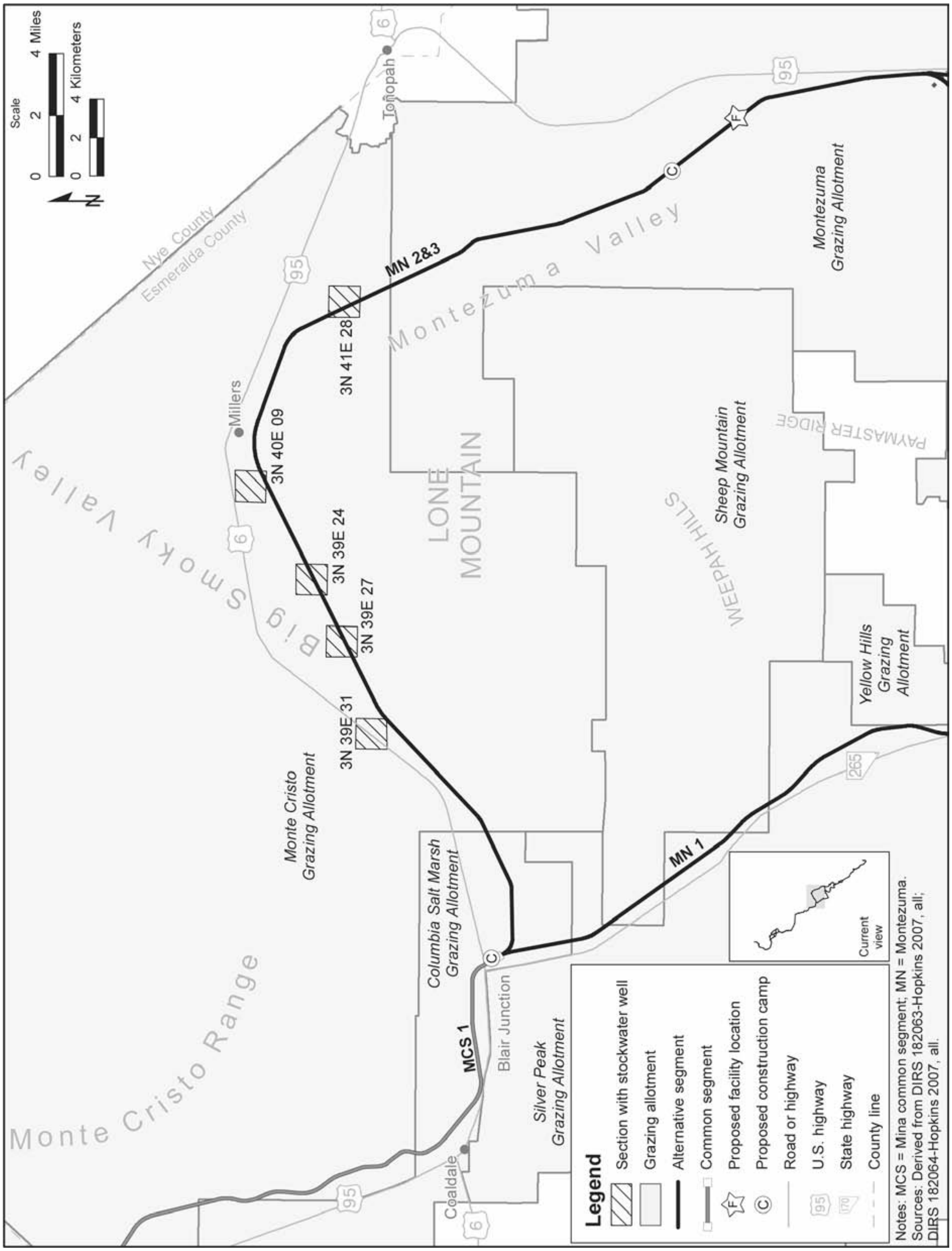


Figure 3-148. Grazing allotments with stockwater features within map area 4.

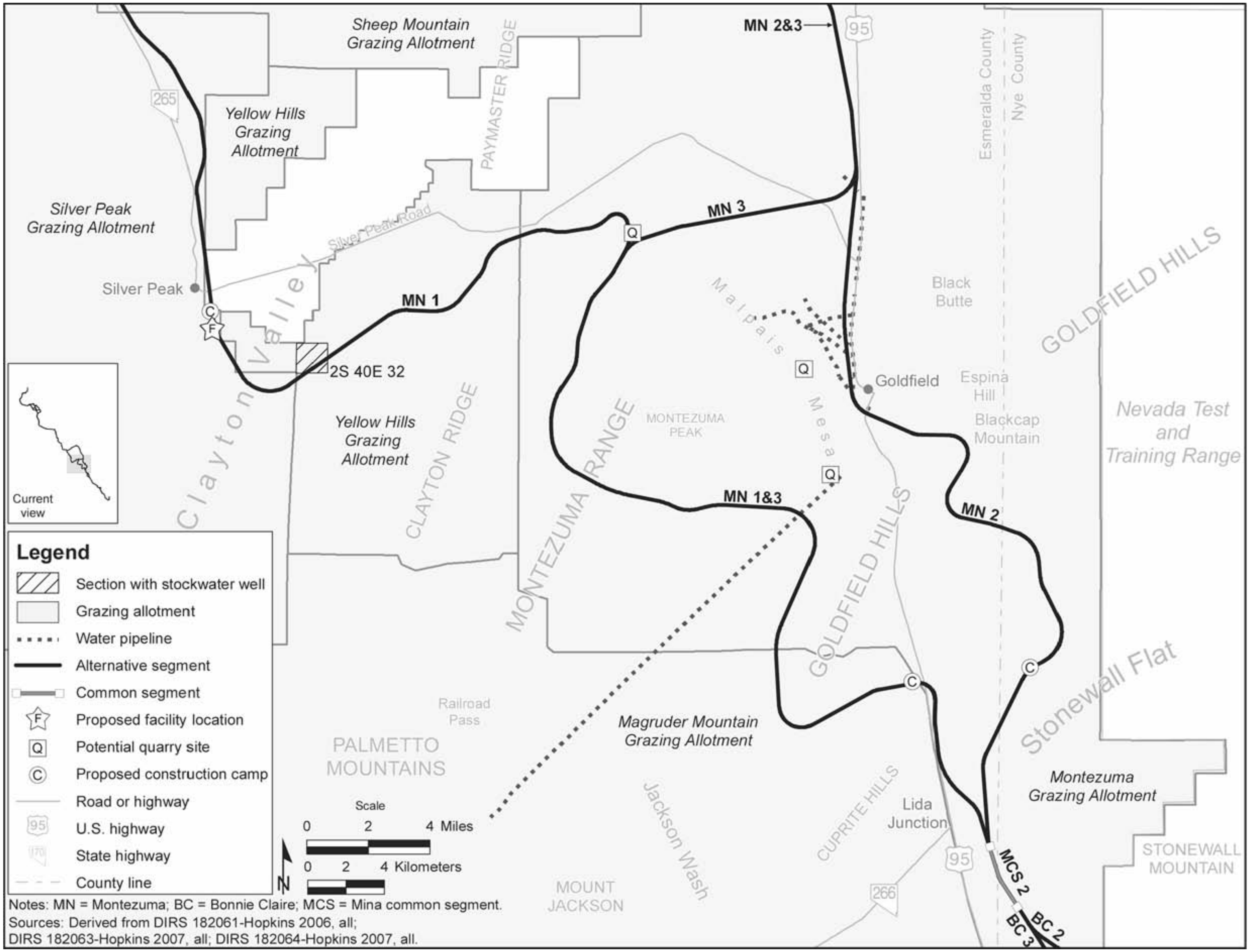


Figure 3-149. Grazing allotments with stockwater features within map area 5.

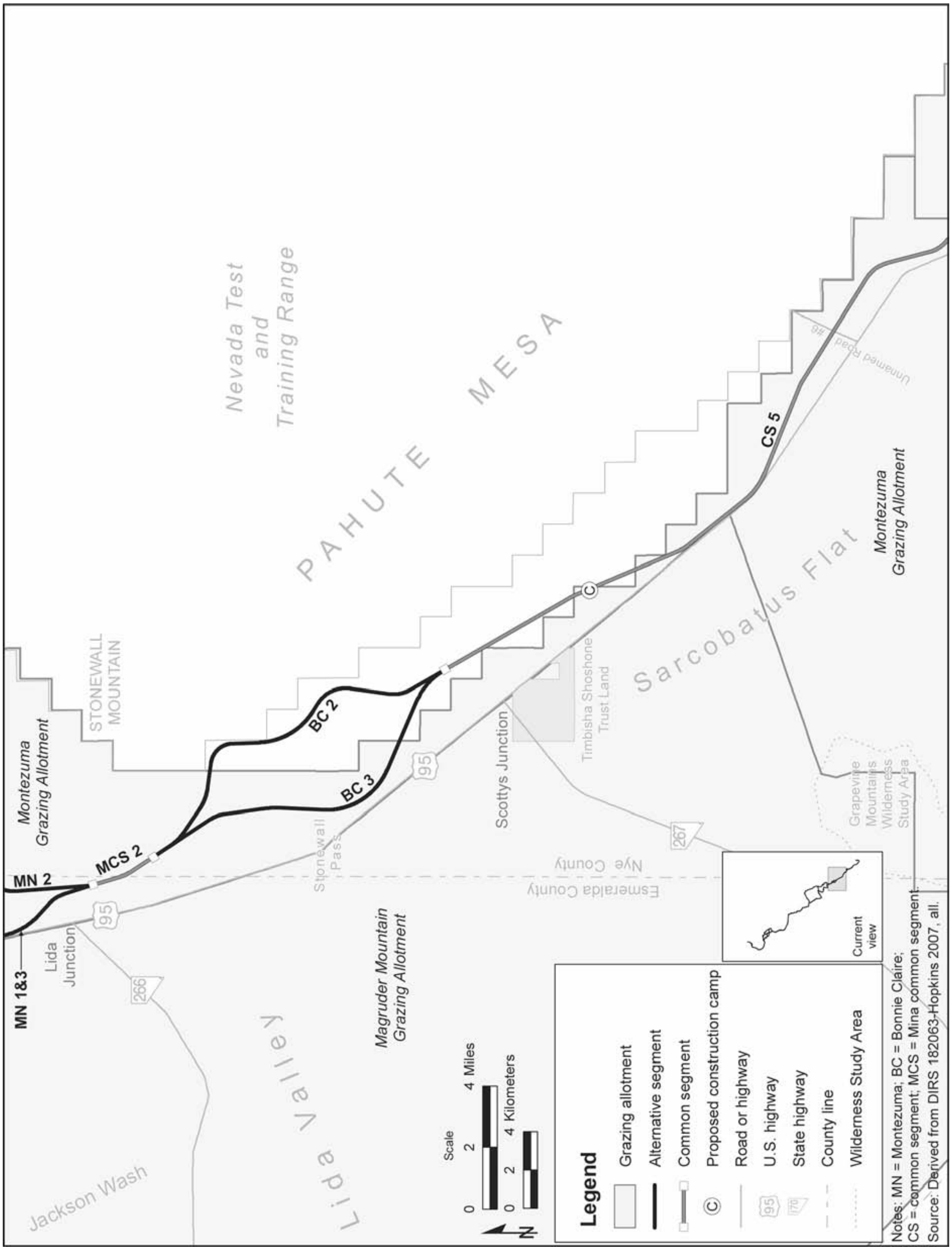


Figure 3-150. Grazing allotments with stockwater features within map area 6.

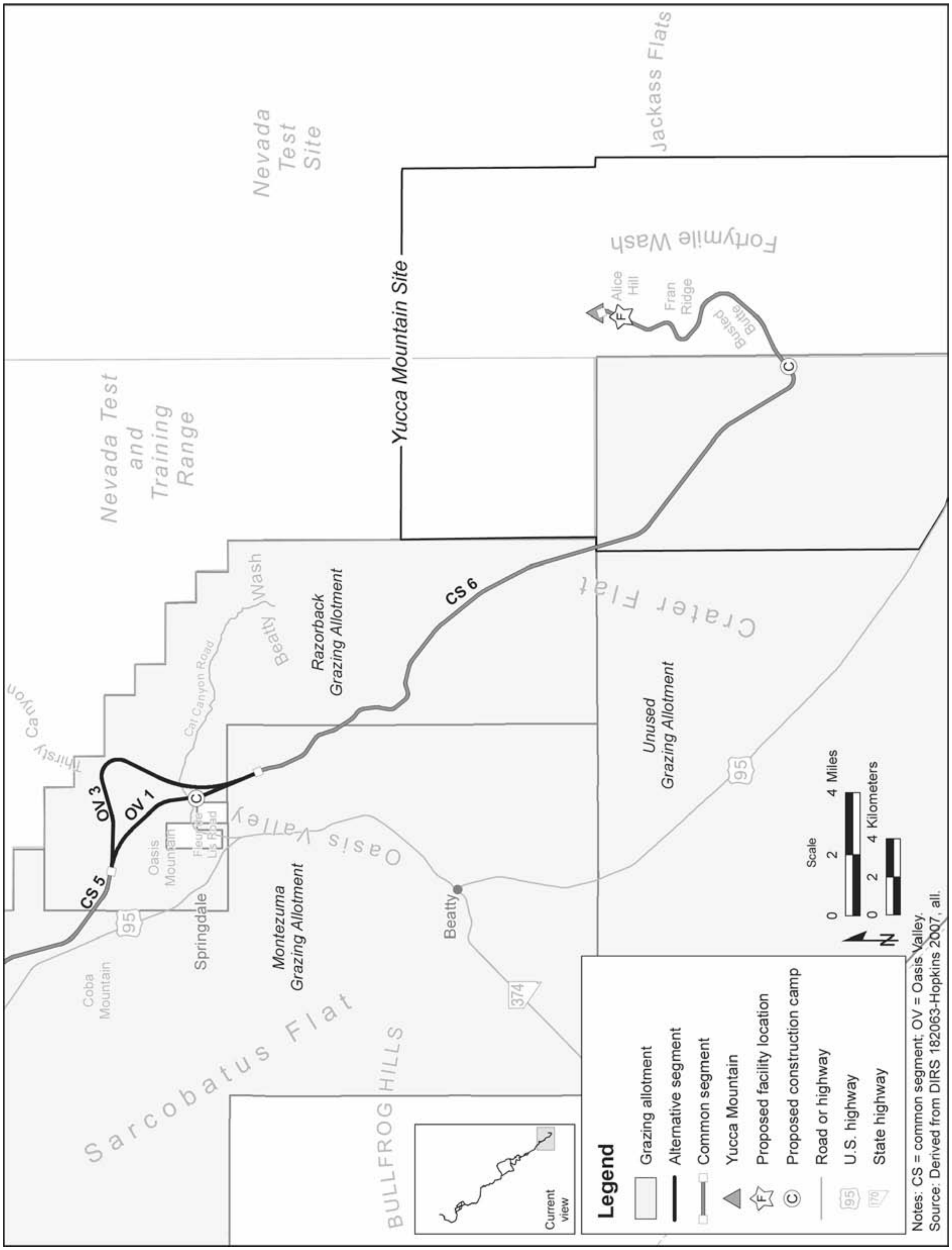


Figure 3-151. Grazing allotments with stockwater features within map area 7.

Table 3-84. Grazing allotment lands within the Mina rail alignment construction right-of-way (page 1 of 2).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (kilometers)[a]	Area that would be within the construction right-of-way or disturbed (square kilometers)[b]
Union Pacific Railroad Hazen Branchline[c]	Not applicable		
Department of Defense Branchline North[d]	Not applicable		
Schurz alternative segment 1[e]	Parker Butte	0.6	0.2
Schurz alternative segment 4	Parker Butte	0.6	0.2
Schurz alternative segment 5	Parker Butte	0.6	0.2
Schurz alternative segment 5	Desert Mountain	3	0.74
Schurz alternative segment 6	Parker Butte	0.6	0.2
Schurz alternative segment 6	Desert Mountain	3	0.74
Department of Defense Branchline South[d]	Not applicable		
Staging Yard at Hawthorne	Gillis Mountain	f	0.25
Mina common segment 1	Pilot-Table Mountain	62	15
Mina common segment 1	Gillis Mountain	0.4	0.04
Mina common segment 1	Bellville	3.5	0.9
Mina common segment 1	Monte Cristo	14	6.3
Mina common segment 1	Columbus Salt Marsh	16	4.3
Potential Garfield Hills quarry	Garfield Flat	c	0.99
Potential Garfield Hills quarry	Pilot-Table Mountain	c	0.09
Potential Gabbs Range quarry	Pilot-Table Mountain	c	0.97
Montezuma alternative segment 1	Columbus Salt Marsh	3.9	23
Montezuma alternative segment 1	Silver Peak	28	8.1
Montezuma alternative segment 1	Sheep Mountain	6.2	1.9
Montezuma alternative segment 1	Yellow Hills	17	4.8
Montezuma alternative segment 1	Montezuma	51	14
Montezuma alternative segment 1	Magruder Mountain	12	3.5
Potential North Clayton quarry	Montezuma	c	1.8
Potential Malpais Mesa quarry	Montezuma	c	2.7
Potential Goldfield ES-7 quarry	Montezuma	c	1.5

Table 3-84. Grazing allotment lands within the Mina rail alignment construction right-of-way (page 2 of 2).

Rail line segment/facility	Grazing allotment	Rail alignment crossing distance (kilometers)[a]	Area that would be within the construction right-of-way or disturbed (square kilometers)[b]
Montezuma alternative segment 2	Columbus Salt Marsh	7.9	2.2
Montezuma alternative segment 2	Monte Cristo	34	10
Montezuma alternative segment 2	Montezuma	77	14
Montezuma alternative segment 3	Columbus Salt Marsh	7.9	2.2
Montezuma alternative segment 3	Monte Cristo	34	10
Montezuma alternative segment 3	Montezuma	87.8	26
Montezuma alternative segment 3	Magruder Mountain	12	3.5
Mina common segment 2	Montezuma	3.4	1.1
Bonnie Claire alternative segment 2	Montezuma	4.4	1.7
Bonnie Claire alternative segment 3	Montezuma	14	4.1
Common segment 5	Montezuma	28	7.9
Common segment 5	Razorback	2.3	0.71
Common segment 5	Magruder Mountain	2.9	0.24
Oasis Valley alternative segment 1	Razorback	7.9	1.9
Oasis Valley alternative segments 1 and 3	Razorback	1.3	0.4
Oasis Valley alternative segment 3	Razorback	12	3.4
Common segment 6	Razorback	18	5.4
Common segment 6	Montezuma	6.4	2.1
Common segment 6	Unused	15	4.7

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert square kilometers to acres, multiply by 247.10.
c. Use of the Union Pacific Hazen Branchline would not require new construction.
d. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.
e. The Walker Paiute Reservation does not have BLM-administered grazing allotments.
f. Facility would not cross allotment; it would occupy the area listed in the next column.

Table 3-85. Features of grazing allotments within the Mina rail alignment region of influence.

Grazing allotment	Area (square kilometers)[a]	Animal unit months	Stockwater features that would be within the construction right-of-way
Parker Butte[b]	122	1,669	None
Desert Mountain[c]	91	840	None
Gillis Mountain[d]	650	1,924	None
Garfield Flat[e]	890	3,516	None
Pilot-Table Mountain[f]	2,070	7,900	Mina common segment 1 would cross one pipeline
Bellville[g]	630	303	None
Columbus Salt Marsh[h]	21		None
Monte Cristo[h]	2,010	9,352	Two stockwater wells along Montezuma alternative segments 2 and 3
Silver Peak[i]	1,430	436	None
Sheep Mountain[j]	360	1,740	None
Yellow Hills[k]	250	1,212	None
Magruder Mountain[l]	270	6,300	None
Montezuma[m]	2,180	--	Montezuma alternative segment 1 would cross one pipeline; Montezuma 2 would cross seven; Montezuma 3 would cross two
Razorback[m]	294.9	959	None
Unused[m]	2,130	---	None

a. To convert square kilometers to acres, multiply by 247.10.
b. Source: DIRS 181020-BLM 2007, all.
c. Source: DIRS 181023-BLM 2007, all.
d. Source: DIRS 180699-BLM 2007, all.
e. Source: DIRS 181024-BLM 2007, all.
f. Source: DIRS 181025-BLM 2007, all.
g. Source: DIRS 181026-BLM 2007, all.
h. Source: DIRS 182338-BLM 2007, all.
i. Source: DIRS 181027-BLM 2007, all.
j. Source: DIRS 181152-BLM 2007, all.
k. Source: DIRS 181029-BLM 2007, all.
l. Source: DIRS 181021-BLM 2007, all.
m. Source: DIRS 173224-BLM 1997, Appendix A (area of allotment might include private land).

Nonmetallic minerals include turquoise, decorative rock, perlite, opal, borate, limestone, clay, building stones, silica, aggregates, gypsum and salt used in industrial processes and building materials (DIRS 150524-Tingley 1998, all).

There is potential mining activity on private land (patented mining claims) and public land (unpatented mining claims). Figure 3-152 shows mining districts and areas near the Mina rail alignment. Figures 3-153 through 3-159 show the locations of sections with unpatented mining claims in relation to the construction right-of-way.

The Mina rail alignment would cross some ***mining areas*** and mining districts, as discussed below.

The Schurz alternative segment 1 construction right-of-way would pass through the very southern portion of the Calico Hills Mining District. Schurz alternative segment 4 would pass through the Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 5 would pass through the Benway, Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 6 would pass through the Holy Cross, Double Springs Marsh, and Buckley Mining Districts (see Table 3-86). These districts are described below.

- Calico Hills: This mining district coincides with the Calico Hills, which are 5 to 8 kilometers (3 to 5 miles) north and east of the Walker River on the Walker River Paiute Reservation, about 10 kilometers (6 miles) north of Schurz, Nevada. Prospecting began after 1956 and outlined a deposit, called the Hottentot prospect, estimated to contain 570,000 metric tons (625,000 tons) of iron and copper ore. However, this prospect has not been developed (DIRS 180882-Shannon &Wilson 2007, pp. 27 and 28).

- Double Springs Marsh: This mining district coincides with an elliptical playa about 13 kilometers (8 miles) east of Schurz, Nevada. The only mining activity on the playa occurred around 1898 when the Occidental Alkali Company produced considerable amounts of high-grade soda from saline crust on the playa surface (DIRS 180882-Shannon & Wilson 2007, pp. 31 and 32).

- Buckley: Very little is known about this mining district. Activity in the district dates from around 1906 and there was no mining activity reported in the district as of the late 1990s. Deposits in the district typically contain small amounts of gold, silver, and copper minerals (DIRS 180882-Shannon and Wilson 2007, pp. 33 and 34).

- Benway: This district is about 16 kilometers (10 miles) north of Schurz and 2 kilometers (1 mile) west of U.S. Highway 95 and lies entirely within the Walker River Paiute Reservation. Two types of ore deposits have been explored in this district – copper-silver-gold bearing quartz and calcite veins, and disseminated sulfide deposits. There are at least 10 veins containing gold, silver, and copper minerals that are as much as 6 meters (20 feet) wide and 2 kilometers long. Drilling at the disseminated sulfide deposits revealed extensive amounts of disseminated pyrite and only minor amounts of disseminated copper, lead, and zinc sulfides that were too deep or too low-grade to be of economic interest (DIRS 180882-Shannon & Wilson 2007, pp. 21 and 22).

- Holy Cross: Silver and gold were first discovered in the Holy Cross Mining District in 1910, on the Silver Star claim near what is now Camp Terrell. From 1911 to 1965, there was intermittent production of silver, gold, and other metals from mines in the southwest Holy Cross Mining District, and the Pyramid Mine in the Camp Terrell area operated for a short period in the 1980s. Although production was high in the past, the veins are narrow and the zones with ore grade are small and sparsely distributed. Therefore, it is doubtful if any of the small mines were profitable in the past and unlikely that enough ore remains undiscovered to make any of them profitable enough to reopen in the future (DIRS 180882-Shannon & Wilson 2007, pp. 18 and 19).

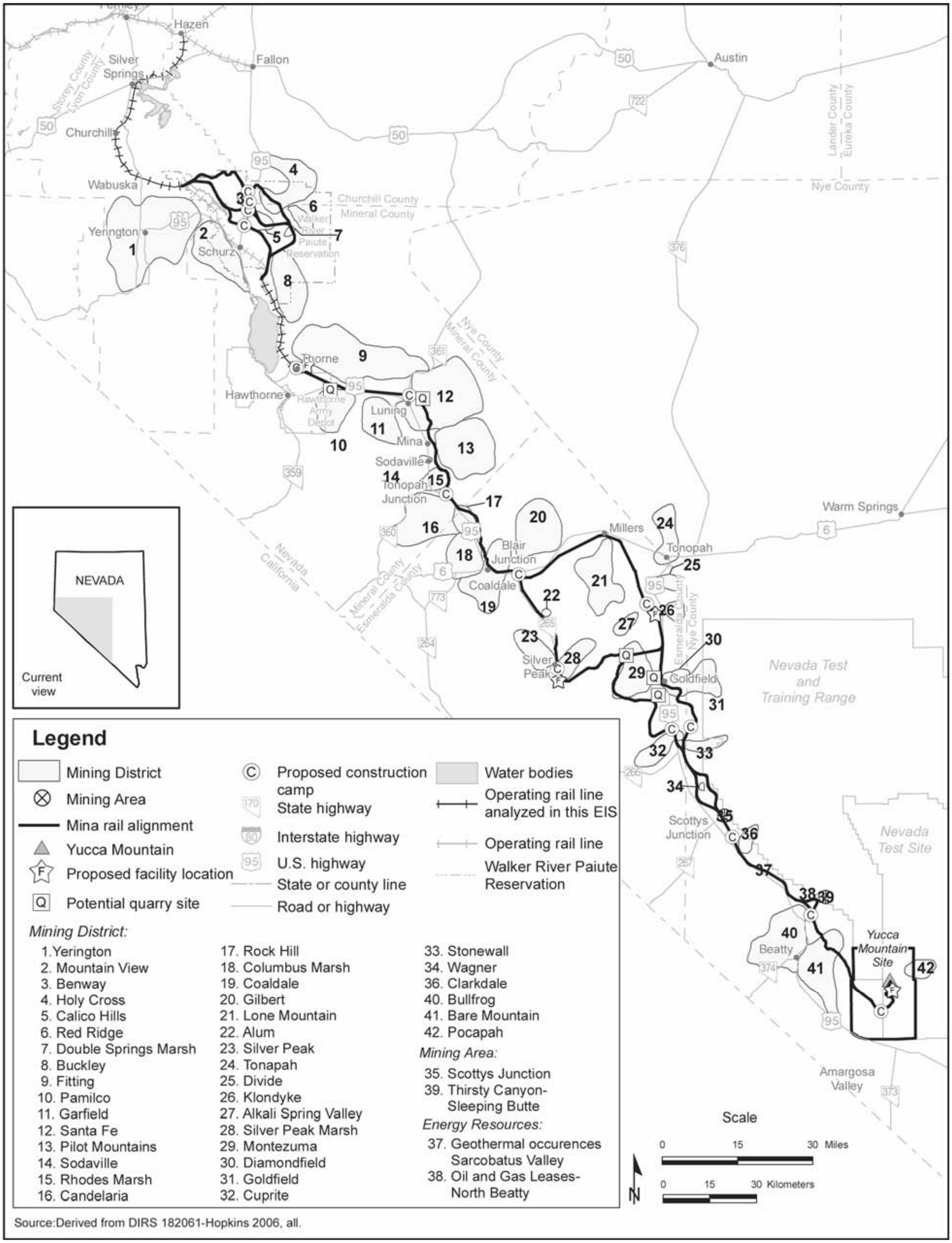


Figure 3-152. Mineral and energy resources along the Mina rail alignment.

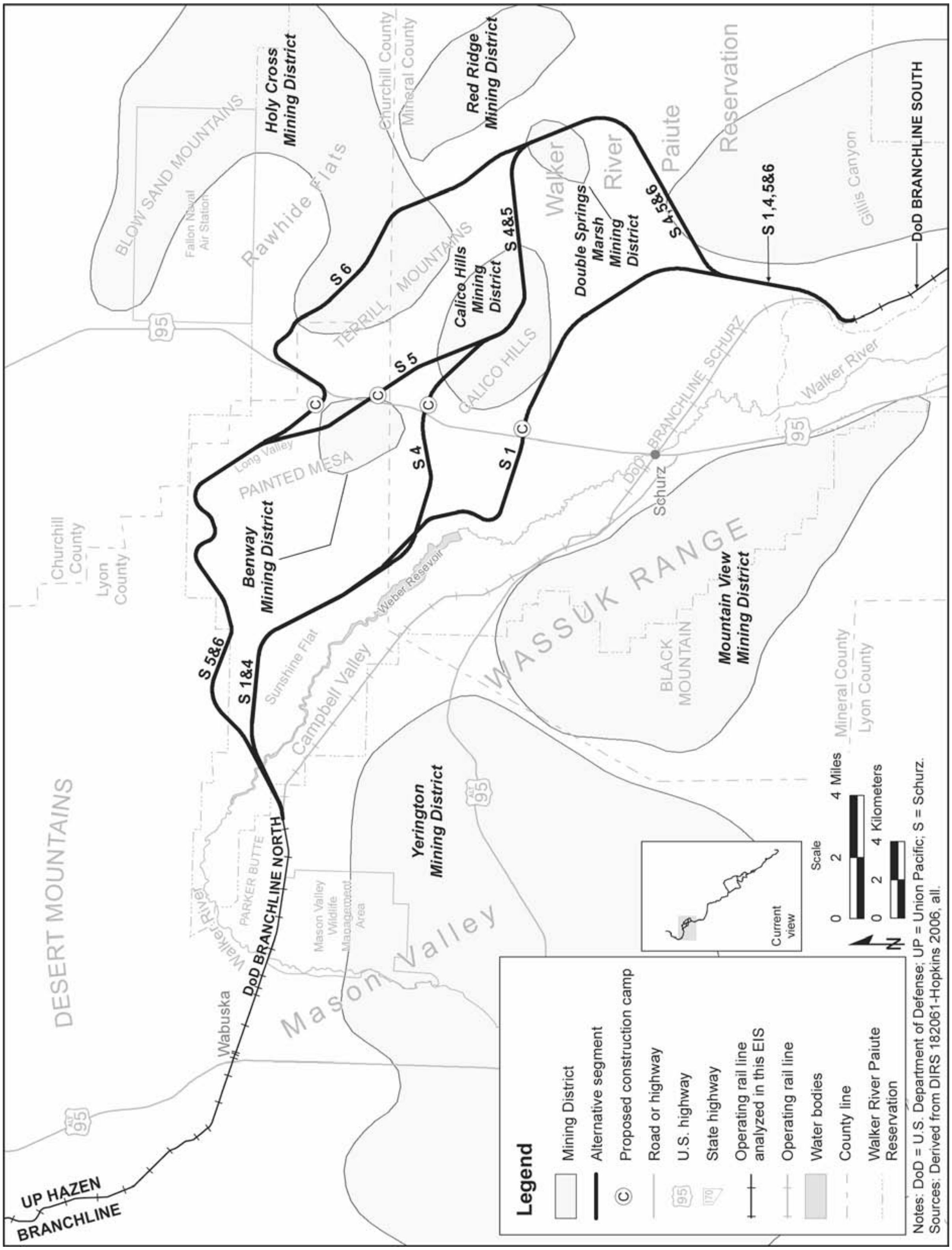


Figure 3-153. Mineral and energy resources within map area 1.

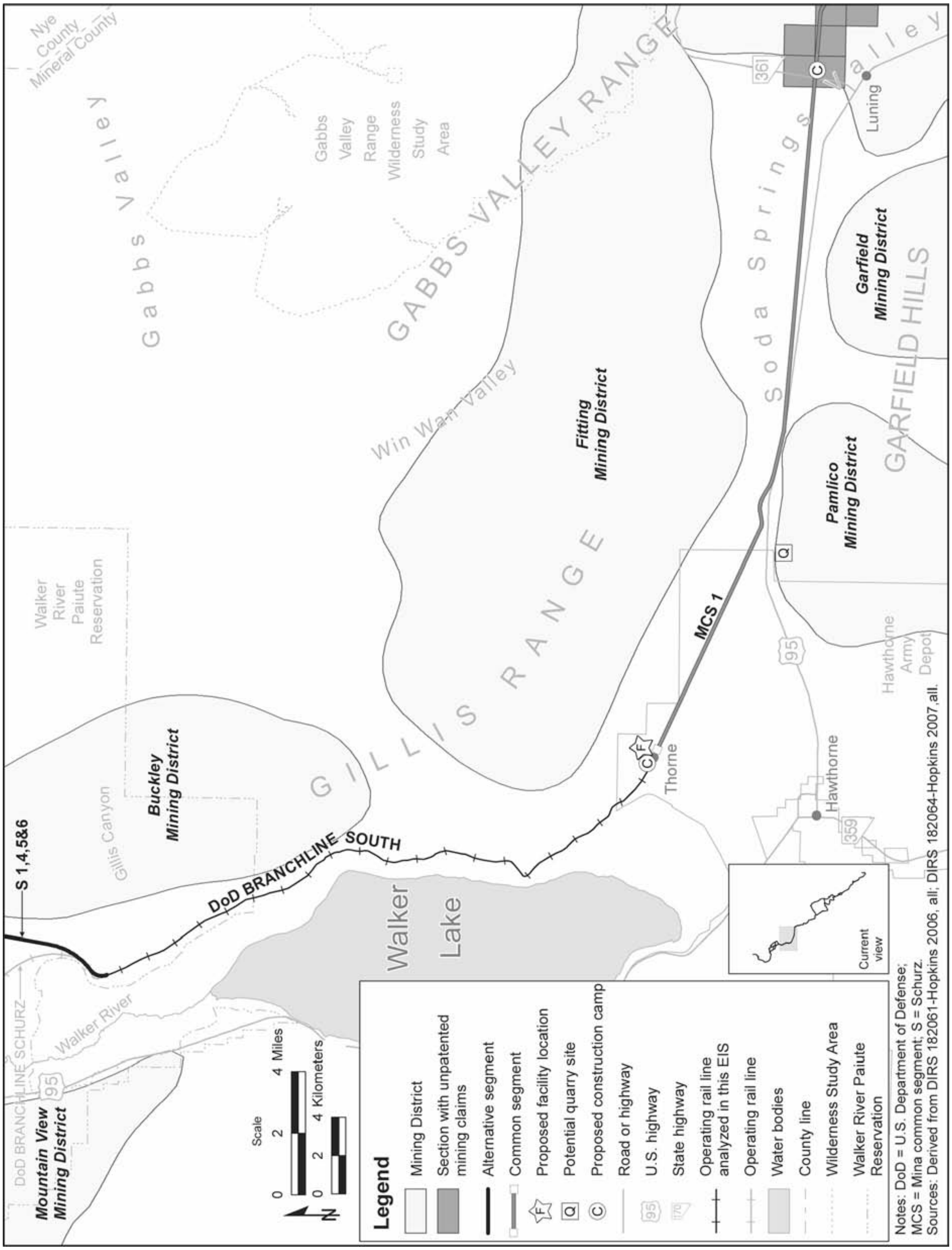
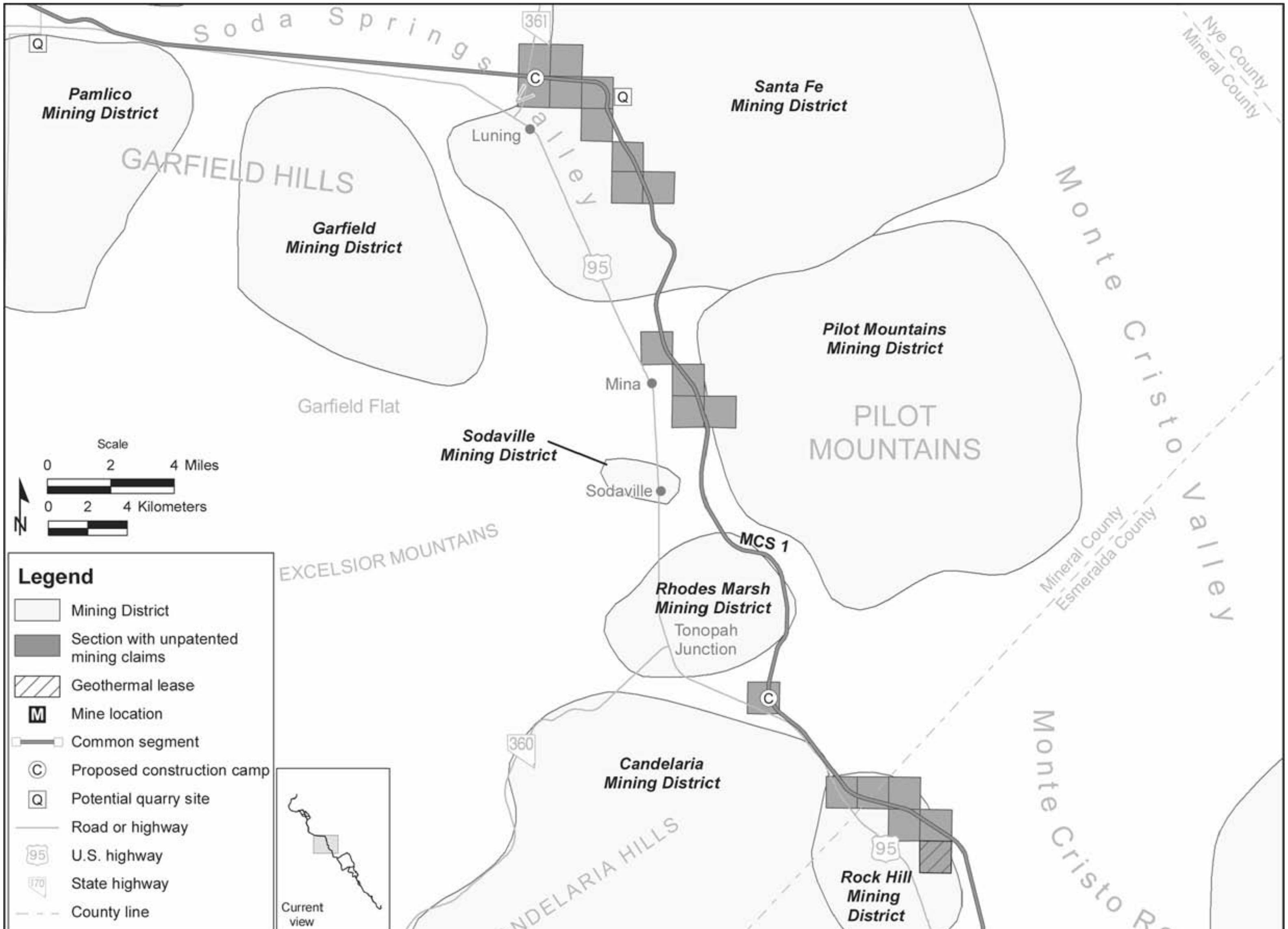


Figure 3-154. Mineral and energy resources within map area 2.



Notes: MCS = Mina common segment.
Sources: Derived from DIRS 182061-Hopkins 2006, all; DIRS 182064-Hopkins 2007, all.

Figure 3-155. Mineral and energy resources within map area 3.

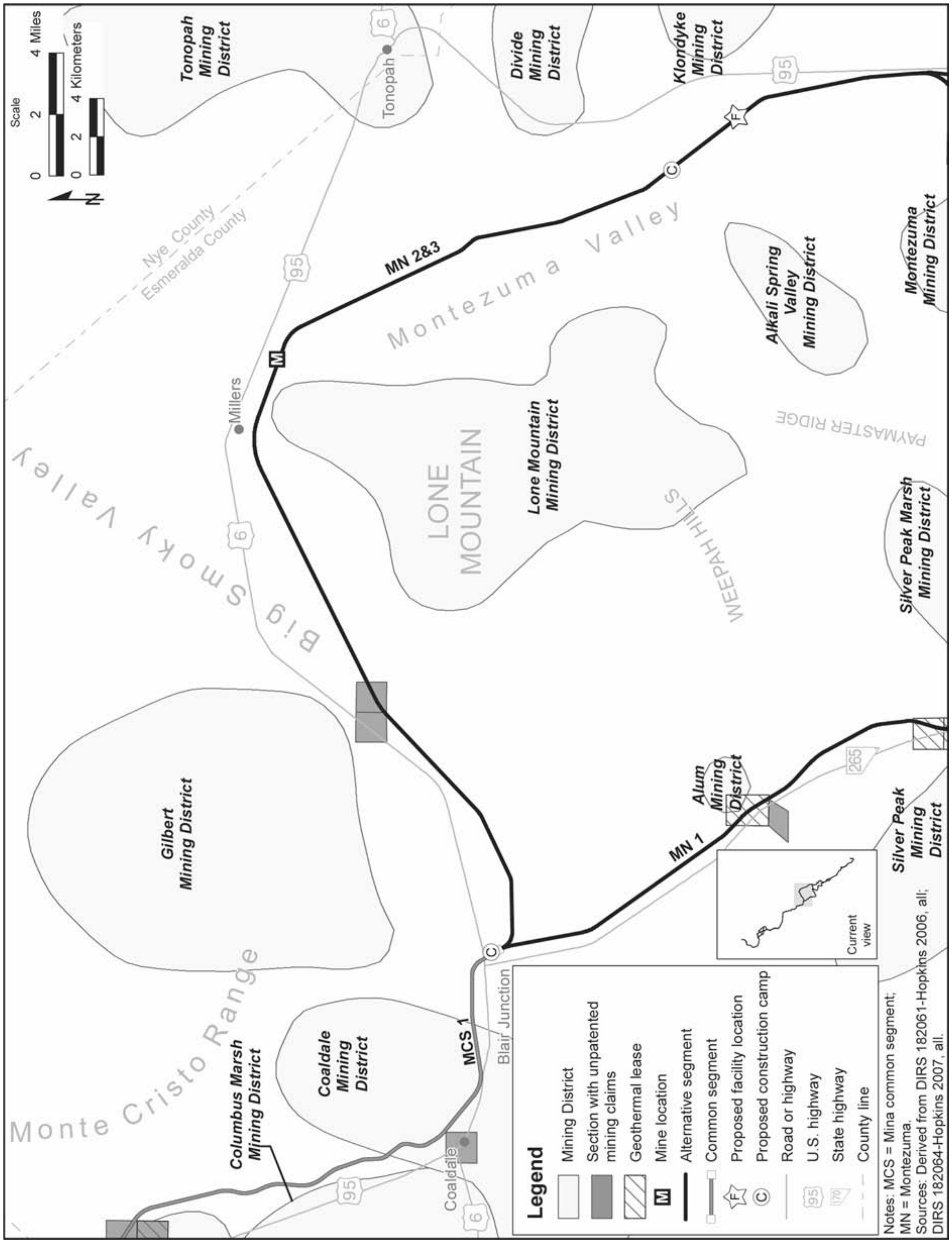


Figure 3-156. Mineral and energy resources within map area 4.

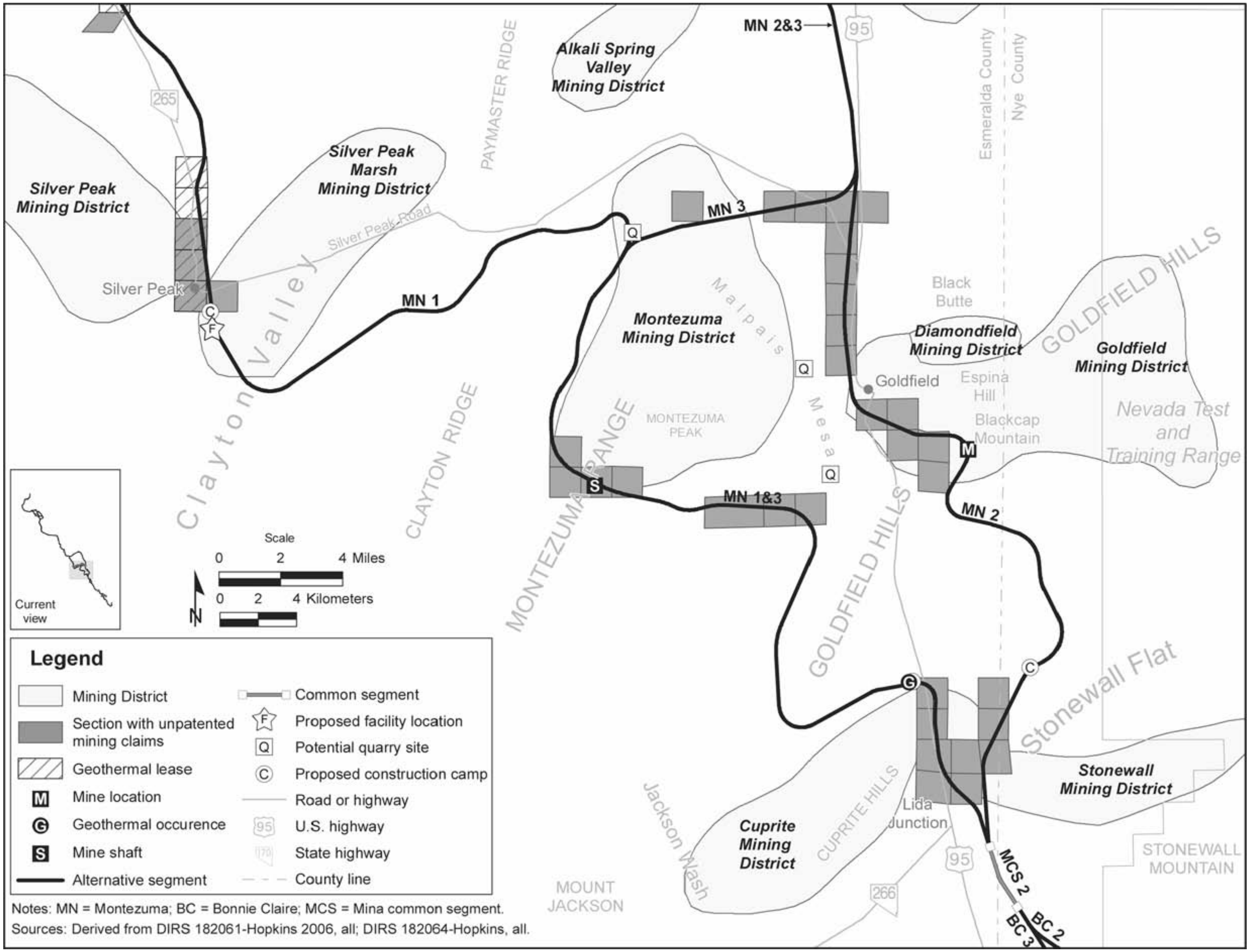


Figure 3-157. Mineral and energy resources within map area 5.

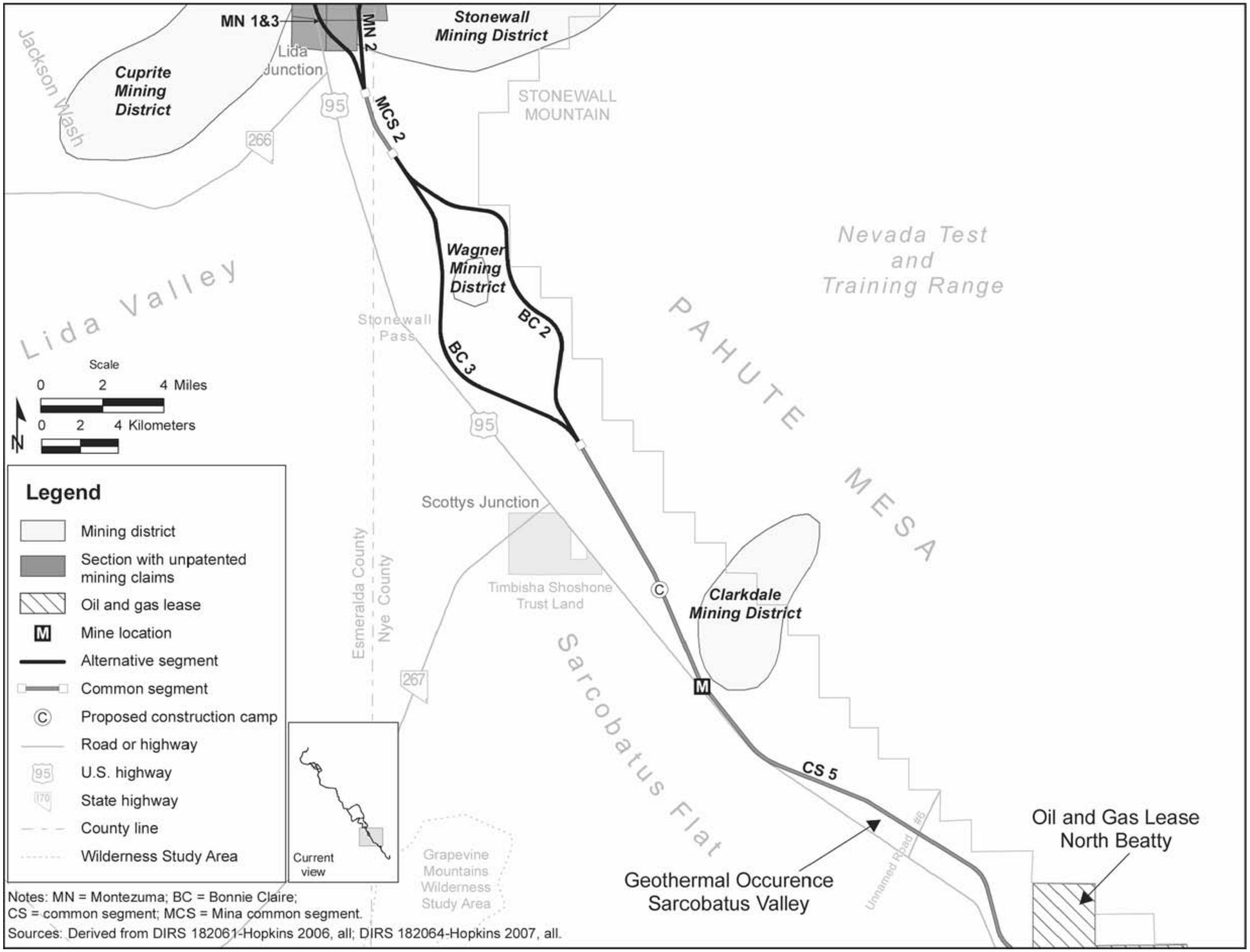


Figure 3-158. Mineral and energy resources within map area 6.

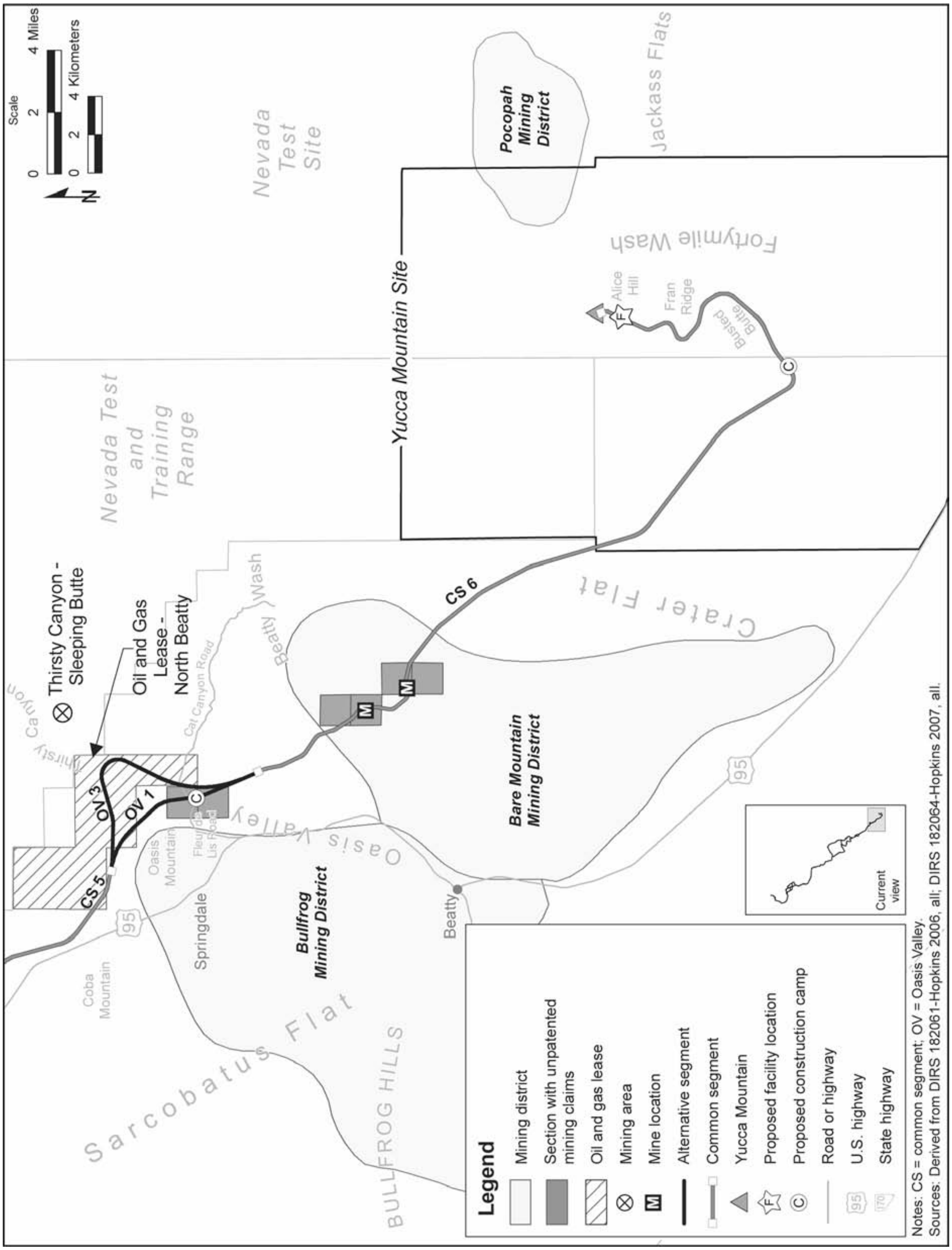


Figure -159. Mineral and energy resources within map area 7.

Table 3-86. Mining districts the Schurz alternative segments would cross.

Mining district	Schurz alternative segment 1	Schurz alternative segment 4	Schurz alternative segment 5	Schurz alternative segment 6
Calico Hills	X	X	X	
Double Springs Marsh		X	X	X
Buckley		X	X	X
Benway			X	
Holy Cross				X

Mina common segment 1 would pass through the Santa Fe, Rhodes Marsh, Rock Hill, and Coaldale Mining Districts. The construction right-of-way would also intersect the outermost boundaries of the Pilot Mountains and Candelaria Mining Districts. These districts are described below.

- Santa Fe: The Santa Fe Mining District is large and diverse geologically and mineralogically. From 1883 to 1894, the Santa Fe Mine produced primarily silver. From 1900 to 1929, copper-lead deposits containing silver were mined. From 1988 to 1995, the Santa Fe-Calavada mine produced over 10 million metric tons (12 million tons) of ore containing 10 million grams (356,700 ounces) of gold, 20 million grams (721,523 ounces) of silver, and an unknown amount of mercury. The New York Canyon area has major copper deposits. The Canyon Copper Company recently staked 550 mining claims and now controls 1,003 claims encompassing more than 81 square kilometers (20,000 acres) in the New York Canyon area, and the company reports that it is planning more exploration of the area in 2007. Nevada Sunrise LLC currently holds claims to the New Boston and Blue Ribbon mines, reported to contain scheelite, molybdenite, chalcopyrite, pyrite and fluorite, but the company's exploration plans are unknown (DIRS 180882-Shannon & Wilson 2007, pp. 40 to 43). Mina common segment 1 would bisect active mining claims and authorized or pending notice(s) of intent in the New York Canyon area east of Luning (DIRS 180882-Shannon & Wilson 2007, Table 1).
- Rock Hill: This mining district is 13 to 23 kilometers (8 to 14 miles) northwest of Coaldale. Mina common segment 1 would cross through the Redlich claim block in the northern part of the Rock Hill Mining District. The Miranda Gold Corporation is actively exploring this claim. Current exploration is focused on 122 lode claims near Redlich Summit that have geologic indicators for gold (DIRS 180882-Shannon & Wilson 2007, pp. 71 to 73).
- Coaldale: This district includes a clay mine (Blanco Mine) that is worked intermittently approximately 11 kilometers (6.7 miles) south-southwest of Mina common segment 1 (DIRS 180882-Shannon & Wilson 2007, pp. 75 and 76).
- Pilot Mountains: The Pilot Mountains Mining District covers the entirety of the Pilot Mountains and has been referred to alternatively as the Pilot or Sodaville Mining District. It includes all of the Telephone Canyon and Graham Springs Mining Districts. The primary commodities produced from this district are mercury and tungsten, with minor production or reported occurrences of gold, copper, silver, molybdenum, antimony, turquoise and montmorillonite. It appears that there has been no significant mining in this district since 1956 (DIRS 180882-Shannon & Wilson 2007, pp. 52 and 53).
- Rhodes Marsh: This district is 8 kilometers (5 miles) south of Mina, Nevada, and coincides with Rhodes Salt Marsh. This area has been known as a source of saline minerals since the 1860s and part of the area is covered by patented mining claims. Mina common segment 1 would follow the eastern edge of the district. There are no production records after 1934 for any minerals at Rhodes Marsh. Neither active mining nor evidence of recent exploratory activity was observed on the marsh during an October 2006 site visit (DIRS 180882-Shannon & Wilson 2007, pp. 58 and 59).

- Candelaria: This district is in the Candelaria Hills and is bordered on the north by Rhodes Marsh and on the east by Rock Hill. From 1873 to 1996, the district produced 4 million grams (167,200 ounces) of gold, 18.1 million grams (63 million ounces) of silver, 32 million grams (72,000 pounds) of copper, 18.9 million grams (4.16 million pounds) of lead, and 10.2 million grams (2.26 million pounds) of zinc. Mina common segment 1 would pass more than 8 kilometers (5 miles) from major historic and recent mining areas in the district and would be generally separated from the district by U.S. Highway 95 (DIRS 180882-Shannon & Wilson 2007, pp. 61 and 62, and Table 1).

Montezuma alternative segment 1 would pass through the Silver Peak Marsh, Montezuma, and Cuprite Mining Districts. Montezuma alternative segment 2 would pass through the Goldfield and Stonewall Mining Districts. Montezuma alternative segment 3 would pass through Montezuma and Cuprite Mining Districts (see Table 3-87). These districts are described below:

- Silver Peak Marsh: This district is entirely in Esmeralda County and is alternatively known as the Clayton Valley Mining District. Lithium, sylvite, and halite are the only commodities the district produces, but there are reported occurrences of halite, borates, and potash. At present, this district is the only domestic source of lithium. The Chemetall Foote Corporation and its predecessor companies have produced lithium, sylvite, and halite from this district since 1966 and production is ongoing (DIRS 180882-Shannon & Wilson 2007, pp. 94 to 96).
- Montezuma: This district covers the northern part of the Montezuma Range on and around Montezuma Peak in eastern Esmeralda County. Montezuma is primarily a silver-lead district, with minor production of gold and copper, and occurrences of mercury and bismuth. Historically, productive deposits have generally occurred in the western part of the district near the Montezuma townsite. The district was discovered in 1867 and the last production was reported as late as 1931 (DIRS 180882-Shannon & Wilson 2007, pp. 96 and 97).
- Cuprite: Coal was discovered in this district in 1893, which led to a series of unsuccessful attempts to mine coal and market it in the 1890s and early 1900s. During World War II, coal mining was revisited, but the coal was found to be too impure for commercial use and no production has been recorded since. Uranium and turquoise have also been discovered in the district, although there is no current production. Copper ore was discovered in this district in 1905. The Cuprite district is about 19 to 24 kilometers (12 to 15 miles) south of Goldfield, Nevada. There is evidence of recent mining claims and recent trenching and drilling at the northeastern portion of the district, west of U.S. Highway 95. There appears to be a relatively large geothermal system in the area. There is also a silica quarry in the district (DIRS 180882-Shannon & Wilson 2007, pp. 105 to 107). Goldfield: Goldfield is the largest center of mining in the region of influence. This mining district consists of the Goldfield Main, McMahon Ridge, and Gemfield areas, and is in the Goldfield Hills that lie to the northeast and southwest of Goldfield, Nevada. An additional area (referred to as the Tom Keane area) has been the subject of recent (2003) exploration efforts. The Goldfield Project consists of 385 patented and 849 unpatented claims covering more than 83 square kilometers (20,600 acres) in Esmeralda and Nye Counties. At present, one company has a large and active exploration program and is consolidating mining lands in and near Goldfield (DIRS 173841-Shannon & Wilson 2005, pp. 60, 62, and 72).
- Stonewall: Most of the past mining activity in this district is approximately 5 kilometers (3 miles) east of Montezuma alternative segment 2. This district was reportedly prospected for gold and silver as early as 1905 (DIRS 173841-Shannon & Wilson 2005, p. 56). Veins of gold and silver currently under exploration in this district are prominent at areas mined in the past and continue easterly away from the rail alignment.

Table 3-87. Mining districts the Montezuma alternative segments would cross.

Mining district	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Silver Peak Marsh	X		
Montezuma	X		X
Cuprite	X		X
Goldfield		X	
Stonewall		X	

Mina common segment 2 would not cross any mining districts.

The Bonnie Claire alternative segments would be west of the Scottys Junction Mining Area and the Wagner Mining District would lie between these segments. Neither segment's construction right-of-way would cross these mining locations. The Wagner Mining District has a number of patented mining claims, although none would fall within the construction right-of-way for either Bonnie Claire alternative segment. The main rock types within the Wagner Mining District are shale, quartzite, and intercalated limestone. There have been recent exploration efforts in this district by several companies (DIRS 173841-Shannon & Wilson 2005, p. 55).

The closest mining districts to common segment 5 would be Clarkdale Mining District to its east and Bullfrog Mining District to its south where it would meet the Oasis Valley alternative segments. The Oasis Valley alternative segments are between the Bullfrog Mining District and the Thirsty Canyon-Sleeping Butte Mining Area. The Clarkdale Mining District contains discontinuous, narrow zones containing some gold and silver mineralization (DIRS 173841-Shannon & Wilson 2005, p. 52). The Bullfrog Mining District contains small, localized areas of gold, silver, and lesser copper mineralization (DIRS 173841-Shannon & Wilson 2005, p. 46). The Thirsty Canyon-Sleeping Butte Mining Area has been historically quarried for decorative rock and building stone (DIRS 173841-Shannon & Wilson 2005, p. 49).

Common segment 6 would cross the northeastern portion of the Bare Mountain Mining District, although the vast majority of past mining activity occurred more than 3 kilometers (2 miles) south of this common segment. The district contains gold-bearing veins, and some veins contain silver. The district also contains a variety of minerals and semi-precious stones, including opal, chalcopyrite, malachite, azurite, galena, pyrite, limonite, hematite, fluorite, and gypsum (DIRS 173841-Shannon & Wilson 2005, pp. 38, 41, and 42).

The only patented mining claims that would fall within or intersect the Mina rail alignment construction right-of-way would be along the Montezuma alternative segment 2. Table 3-88 lists the number of sections containing unpatented mining the rail line construction right-of-way would cross.

The existence of abandoned or active mining tunnels and shafts near the rail alignment would also be a concern for safety reasons. There is one underground mine that would be within the Montezuma alternative segment 1 or 3 construction right-of-way, approximately 3 kilometers (2 miles) east of private land at Millers. There would be one tunnel/shaft within the Montezuma alternative segment 1 or 3 construction right-of-way and one tunnel/shaft within the Montezuma alternative segment 2 construction right-of-way in the Goldfield area, as shown in Figure 3-157. DOE obtained the data on locations of tunnels and caves, mining shafts, and underground mines from the Nevada Bureau of Mines and Geology (DIRS 180882-Shannon & Wilson 2007).

Table 3-88. Numbers of unpatented mining claims that may intersect the Mina rail alignment construction right-of-way.[a]

Rail line segment	Number of sections with unpatented mining claims[a]	Unpatented mining claims across all sections [b]
Mina common segment 1	20	388
Montezuma alternative segment 1	17	202
Montezuma alternative segment 2	24	655
Montezuma alternative segment 3	19	249

a. Source: DIRS 181617-Hopkins 2007.
b. Data are provided by Township, Range, and Section and might not fall within the rail line construction right-of-way. DOE would need to verify the actual numbers and locations of unpatented mining claims before applying for a right-of-way grant.

However, none of the tunnels, shafts, and underground mines in this dataset is identified as having been field verified by the Division of Mines. Furthermore, this dataset might not include very old tunnels, shafts, and underground mines that were not recorded.

3.3.2.5.2.2 Energy Resources. The Basin and Range Province is considered a favorable area for geothermal resources because it has higher-than-average heat flow and is an area of crustal expansion, where faults can provide permeable reservoirs and conduits for deep circulation of water, and the crust is so thin it has a higher-than-average heat flux. Several hundred wells have been drilled in Nevada to discover high-temperature geothermal steam resources (DIRS 173841-Shannon & Wilson 2005, p. 32).

Geothermal resources are present as hot springs and thermal waters near Hazen, Hawthorne, Mina, Redlich, Silver Peak, Sarcobatus Flat, Scottys Junction, Panaca (Owl Warm Springs), Cedar Spring, Stonewall Flat, and Beatty Warm Springs.

The following paragraphs describe energy leases, the geographic locations of which are identified based on the township-range system, the method by which public land in Nevada and many other states was surveyed before being made available for purchase or homesteading. The township is the major subdivision of land; it is numbered north to south and measures 36 square miles; range is the east/west location identifier; sections are 1-square-mile areas within townships. Township, range, and section are abbreviated T, R, and S; directional information is abbreviated N, S, E, and W. Thus, E/2 T2S R39E refers to the east half of Township 2 South, Range 39 East).

The following Mina rail alignment segments would cross geothermal leases:

- Mina common segment 1 (Warm Wells north of Columbus Marsh) – The BLM issued a block of leases (all but one are still active) located in T3N and T4N, R36E. Mina common segment 1 would cross the northeastern-most leased section of the lease block (Section 26, T4N, R36E). Figure 3-155 shows these leases (DIRS 180882-Shannon & Wilson 2007, pp. 122 and 123).

- Montezuma alternative segment 1 (Alum District – Warm Wells) – A block of current and expired BLM geothermal leases are present in the southern Big Smoky Valley. Montezuma alternative segment 1 would cross several leases with an effective date of March 1, 2003, in S/2 T1N, R38.5. Figure 3-156 shows these leases (DIRS 180882-Shannon & Wilson 2007, p. 122).

- Montezuma alternative segment 1 (Silver Peak Marsh District – Silver Peak Hot Springs) – would cross several geothermal leases obtained by Western Geothermal Partners LLC in Section 34, T1S, R39E and several sections in E/2 T2S, R39E. Figure 3-157 shows these leases (DIRS 180882-Shannon & Wilson 2007, pp. 120 and 121).

There are geothermal occurrences (springs and wells) in Sarcobatus Valley along U.S. Highway 95 south of Scottys Junction (DIRS 173842-Shannon & Wilson 2005, p. 50).

There are no producing oil or gas wells within 16 kilometers (10 miles) of the Mina rail alignment north of common segment 5 (DIRS 180882-Shannon & Wilson 2007, p. 116). The rail alignment would cross several areas of expired or relinquished (closed) oil and gas leases. The closest oil and gas lease is approximately 3 kilometers (2 miles) northeast of Mina, Nevada, which is approximately 1.6 kilometers (1 mile) east of Mina common segment 1. The BLM authorized this lease in September 2006 (DIRS 180882-Shannon & Wilson 2007, pp. 117 and 118). The BLM also authorized an oil and gas lease on the north slope of the Pilot Mountains in July 2006; however, Mina common segment 1, the rail line segment that would be closest to this lease, would pass approximately 6 kilometers (4 miles) west of this area (DIRS 180882-Shannon & Wilson 2007, p. 117).

Fourteen sections of land constitute a single oil and gas lease (one permittee) 19 kilometers (12 miles) north of Beatty, Nevada, along the southwest flank of Pahute Mesa in southern Nye County (DIRS 179587-Wilson 2007, all). Oasis Valley alternative segment 3 would cross 7 of the 14 sections and Oasis Valley alternative segment 1 would cross 2 sections of this oil and gas lease block.

As of January 2007, no BLM coal leases (active or closed) have been identified within 16 kilometers (10 miles) of the Mina rail alignment (DIRS 180882-Shannon & Wilson 2007, p. 118).

3.3.2.5.3 Recreation and Access

This section describes the recreational areas within the Mina rail alignment region of influence and the secondary roads and trails the rail alignment would cross. Figures 3-160 through 3-167 show recreational areas in the region of influence.

3.3.2.5.3.1 Churchill County. Outdoor recreation in Churchill County includes a mixture of dispersed and location-specific activities (DIRS 180482-Churchill County 2005, p. 9-1). There are no developed BLM recreation sites within 1.6 kilometers (1 mile) of the Mina rail alignment. U.S. Highway 50 intersects and parallels the Union Pacific Railroad Hazen Branchline for approximately 11 kilometers (7 miles) in Churchill and Lyon Counties. U.S. Highway 50, which traces the routes of the historic transcontinental Lincoln Highway, has recently been marketed as the “Loneliest Road in America” for its extreme remoteness (DIRS 180483-NPS 2004, p. 21).

The Union Pacific Railroad Hazen Branchline abuts the Lahontan State Recreation Area, tracing the area’s northern boundary for approximately 6.5 kilometers (4.0 miles). The site, managed by the Nevada Division of State Parks, Department of Conservation and Natural Resources, is primarily focused on the Lahontan Reservoir and associated water-based activities (fishing, boating, waterskiing) as well as recreational vehicle and tent camping (DIRS 180481-Nevada Division of State Parks [n.d.], all).

3.3.2.5.3.2 Lyon County. Recreation on BLM lands in Lyon County is managed primarily for dispersed recreation, with developed recreation only at certain high-use sites. There are no developed BLM recreation areas along the portions of Union Pacific Railroad Hazen Branchline, Department of Defense Branchline North, or Schurz alternative segments in Lyon County.

In addition to Lahontan State Recreation Area, the State of Nevada manages two recreation areas in the region of influence of existing rail segments, Fort Churchill State Historic Park and the Mason Valley Wildlife Management Area.

Fort Churchill State Historic Park preserves the ruins of a Civil War-era U.S. Army fort and Pony Express station (DIRS 180459-Nevada Division of State Parks [n.d.], all). Department of Defense Branchline North crosses about 1 kilometer (0.6 mile) of this park.

The 54 square-kilometer (13,375-acre) Mason Valley Wildlife Management Area, administered by the Nevada Department of Wildlife, provides a mosaic of game habitats from open water to wetlands and upland areas (DIRS 180480-NDOW [n.d.], all). Department of Defense Branchline North runs adjacent to the northern boundary of the Wildlife Management Area for more than 5 kilometers (3 miles).

Schurz alternative segments 1 and 4 would come within 1 kilometer (0.6 mile) of Weber Reservoir, a recreational water body straddling the boundary of Lyon and Mineral Counties and managed by the Walker River Paiute Tribe.

A **Back Country Byway** is a vehicle route that traverses scenic corridors utilizing secondary or back country road systems (DIRS 181598-BLM 2007).

The Fort Churchill to Wellington ***Back Country Byway*** begins on Nevada State Highway 2B at Fort Churchill State Historic Park and runs 80 kilometers (50 miles) west to Wellington, Nevada (DIRS 180461-BLM 2006, all). This unimproved road parallels the existing rail line at a distance of approximately 460 meters (1,500 feet) at its closest for 0.8 kilometer (0.5 mile) before the two diverge.

3.3.2.5.3.3 Mineral County. BLM lands in Mineral County are managed primarily for dispersed recreation, with developed recreation opportunities available only at a few sites. The BLM and Nevada Division of State Parks manage facilities at Walker Lake and the Walker River Paiute Tribe operates facilities at Weber Reservoir. Only one Wilderness Study Area, the Gabbs Valley Range Wilderness Study Area, is near any proposed or existing rail lines in the county, but at approximately 7.5 kilometers (4.6 miles) from Mina common segment 1, it would be outside the region of influence.

Existing Department of Defense Branchline South follows the periphery of Walker Lake, at a distance of no closer than 0.7 kilometer (0.44 mile), for approximately 20 kilometers (12 miles) of the lake's eastern shore. Walker Lake serves as a regional focal point for water-based recreational activities, and is a designated recreation area for the State of Nevada and the BLM (DIRS 180702-Mineral County Nuclear Projects Office 2005, pp. 15 and 30).

Mina common segment 1 would cross a BLM-designated recreation area south of Mina, Nevada, for approximately 19 kilometers (12 miles).

Organized, reoccurring recreation events near the proposed Mina rail alignment typically involve off-highway vehicle based recreation. These events have historically been of both a competitive (speed-based races) and non-competitive (road-rallies, scenic/***historic tourism***, etc.) nature and range widely in the number of participants and communication with BLM managers). The BLM requires that the organizers of these events submit applications for a Special Recreation Permits that describe the details and logistics of each event, such as course and operations plans (DIRS 181599-BLM Special Recreation Permit requirements). Because part of the draw of these events is the wide open spaces and large distances participants are able to traverse, courses often cross several BLM administrative districts or counties. One of the largest of these annual off-highway vehicle events near the Mina rail corridor is the "Las Vegas to Reno" race, which crosses the Battle Mountain, Carson City, and Ely BLM districts (DIRS 181600-BLM 2005, all).

There are very few BLM-permitted off-highway vehicle races and special recreation events in the Mina rail alignment region of influence in Mineral County. Mina common segment 1 would cross approved race routes in several locations. Permitted off-highway vehicle events in the area have included the Las Vegas to Reno Race and Dual Sport Tour (DIRS 182283-Callan 2007). All approved race routes that the rail line would cross are on existing roads and trails.

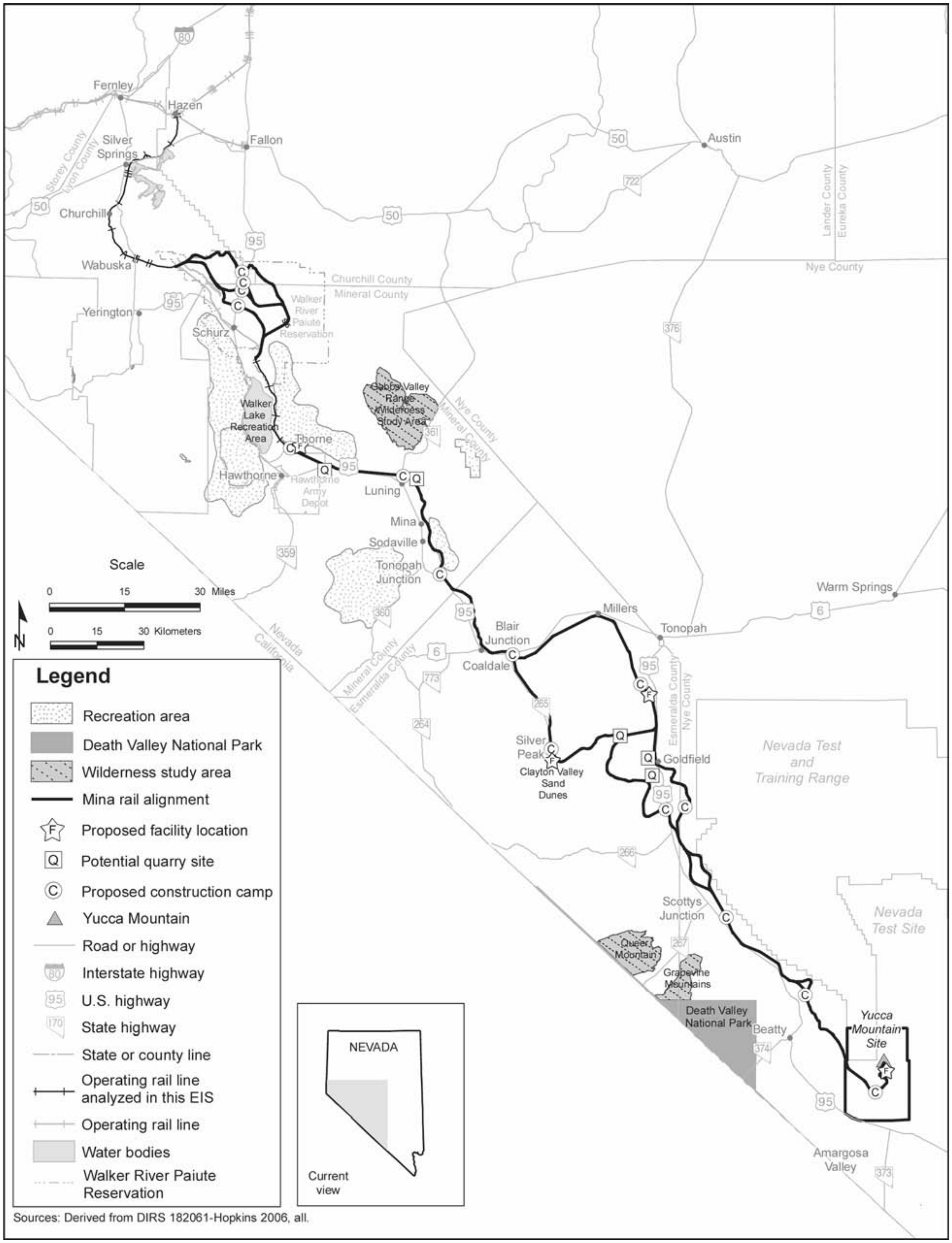


Figure 3-160. Recreation areas and roads along the Mina rail alignment.

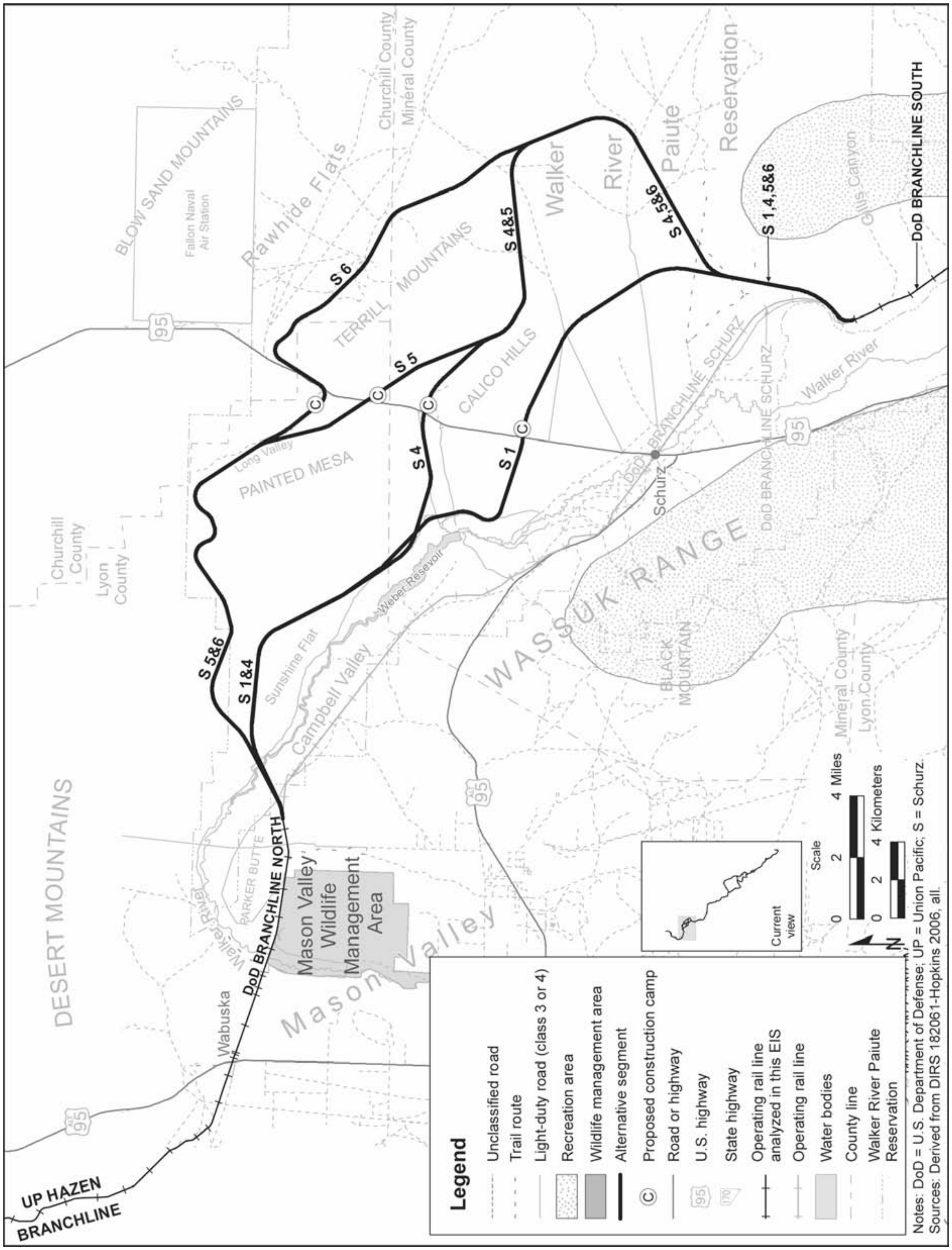


Figure 3-161. Recreation areas and roads within map area 1.

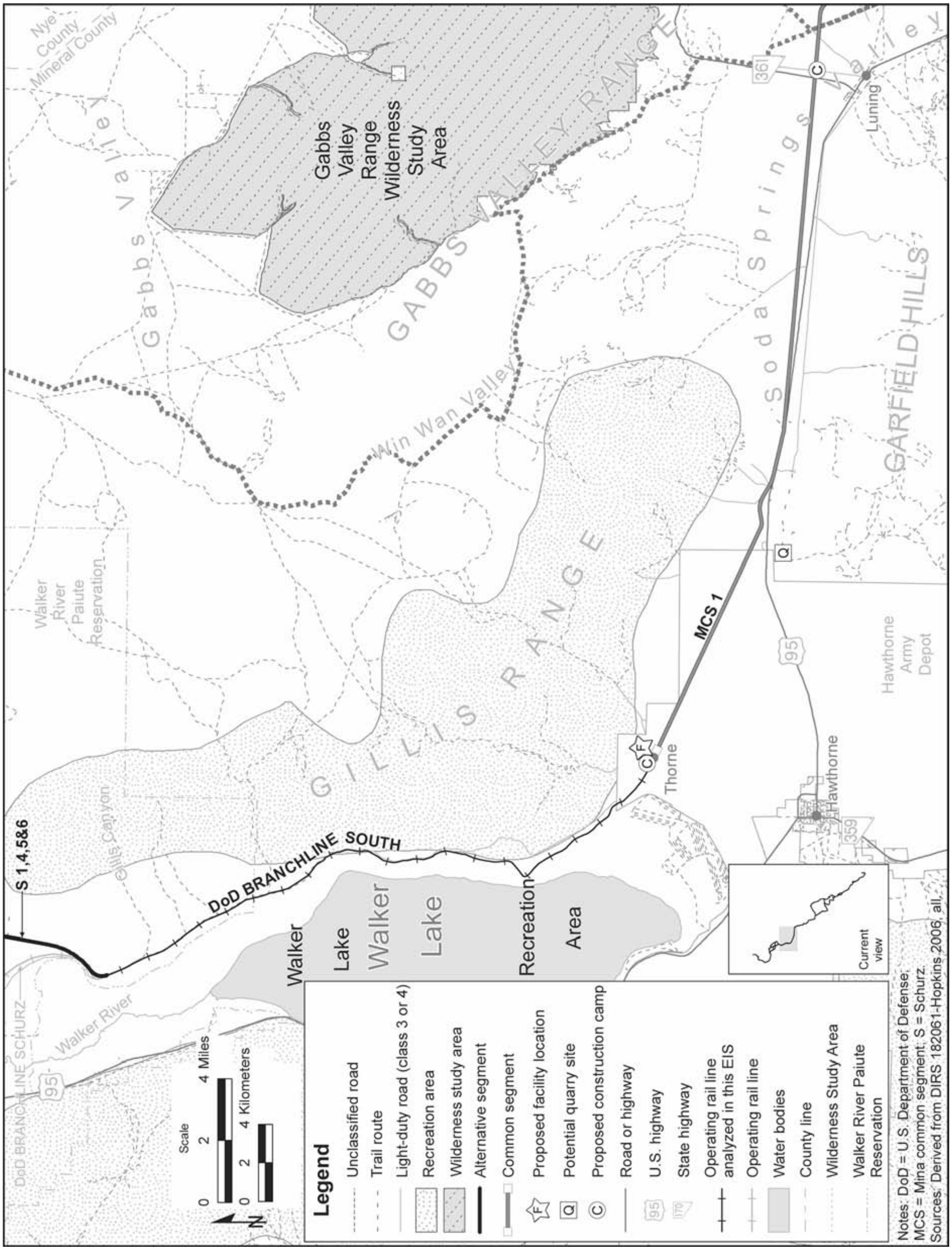


Figure 3-162. Recreation areas and roads within map area 2.

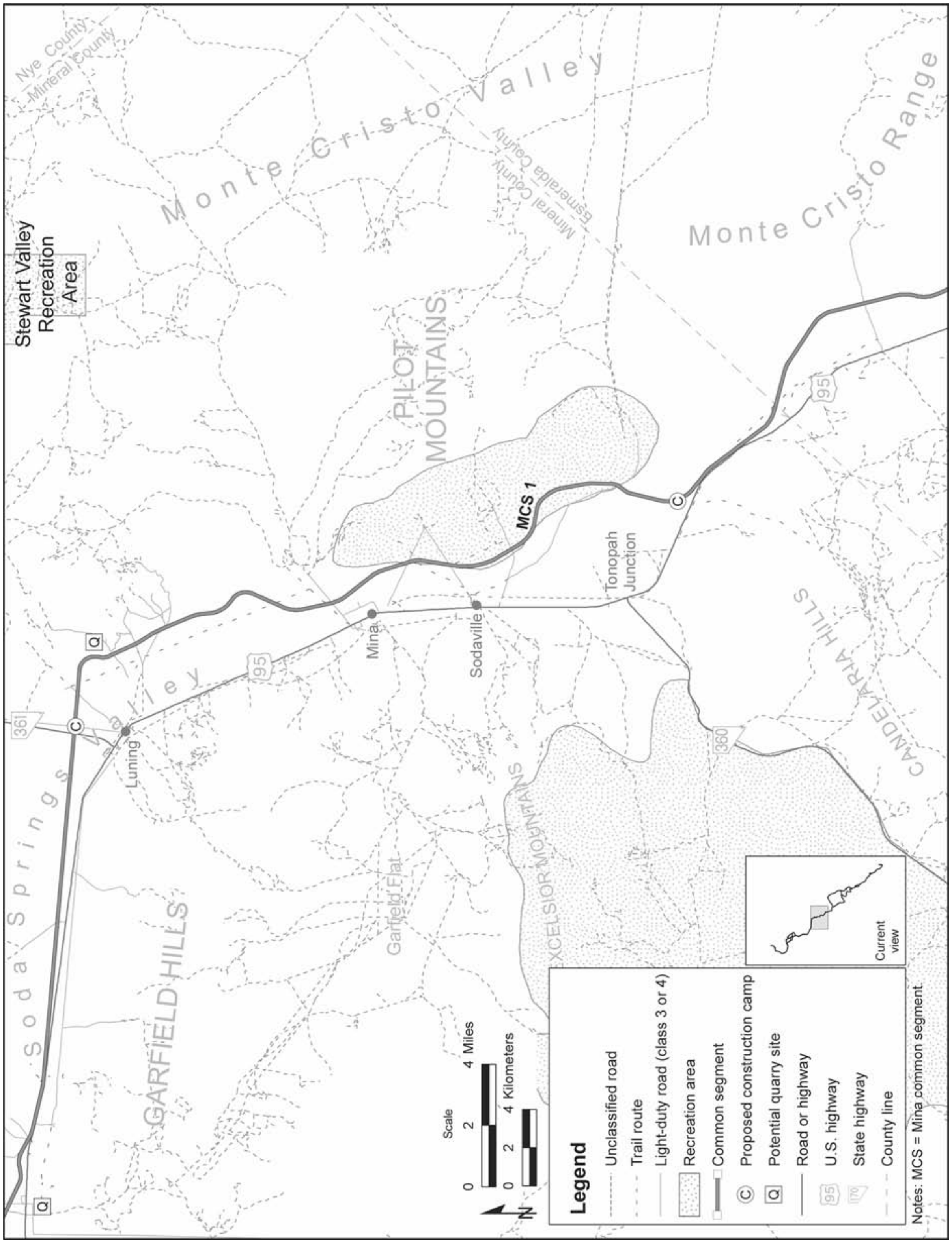


Figure 3-163. Recreation areas and roads within map area 3.

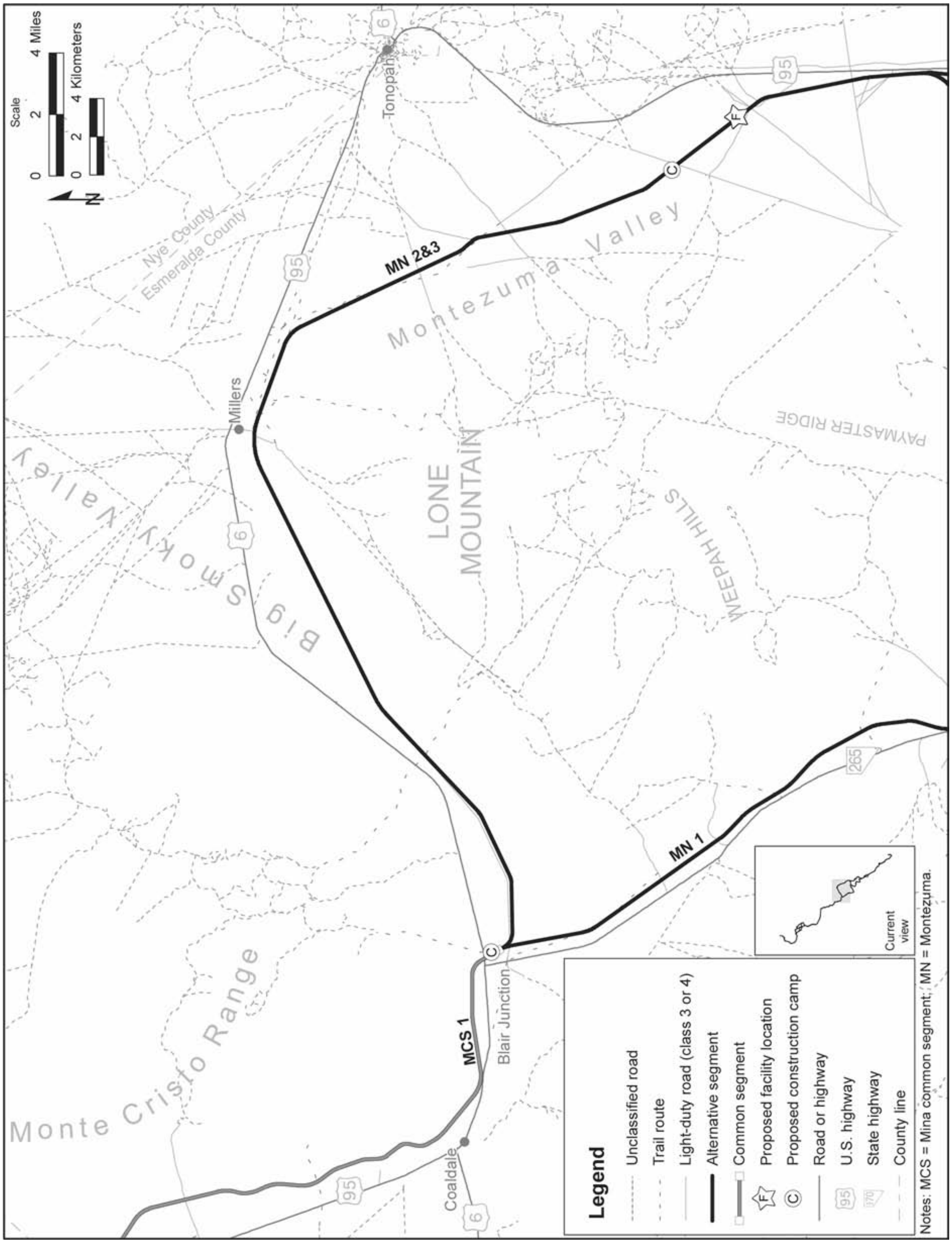


Figure 3-164. Recreation areas and roads within map area 4.

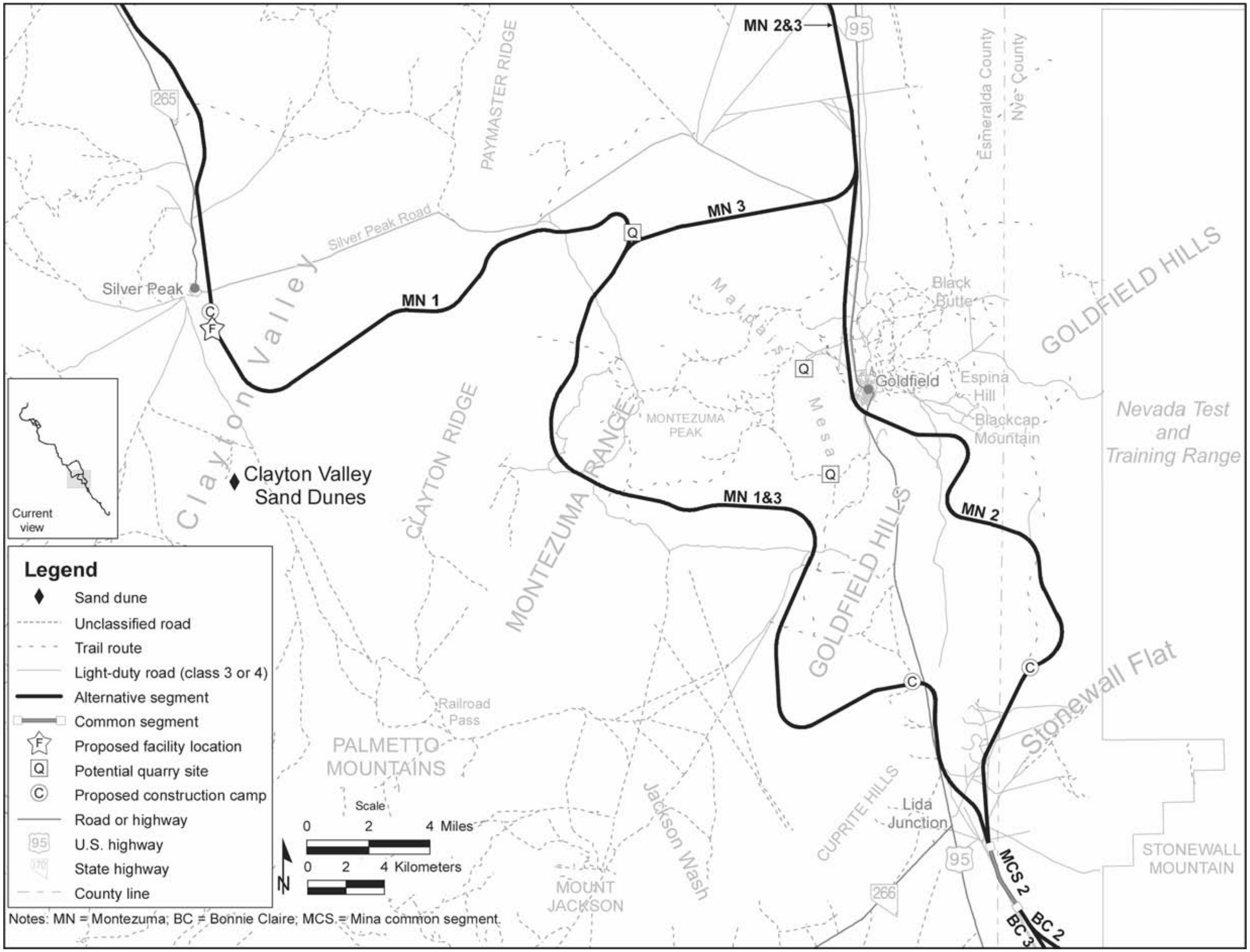


Figure 3-165. Recreation areas and roads within map area 5.

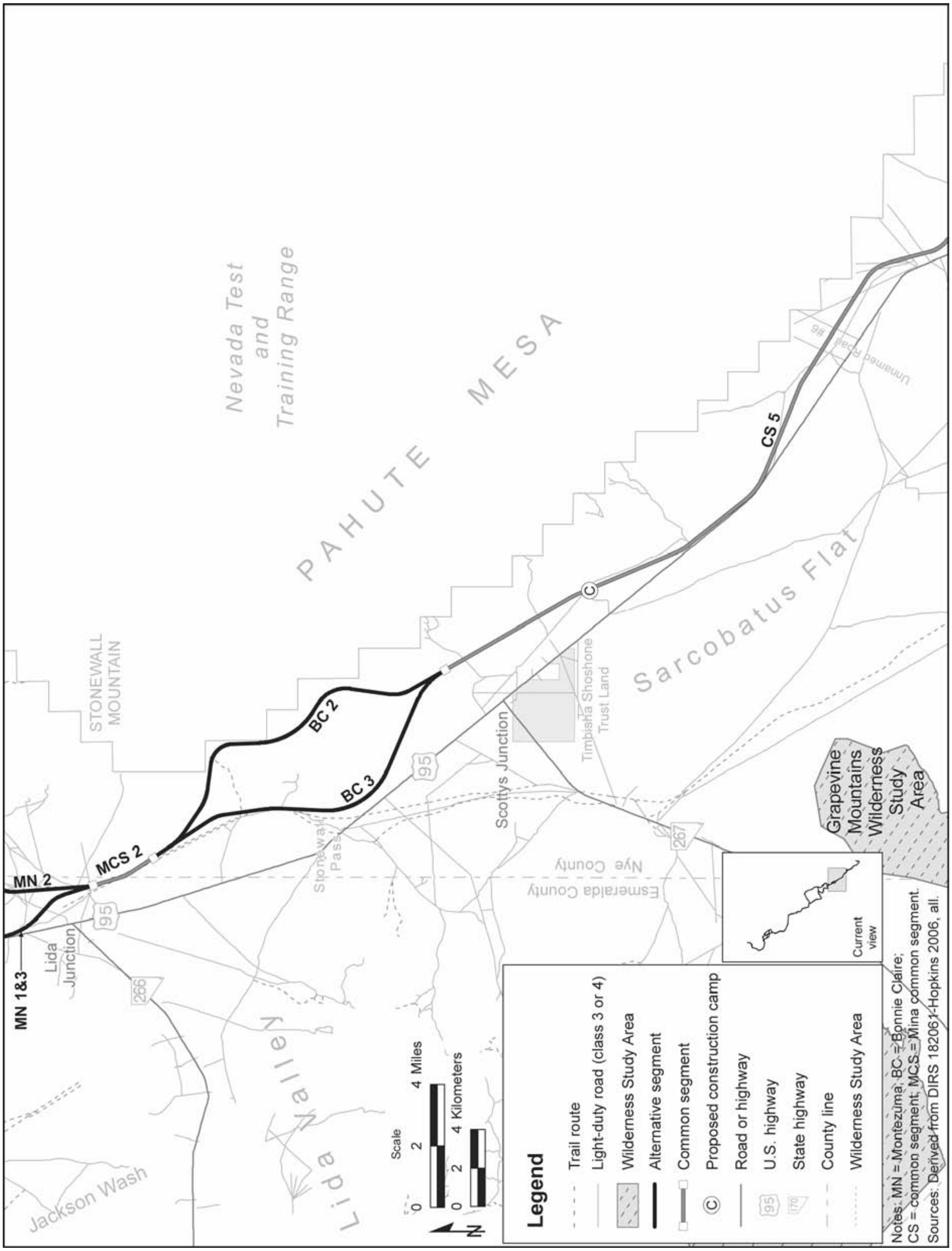


Figure 3-166. Recreation areas and roads within map area 6.

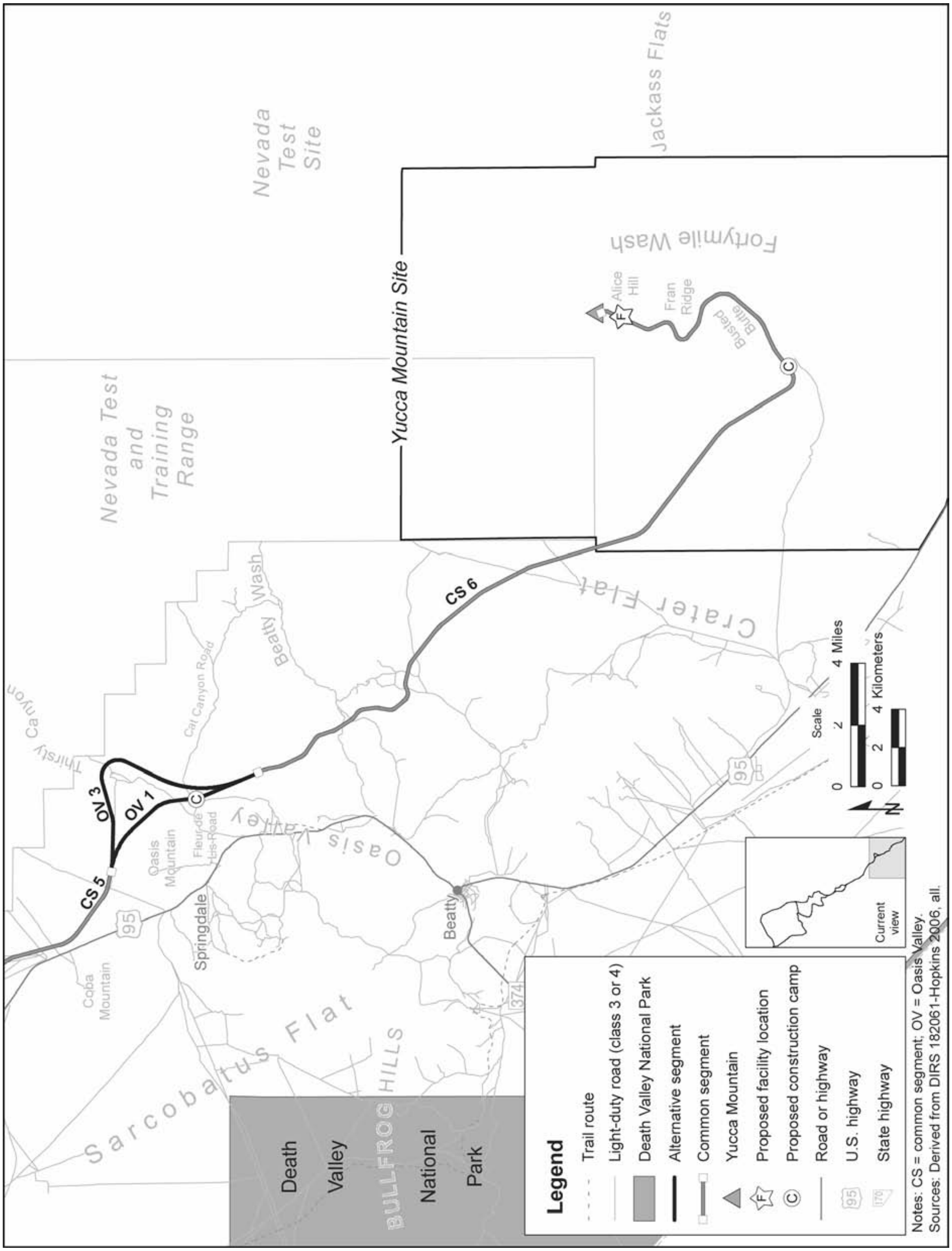


Figure 3-167. Recreation areas and roads within map area 7.

3.3.2.5.3.4 Esmeralda County. Recreation in Esmeralda County is generally dispersed and includes off-highway vehicle events, sometimes near the Mina rail alignment. The county is home to numerous largely abandoned towns and historical sites, many of which are in old mining districts and areas for hunting and fishing (DIRS 176770-Duval et al. 1976, p. 28). The closest Wilderness Area or Wilderness Study Area to the rail alignment in Esmeralda County would be Silver Peak Wilderness Study Area, which would be approximately 21 kilometers (13 miles) away from Montezuma alternative segment 1, outside the region of influence. The closest BLM-designated Special Recreation Management Areas, the Clayton Valley Sand Dunes Special Recreation Management Areas and the Crescent Sand Dunes Special Recreation Management Area, are also outside the Mina rail alignment region of influence, approximately 4.5 kilometers (2.8 miles) and 14 kilometers (8.8 miles) away, respectively.

Mina common segment 1 would cross near the southwestern edge of the Monte Cristo Range, an area under consideration by the Nevada Legislature as a Nevada State Park. Proponents of the proposed state park cite the area's unique geology as its major appeal and justification for park designation (DIRS 180460-Robb-Bradick et al. 2006, all). At present, the BLM manages the area as open to all individual, commercial, or competitive recreational uses (DIRS 173224-BLM 1997, p. 34).

A number of BLM-permitted off-highway vehicle races and permitted special recreation events take place annually in areas around the Mina rail alignment common segments and alternative segments in Esmeralda County. Montezuma alternative segment 2 would cross previously used race routes approximately 10 times, with most crossings occurring as the alternative segment neared Goldfield. Montezuma alternative segment 3 would cross previously used race routes approximately 15 times, while Montezuma alternative segment 1 would cross race routes approximately five times, principally in areas south of the Silver Peak. Most approved race routes are on existing roads and trails.

3.3.2.5.3.5 Nye County. Recreation on BLM-administered lands in Nye County is generally dispersed, and there would be no developed recreation sites within 1.6 kilometers (1 mile) of the Mina rail alignment. Dispersed recreation opportunities in Nye County include hunting, camping, exploration and sightseeing, and off-highway vehicle recreation and events.

There are very few off-highway vehicle events in the Mina rail alignment region of influence in Nye County. Common segment 6 would cross race routes several times. All approved race routes the rail line would cross are on existing roads and trails.

3.3.2.5.3.6 Land Access. The Mina rail alignment would cross a number of class 3 or 4 roads and unpaved trail routes (see Table 3-89).

> A **class 3 road** is a light-duty, paved or improved road.
>
> A **class 4 road** is an unimproved, unsurfaced road (includes track roads in back country).
>
> **Trail routes** are trails and roads passable only with a 4-wheel drive vehicle (also called Jeep trails).
>
> Source: DIRS 181598-BLM [n.d.].

3.3.2.5.4 Utility and Transportation Corridors

3.3.2.5.4.1 Utility Rights-of-Way. Figures 3-168 through 3-175 show the major utilities and utility corridor networks in the Mina rail alignment region of influence. The figures do not identify smaller, local electric distribution lines, typically in the 14- to 25-kilovolt range, with linear right-of-way reservations along major roads, or local water, sewer, power, or telephone lines serving individual residences or businesses, or their corresponding rights-of-way.

3.3.2.5.4.2 Utility Corridors. As stated in Section 3.3.2.4.1, BLM resource management plans designate utility and transportation corridors to consolidate the location of new and existing rights-of-way whenever feasible. Table 3-90 lists the extent to which DOE would construct each Mina rail alignment segment within BLM-designated corridors.

Table 3-89. Trails and class 3 or 4 roads the Mina rail alignment alternative segments and common segments would cross.

Segment	Walker River Paiute Reservation roads/trails	Mineral County roads	Mineral County trails	Esmeralda County roads	Esmeralda County trails	Nye County roads	Nye County trails
Union Pacific Railroad Hazen Branchline[a]	Not applicable						
Department of Defense Branchline North[b]	Not applicable						
Schurz alternative segment 1 [c]	2	0	0	0	0	0	0
Schurz alternative segment 4 [c]	2	0	0	0	0	0	0
Schurz alternative segment 5 [c]	3	0	0	0	0	0	0
Schurz alternative segment 6 [c]	2	0	0	0	0	0	0
Department of Defense Branchline South[b]	Not applicable						
Mina common segment 1[c]	0	3	0	0	0	0	0
Montezuma alternative segment 1[c]	0	0	0	1	0	0	0
Montezuma alternative segment 2[c]	0	0	0	5	0	0	0
Montezuma alternative segment 3[c]	0	0	0	5	0	0	0
Mina common segment 2[c]	0	0	0	0	0	0	0
Bonnie Claire alternative segment 2	0	0	0	0	0	0	1
Bonnie Claire alternative segment 3	0	0	0	0	0	2	2
Common segment 5	0	0	0	0	0	14	0
Oasis Valley alternative segment 1	0	0	0	0	0	3	0
Oasis Valley alternative segment 3	0	0	0	0	0	3	0
Common segment 6	0	0	0	0	0	7	0

a. Use of the Union Pacific Railroad Hazen Branchline would not require new construction or new road crossings.
b. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.
c. Source: DIRS 181617-Hopkins 2007, all.

Table 3-90. Rail line segments within designated utility or transportation corridors[a].

Segment	Resource management plan	Distance (kilometers)[b] within BLM-designated corridors	Total distance (kilometers) of segment	Percent within BLM-designated corridor
Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North[c,d]	Carson City	Not applicable		
Schurz alternative segment 1[e]	Carson City	Not applicable	51	Not applicable
Schurz alternative segment 4[e]	Carson City	Not applicable	65	Not applicable
Schurz alternative segment 5[e]	Carson City	0[f]	66	0
Schurz alternative segment 6[e]	Carson City	0[f]	67	0
Department of Defense Branchline South[c,d]	Carson City	Not applicable		
Mina common segment 1	Carson City	52	85	61
Mina common segment 1	Tonopah	15	35	43
Montezuma alternative segment 1	Tonopah	51	118	43
Montezuma alternative segment 2	Tonopah	35.5	118	30
Montezuma alternative segment 3	Tonopah	49.9	142	35
Mina common segment 2	Tonopah	0	3.4	0
Bonnie Claire alternative segment 2	Tonopah	0	20	0
Bonnie Claire alternative segment 3	Tonopah	1.6	20	8.0
Common segment 5	Tonopah	20	41	49
Oasis Valley alternative segment 1	Tonopah	8.3	10	83
Oasis Valley alternative segment 3	Tonopah	10	14	71
Common segment 6	Tonopah	7.8	24	33
Common segment 6	Las Vegas	4.0	27	15

a. Source: DIRS 181617-Hopkins 2007, all.
b. To convert kilometers to miles, multiply by 0.62137.
c. Use of the Union Pacific Hazen Branchline would not require new construction.
d. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.
e. While there are BLM-designated corridors shown on the southern portion of the Walker River Paiute Reservation, the BLM does not have jurisdiction to authorize rights-of-way across the Reservation or designate corridors on the Reservation.
f. Schurz alternative segments 5 and 6 would travel 4.8 kilometers outside the Walker River Paiute Reservation and these portions of the segments do not fall within BLM-designated corridors.

Table 3-91 identifies 38 locations of potential utility crossings. Because some of the locations are very close together, some of the individual crossings cannot be shown on the figures. Utility lines listed in Table 3-91 are depicted on the figures by their location number designated in the table. For clarification, see Volume III-B of this Rail Alignment EIS, Map Atlas. Table 3-92 lists utilities in the regions of influence of rail line support facilities. The locations of potential utility crossings shown on figures and listed in tables are approximate. Under the Mina Implementing Alternative, the Department would review and verify their locations during final rail line design.

Table 3-91. Potential Mina rail alignment utility crossings[a] (page 1 of 2).

Rail line segment/facility	Identified utilities and utility corridors[b,c,d]	Construction right-of-way crossings	Location number
Union Pacific Railroad Hazen Branchline[e]		Not applicable	
Department of Defense Branchline North[e]		Not applicable	
Schurz alternative segment 1	Telephone line	1	1
Schurz alternative segment 1	Unidentified line	1	2
Schurz alternative segment 1	Unidentified line	1	3
Schurz alternative segment 4	Telephone line	1	1
Schurz alternative segment 4	Unidentified line	1	2
Schurz alternative segment 4	Unidentified line	1	3
Schurz alternative segment 5	Telephone line	1	1
Schurz alternative segment 5	Unidentified line	1	2
Schurz alternative segment 5	Unidentified line	1	3
Schurz alternative segment 6	Telephone line	1	1
Schurz alternative segment 6	Unidentified line	1	2
Schurz alternative segment 6	Unidentified line	1	3
Department of Defense Branchline South[e]	Not applicable		
Staging Yard at Hawthorne	Transmission/power line	1	4
Staging Yard at Hawthorne	Transmission/power line	1	5
Mina common segment 1	Transmission/power line	2	5
Mina common segment 1	Transmission/power line	1	9
Mina common segment 1	Transmission/power line	1	10
Mina common segment 1	Transmission/power line	1	11
Mina common segment 1	Transmission/power line	1	12
Mina common segment 1	Transmission/power line	1	13
Mina common segment 1	Transmission/power line	2	14
Mina common segment 1	Transmission/power line	1	15

Table 3-91. Potential Mina rail alignment utility crossings[a] (page 2 of 2).

Rail line segment/facility	Identified utilities and utility corridors[b,c,d]	Construction right-of-way crossings	Location number
Mina common segment 1	Transmission/power line	4	16
Mina common segment 1	Telephone line	3	17
Mina common segment 1	Transmission/power line	1	18
Mina common segment 1	Transmission/power line	1	19
Mina common segment 1	Transmission/power line	2	20
Mina common segment 1	Transmission/power line	1	21
Mina common segment 1	Transmission/power line	1	22
Montezuma alternative segment 1	Transmission/power line	2	23
Montezuma alternative segment 1	Transmission/power line	1	24
Montezuma alternative segment 1	Telephone line	2	25
Montezuma alternative segment 1	Transmission/power line	2	26
Montezuma alternative segment 2	Transmission/power line	1	27
Montezuma alternative segment 2	Transmission/power line	2	28
Montezuma alternative segment 2	Transmission/power line	1	29
Montezuma alternative segment 2	Transmission/power line	1	30
Montezuma alternative segment 2	Transmission/power line	1	31
Montezuma alternative segment 2	Transmission/power line	2	32
Montezuma alternative segment 2	Transmission/power line	1	33
Montezuma alternative segment 2	Telephone line	1	34
Montezuma alternative segment 2	Transmission/power line	1	35
Montezuma alternative segment 2	Telephone line	1	36
Montezuma alternative segment 3	Telephone line	2	25
Montezuma alternative segment 3	Transmission/power line	2	26
Montezuma alternative segment 3	Transmission/power line	1	27
Montezuma alternative segment 3	Transmission/power line	2	28
Montezuma alternative segment 3	Transmission/power line	1	29
Montezuma alternative segment 3	Transmission/power line	1	30
Montezuma alternative segment 3	Transmission/power line	1	31
Montezuma alternative segment 3	Transmission/power line	1	32
Montezuma alternative segment 3	Transmission/power line	1	33
Montezuma alternative segment 3	Transmission/power line	1	37
Mina common segment 2	None	None	None
Bonnie Claire alternative segments	None	None	None

a. Sources: DIRS 181617-Hopkins 2007, all.
b. Electric distribution lines along major roads may not have been identified. Utilities serving individual residences or businesses have not been identified.
c. Use of the Union Pacific Railroad Hazen Branchline would not require new construction or new utility crossings.
d. Lines listed as "unidentified" are so listed in the Geographic Information System database.
e. DOE would construct new sidings along Department of Defense Branchlines North and South within the existing rail line right-of-way; therefore DOE did not analyze these portions of the rail alignment. No other new construction would be required.

Table 3-92. Potential quarry site utility crossings.[a]

Potential quarry site	Identified utilities and utility corridors	Number of crossings
Garfield Hills	Transmission/power line	1
Garfield Hills	Transmission/power line	1
Gabbs Range	None	None
North Clayton	Transmission/power line	1
Malpais Mesa	Pipeline	1
ES-7	Water line	1
ES-7	Water line	1
ES-7	Transmission/power line	1

a. Source: DIRS 181617-Hopkins 2007, all.

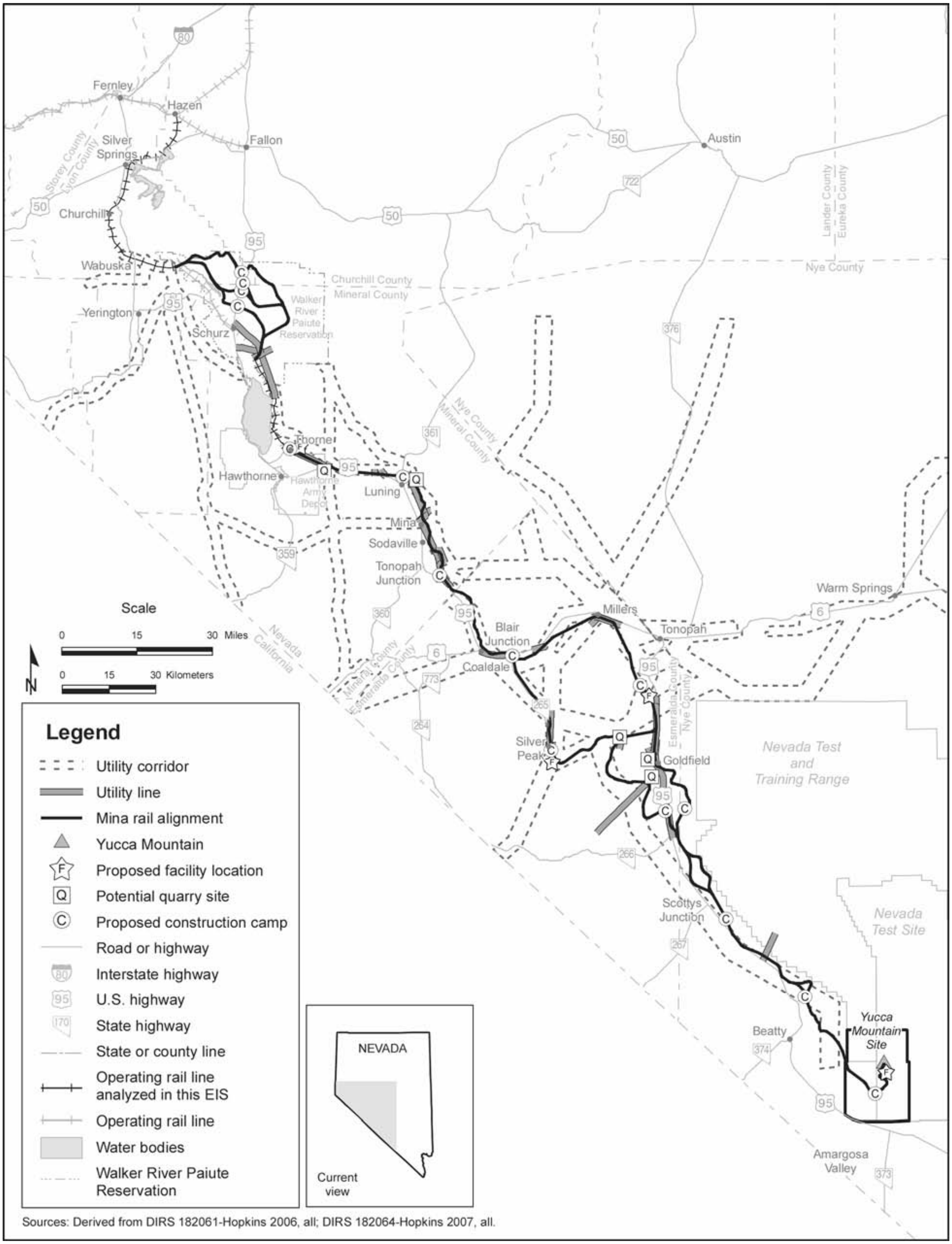


Figure 3-168. Utility corridors along the Mina rail alignment.

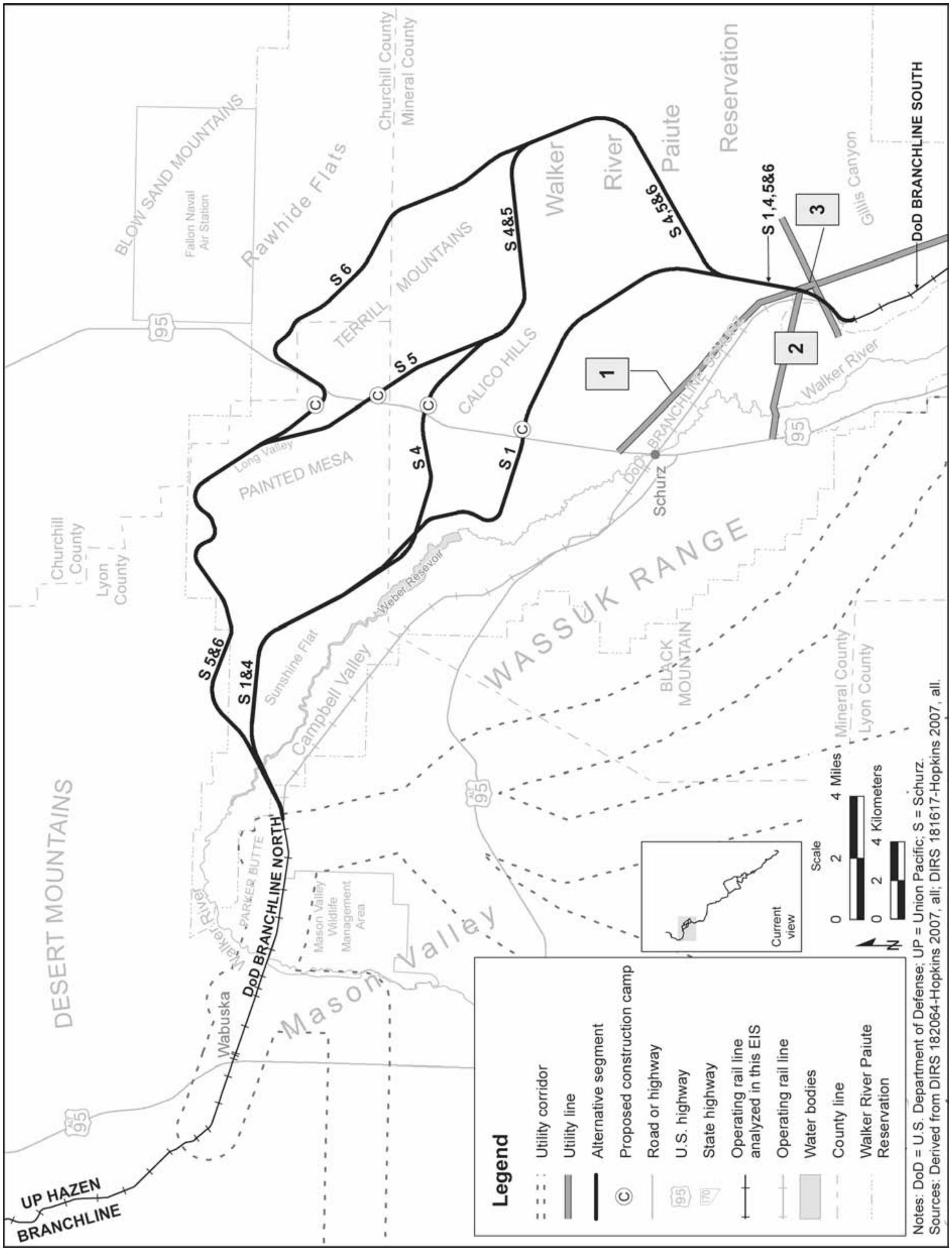


Figure 3-169. Utility corridors within map area 1.

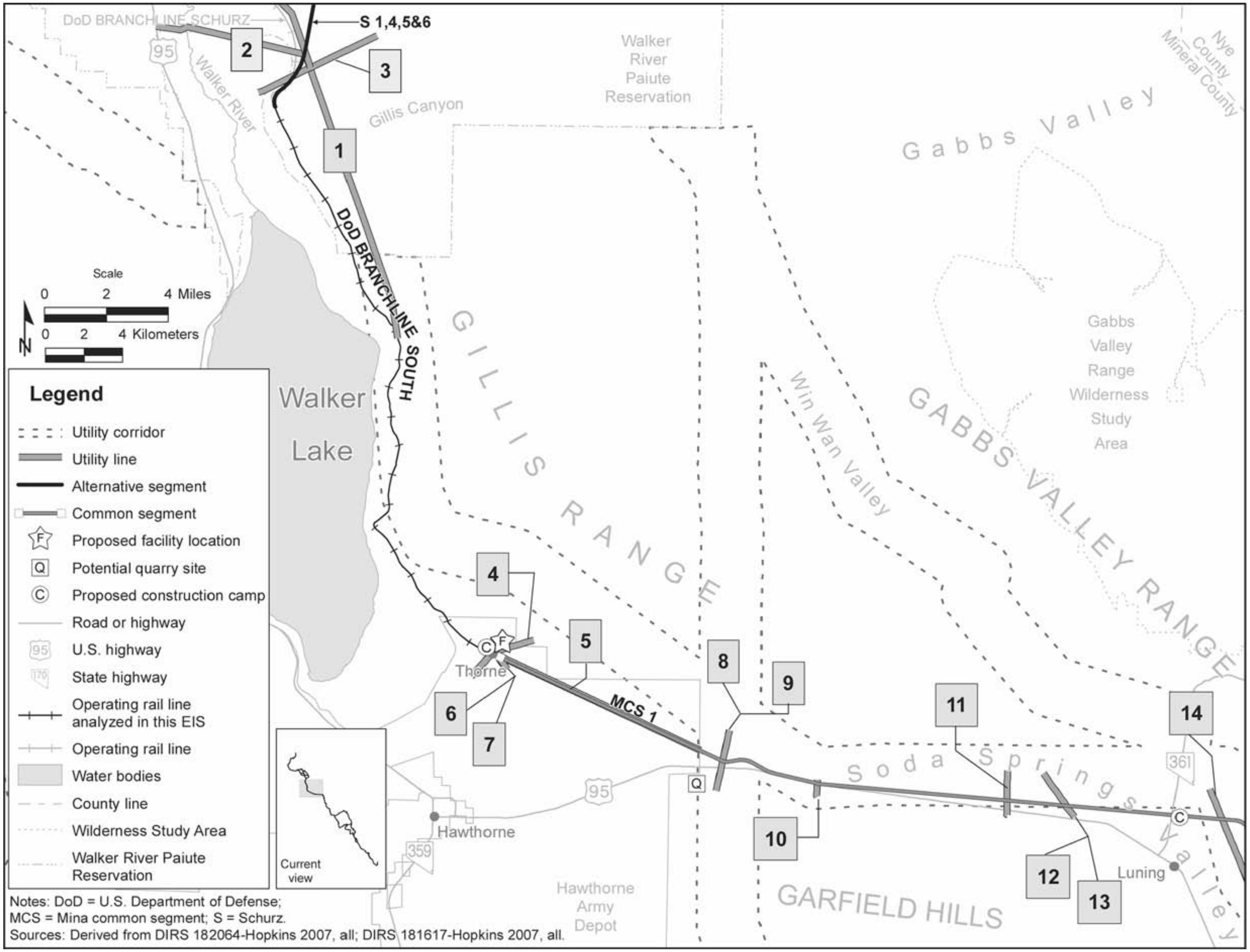


Figure 3-170. Utility corridors within map area 2.

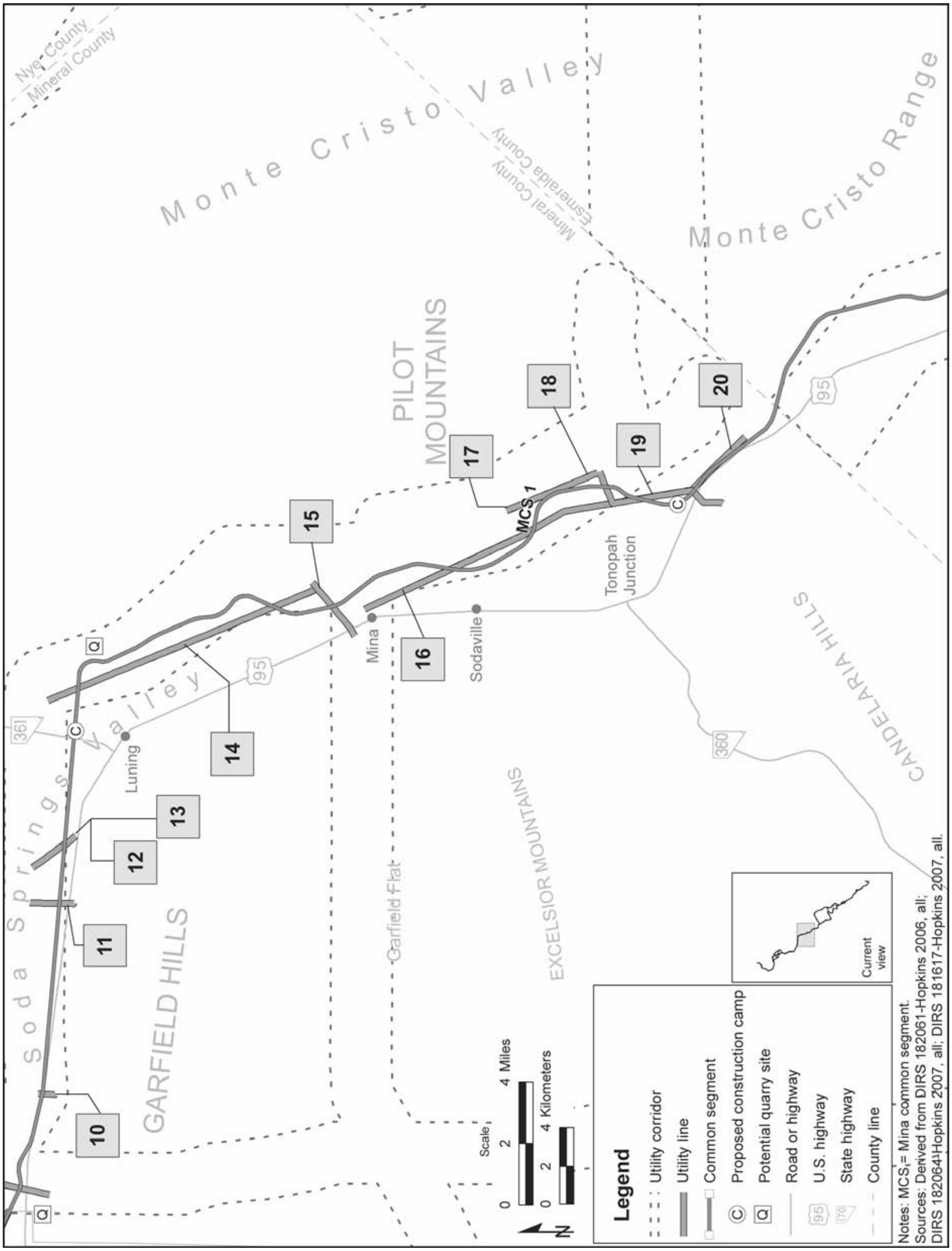


Figure 3-171. Utility corridors within map area 3.

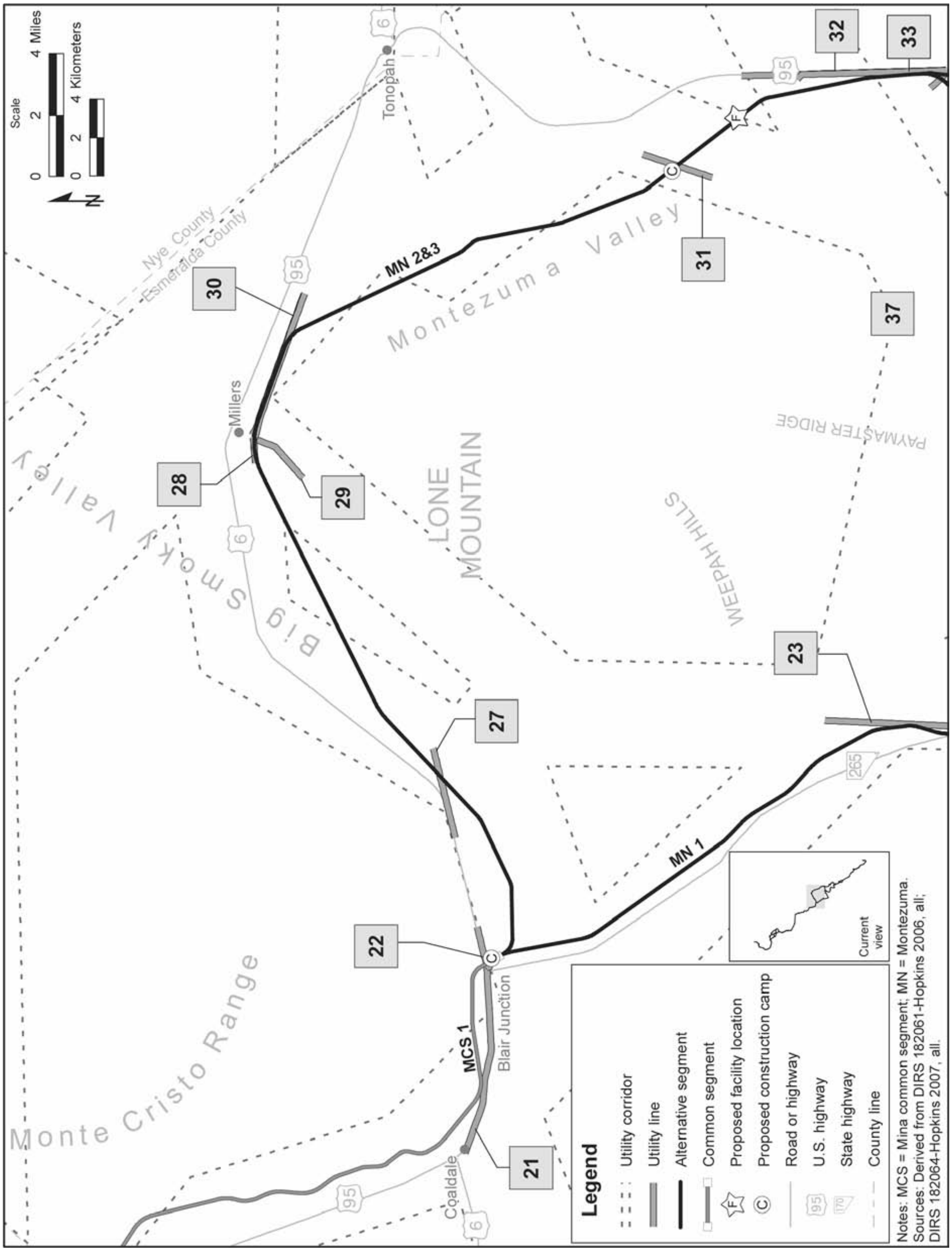


Figure 3-172. Utility corridors within map area 4.

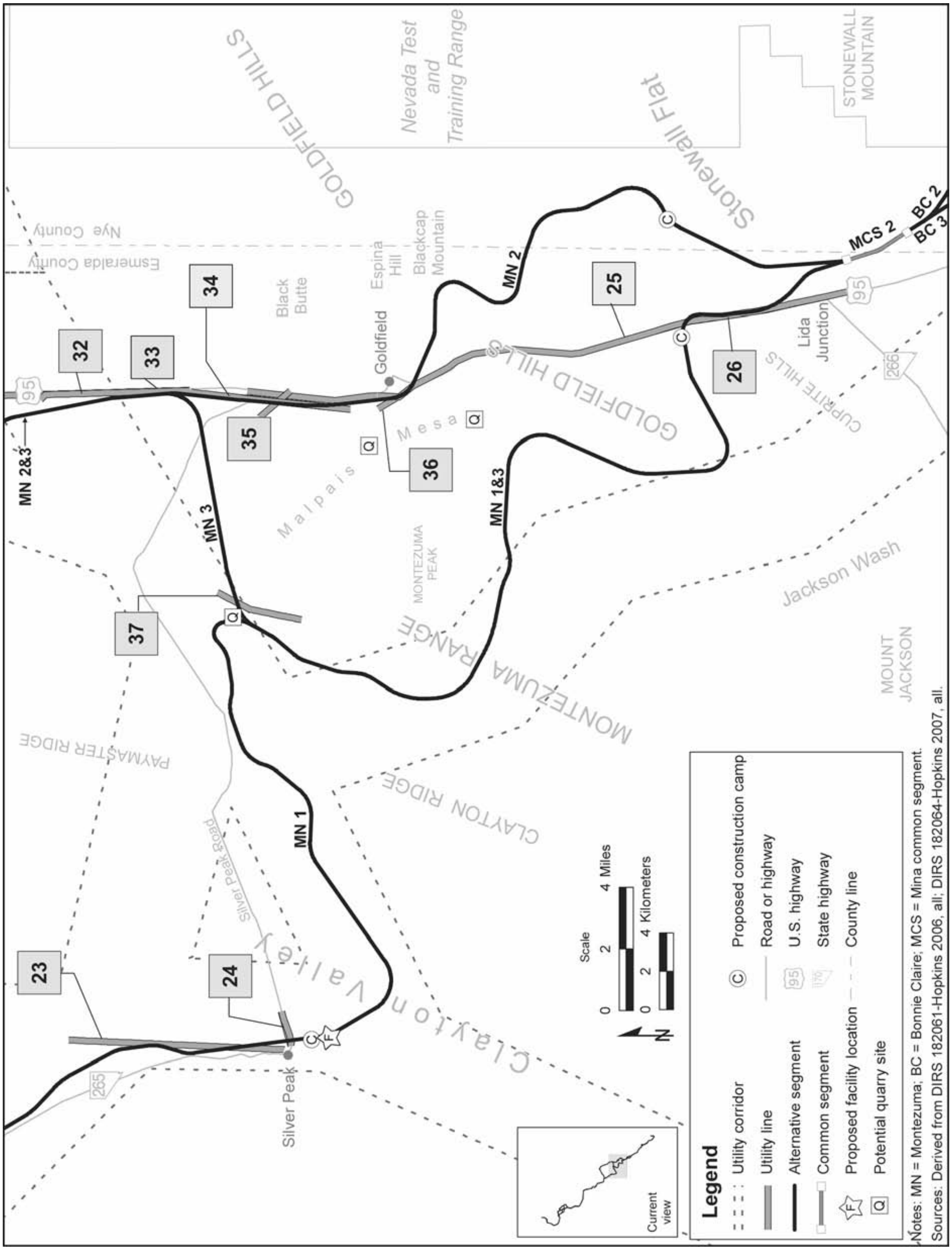


Figure 3.-173. Utility corridors within map area 5.

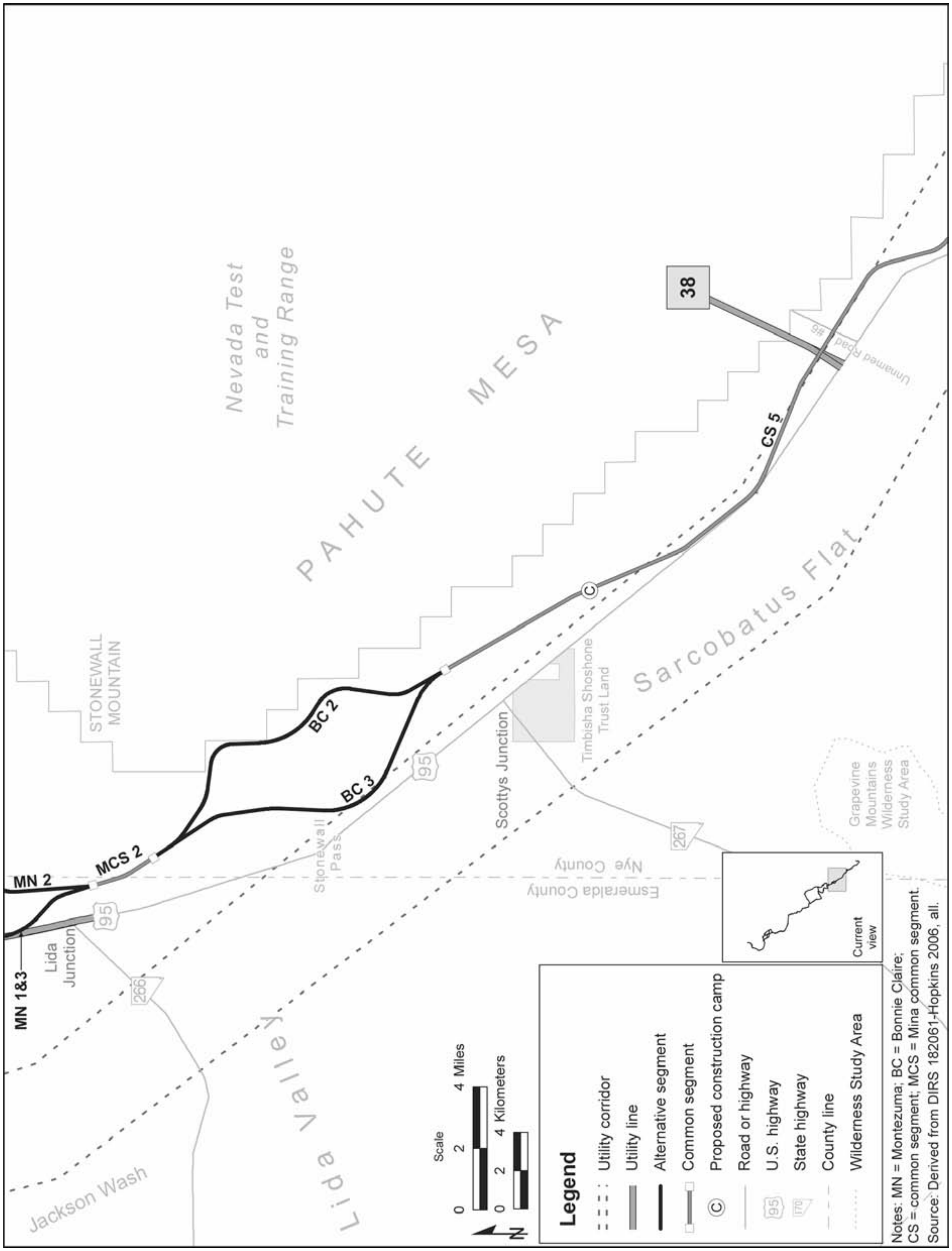


Figure 3-174. Utility corridors within map area 6.

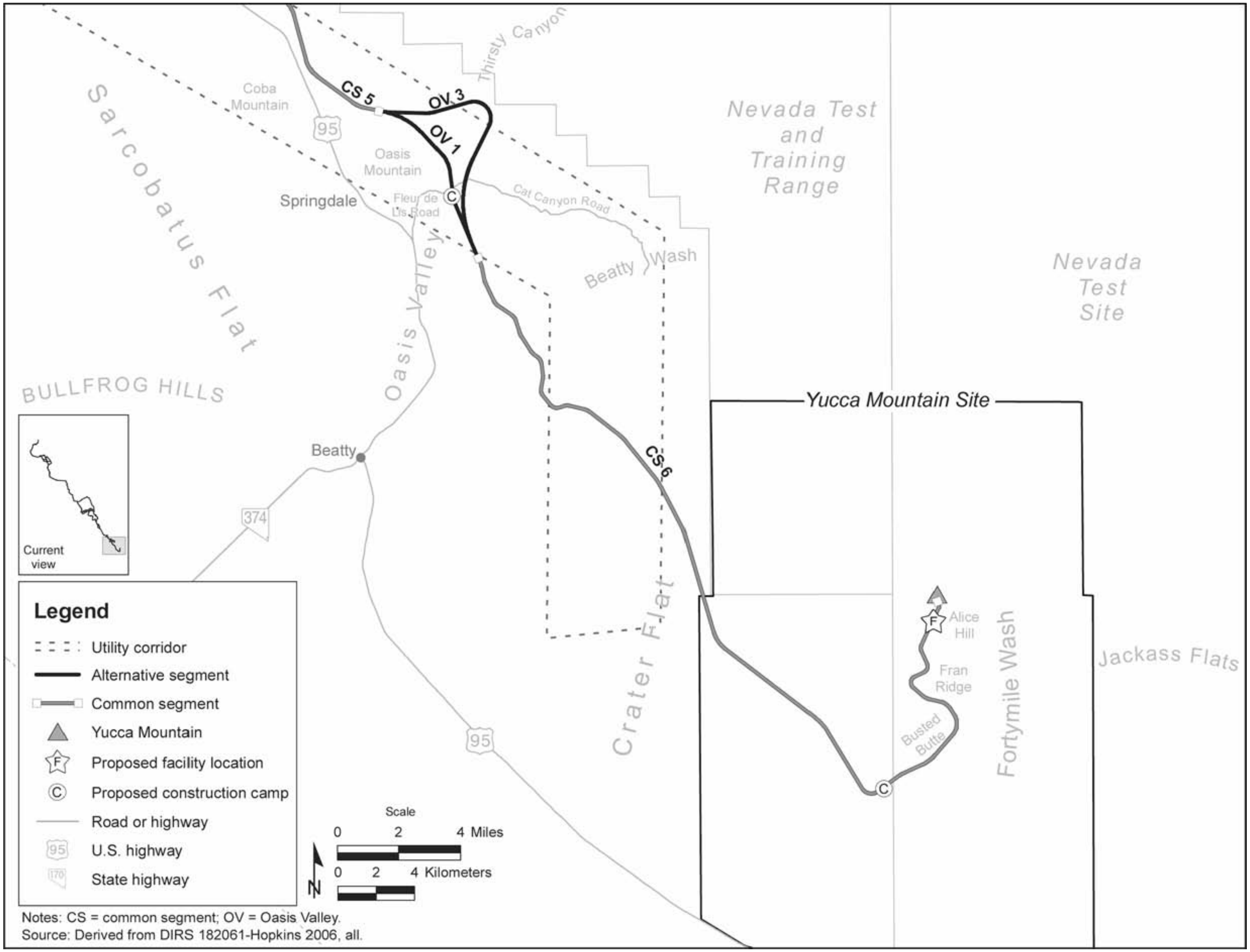


Figure 3-175. Utility corridors within map area 7.

3.3.3 AESTHETIC RESOURCES

This section describes the aesthetic (visual) setting in the region of influence along the Mina rail alignment. Section 3.3.3.1 describes the region of influence for aesthetic resources; Section 3.3.3.2 describes the methods DOE used to classify visual values; Section 3.3.3.3 describes the environmental setting and characteristics for aesthetic resources along the Mina rail alignment.

3.3.3.1 Region of Influence

The region of influence for aesthetic resources is the viewshed around all Mina rail alignment alternative segments, common segments, and proposed locations of ***rail line*** construction and operations support facilities.

BLM guidance subdivides landscapes into three ***distance zones*** based on relative visibility from travel routes or observation points. "Foreground-middleground" zone includes areas less than 5 to 8 kilometers (3 to 5 miles) away. "Background" zone includes areas visible beyond the foreground-middleground zone but usually less than 24 kilometers (15 miles) away. Areas not seen as foreground-middleground or background are in the "seldom-seen" zone (DIRS 101505-BLM 1986, Section IV). To ensure that seldom-seen views were included in this analysis, DOE used a conservative region of influence extending 40 kilometers (25 miles) on either side of the centerline of the Mina rail alignment.

Landscapes are divided into three **distance zones** based on their relative location to common viewpoints: foreground to middleground, background, and seldom seen (DIRS 101505-BLM 1986, Section IV).

Scenic quality is a measure of the visual appeal of a tract of land. Areas are rated based on key factors including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (DIRS 101505-BLM 1986, Section II).

Sensitivity levels are a measure of public concern for scenic quality. Areas are ranked high, medium, or low based on types of users, amount of use, public interest, adjacent land uses, and whether they are special areas (DIRS 101505-BLM 1986, Section III).

3.3.3.2 Methodology for Classifying Visual Values

Most of the lands along the Mina rail alignment are BLM-administered public lands, with the remainder owned or administered by the Walker River Paiute Tribe, the U.S. Army, or private entities. Because of the predominance of BLM-administered land, and because neither the Walker River Paiute Tribe nor the U.S. Army assign visual quality ratings to lands in their jurisdiction, DOE used BLM methodologies for evaluating visual values. The BLM considers visual resources when addressing aesthetic issues during BLM planning. These resources include natural or manmade physical features that give a landscape its character and value as an environmental factor. The BLM uses a visual resource management system to classify the aesthetic value of its lands and to set management objectives (DIRS 173052-BLM 1984, all).

The BLM classification of visual resource value, the visual resource inventory, involves assessing visual resources and assigning them to one of four visual resource management classes based on three factors: ***scenic quality***, visual sensitivity (***sensitivity levels***), and distance from travel or observation points (DIRS 101505-BLM 1986, all). The BLM uses a combination of the ratings of these three factors to assign a visual resource inventory class to a piece of land, ranging from Class I to Class IV, with Class I representing the highest visual values. Each visual resource class is subsequently associated with a management objective, defining the way the land may be developed or used. Each BLM district assigns visual resource management classes to its lands during the resource management planning process. Table 3-93 lists the BLM management objectives for visual resource classes.

Table 3-93. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

The BLM uses visual resource contrast ratings to assess the visual impacts of proposed projects and activities on the existing landscape (DIRS 173053-BLM 1986, all). The BLM looks at basic elements of design to determine levels of contrast created between a proposed project and the existing viewshed. Depending on the visual resource management objective for a particular location, varying levels of contrast are acceptable.

Contrast ratings are determined from locations called “key observation points,” which are usually along commonly traveled routes such as highways or frequently used county roads or in communities. To identify key observation points along the Mina rail alignment, DOE considered the following factors: angle of observation, number of viewers, how long the project would be in view, relative project size, season of use, and light conditions. BLM guidance (DIRS 173053-BLM 1986, Section IIC) recommends that key observation points for linear projects, such as the proposed railroad, include the following:

- Most-critical viewpoints (for example, views from communities at road crossings)
- Typical views encountered in representative landscapes, if not covered by critical viewpoints
- Any special project or landscape features such as river crossings and substations

3.3.3.3 Visual Setting and Characteristics

3.3.3.3.1 General Setting and Characteristics

The Class IV lands in the region of influence consist of landscapes that are generally flat in form and horizontal in line, with gray and brown colors from soil and rock, and texture ranging from flat to slightly rough, depending on whether the broad flat valleys and alluvial fans include any topographic features such as hills, buttes, or eroded stream channels. Vegetation is usually small, low, and rounded in form (for example, grasses, shrubs, and small trees), horizontal in line, brown or gray-green in color, and light-to-medium in texture with irregular spacing. Structures are rare, but could include transmission towers, ranch buildings, or similar structures. Class III lands generally include more varied forms, lines, colors, and textures, including vertical lines in topography and vegetation, brighter greens in vegetation, visible blues from water, and dense texture from forested lands or rough texture in eroded rock. Some Class III areas in the Carson City BLM District will not necessarily fit this description, because the district has not inventoried most of the lands adjacent to the Mina rail alignment. The BLM manages uninventoried lands as Class III under district policy (DIRS 179571-Knight 2007, all). Class II lands are mostly in mountains that include forested areas and open rock exposures, with mixed forms including slopes and ridges; rounded lines; a wide range of rock and soil colors, and vegetation that changes color with the seasons; and variable texture that is often dense in forested areas. There are no Class I areas along the Mina rail alignment.

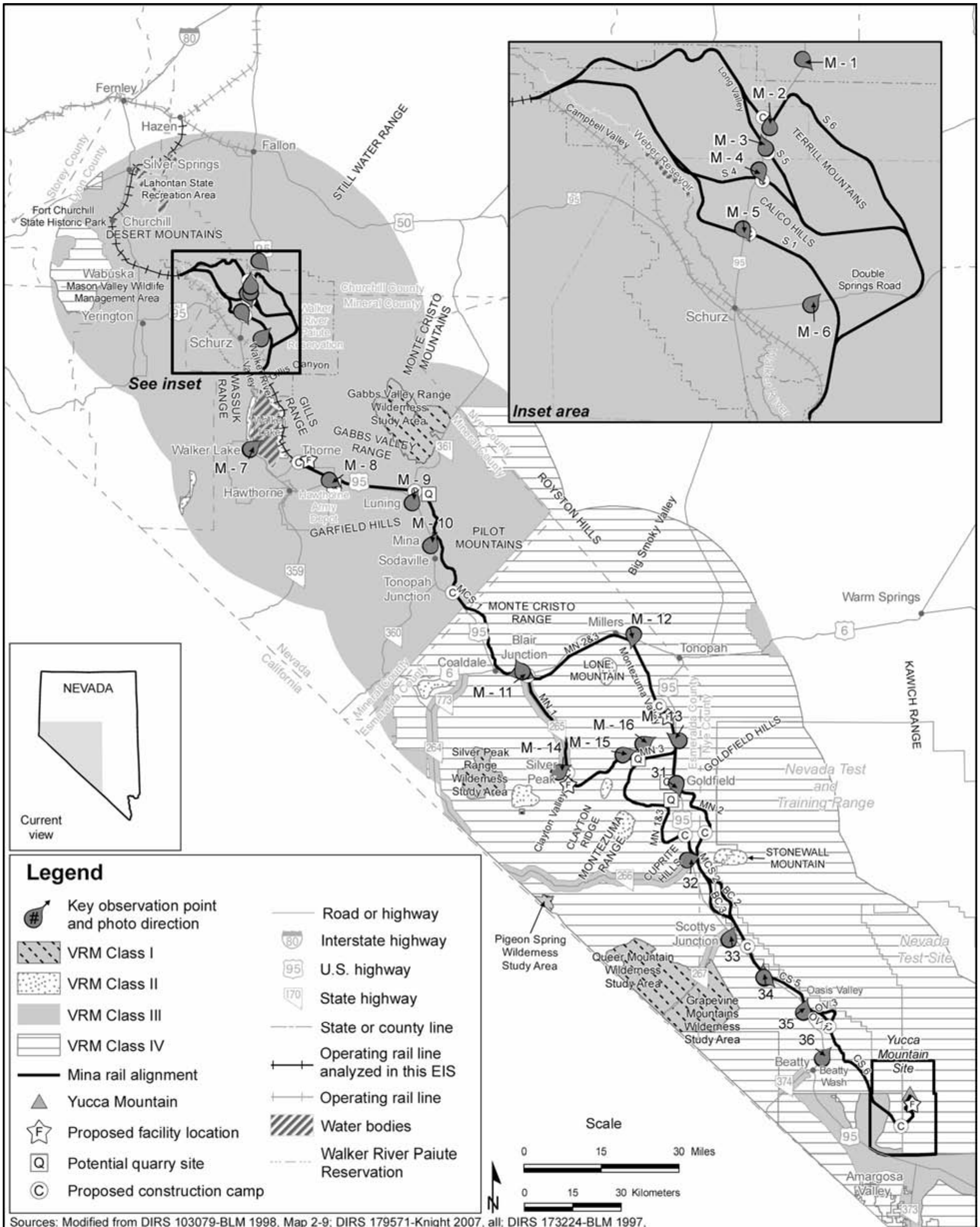
Special areas are lands where measures must be taken to protect visual values. Special areas often include designated natural areas, Wilderness Study Areas, scenic rivers, and scenic roads. Special areas are not necessarily unique or picturesque, but the management objective for a special area is to preserve its natural characteristics (DIRS 101505-BLM 1986, Section III.5).

Sections 3.3.3.3.2.1 through 3.3.3.3.2.11 describe visual resources along and near the Mina rail alignment alternative segments and common segments. The discussions highlight resources of high visual value, identify current visual resource management classifications, ***special areas***, and key observation points.

DOE excerpted visual resource management classifications for lands along the Mina rail alignment primarily from BLM resource management plans from districts the alignment would cross (DIRS 173224- BLM 1997, all; DIRS 103079-BLM 1998, all; DIRS 179560-BLM 2001). DOE confirmed these classifications through telephone communications, electronic mail, and meetings with BLM personnel responsible for visual resource management for the Las Vegas, Carson City, and Battle Mountain Districts (DIRS 174631-Quick 2005, all; DIRS 174632-Quick 2005, all; DIRS 176988-Quick 2006, all; DIRS 179571-Knight 2007, all). The BLM Las Vegas and Carson City Districts provided Geographic Information System data from their resource management plans as a source for mapping the visual resource management classes in their districts (DIRS 103079-BLM 1998, Map 2-9). Geographic Information System data provided by the BLM Carson City District were augmented with information on default classifications from the district (DIRS 179571-Knight 2007, all). The Department based visual resource classifications for the Battle Mountain BLM District on the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all). DOE developed visual resource management classifications for non-BLM lands using BLM methodology (DIRS 173053-BLM 1986, all; DIRS 173052-BLM 1984, all), considering scenic quality ratings reported in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, pp. 3-158 and 3-159) where available. Non-BLM areas adjacent to lands managed by the Carson BLM District were analyzed as Class III unless their scenic qualities warranted more restrictive classifications.

Figure 3-176 is a map of visual resource management classifications for lands surrounding the Mina rail alignment based on the sources identified above. There are no locations where the alternative segments and common segments would cross or be close to Class I lands, and few where the alternative segments would cross or be close to Class II lands. As the figure shows, most of the lands surrounding the alternative segments and common segments are Class IV or Class III lands.

DOE selected 22 key observation points along the Mina rail alignment to evaluate the visual impacts of constructing and operating the proposed railroad. (Note: Key observation points M-1 through M-16 are unique to the Mina rail alignment. Points 31 through 36 are along the portion of the Mina rail alignment that is the same as the Caliente rail alignment and DOE has not renumbered them for the Mina analysis.) Figure 3-176 shows the locations of key observation points.



Sources: Modified from DIRS 103079-BLM 1998, Map 2-9; DIRS 179571-Knight 2007, all; DIRS 173224-BLM 1997, pp. 6, 7, 27, and Map 8-9; DIRS 155970-DOE 2002, pp. 3-158 and 3-159.
Notes: VRM = Visual Resource Management; CS = common segment; MCS = Mina common segment; S = Schurz; MN = Montezuma; BC = Bonnie Claire; OV = Oasis Valley.

Figure 3-176. Visual resource management classifications and key observation points along the Mina rail alignment.

Appendix D, Aesthetics, contains photos taken at each key observation point. Table 3-94 lists visual resource management classes in the viewshed of each key observation point. Following BLM guidance, DOE selected most key observation points along travel routes or at use areas or potential use areas, and included critical viewpoints and typical views. Section 3.3.3.3.2 highlights areas of high visual value and other special areas, and identifies key observation points from which DOE analyzed impacts to these areas.

Table 3-94. Key observation points and visual resource management classes in the Mina rail alignment viewshed[a] (page 1 of 2).

Key observation point[b]	Location	Visual resource management classes[c]
M-1	U.S. Highway 95 looking over Rawhide Flats and the rail alignment against hills	Surrounding lands (III)
M-2 [d]	U.S. Highway 95 at intersection with county/Reservation road to Rawhide Flats, view of Schurz alternative segment 6 rail-over-road crossing	Surrounding lands (III)
M-3 [d]	U.S. Highway 95 in Long Valley, view of road-over-rail crossing of Schurz alternative segment 5	Surrounding lands (III)
M-4 [d]	U.S. Highway 95 at intersection with Weber Dam Road, view of Schurz alternative segment 4 road-over-rail crossing	Surrounding lands (III)
M-5 [d]	U.S. Highway 95, view of Schurz alternative segment 1 road-over-rail crossing	Surrounding lands (III)
M-6 [d]	Double Springs Road, view of Schurz alternative segment 1 at-grade crossing	Surrounding lands (III)
M-7	Town of Walker Lake, view across lake to Department of Defense Branchline South	Surrounding lands (II), western and eastern perimeters of Walker Lake (II)
M-8	U.S. Highway 95 just west of Hawthorne, view of potential Garfield Hills quarry facilities	Surrounding lands (III)
M-9	Town of Luning just off U.S. Highway 95, view of potential Gabbs Valley Range quarry site	Surrounding lands (III)
M-10	Town of Mina, corner of C Street and Hilda, view of Mina common segment 1	Surrounding lands (III)
M-11	Intersection State Route 265 and U.S. Highway 95 (Blair Junction), views of Mina common segment 1 toward Monte Cristo Range; south/southeast over State Route 265 to Montezuma alternative segment 1; west over Mina common segment 1	Surrounding lands (III and IV), State Route 265 (III), Monte Cristo Range (IV)
M-12	U.S. Highway 95 in Montezuma Valley, view south across Montezuma alternative segments 2 and 3 toward Lone Mountain	Surrounding lands (IV)
M-13	U.S. Highway 95, view toward Montezuma alternative segments 2 and 3 and potential Maintenance-of-Way Facility at Klondike	Surrounding lands (IV)
M-14	Main Street in Silver Peak (just past Chemetall Foote Corporation processing plant), view east over Montezuma alternative segment 1	Surrounding lands (III), State Route 265 (III)

Table 3-94. Key observation points and visual resource management classes in the Mina rail alignment viewshed[a] (page 2 of 2).

Key observation point[b]	Location	Visual resource management classes[c]
M-15	Silver Peak Road, view toward Montezuma alternative segment 1 and potential North Clayton quarry	Surrounding lands (IV)
M-16	Silver Peak Road intersection with road to Klondike, views over Montezuma alternative segments 2 and 3	Surrounding lands (IV)
31[b]	Alignment crossing U.S. Highway 95 south of Goldfield, view south-southeast over Montezuma alternative segment 2	Surrounding lands (IV)
32	U.S. Highway 95 at State Route 266, view east over Montezuma alternative segments 1, 2, and 3	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)
33	U.S. Highway 95 at State Route 267, view north-northeast over common segment 5	Surrounding lands (IV), State Route 267 (III)
34	U.S. Highway 95 (typical cut), view toward common segment 5 hill cuts	Surrounding lands (IV)
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)
36	U.S. Highway 95 and Beatty Wash access road, view northeast to construction access road	Surrounding lands (IV)

a. Appendix D contains photographs taken from each key observation point.
b. Key observation points M-1 through M-16 are unique to the Mina rail alignment. Points 31 through 36 are along the portion of the Mina rail alignment that is the same as the Caliente rail alignment and DOE has not renumbered them for the Mina analysis.
c. Sources: DIRS 155970-DOE 2002, pp. 3-158 and 3-159; DIRS 173224-BLM 1997, pp. 6, 7, and 27, and Map 8; DIRS 103079-BLM 1998, Map 2-9; DIRS 101811-DOE 1996, pp. 4-152 to 4-154; DIRS 179571-Knight 2007, all.
d. Key observation point is located on the Walker River Paiute Reservation.

3.3.3.3.2 Specific Visual Settings and Characteristics along Alternative Segments and Common Segments

3.3.3.3.2.1 Union Pacific Railroad Hazen Branchline. The Mina rail alignment would begin on an existing Union Pacific Railroad branchline near Hazen, Nevada. This existing rail segment crosses primarily Class III areas between Alternate U.S. Highway 50 and the former town site of Wabuska. The existing Union Pacific Railroad Hazen Branchline borders the boundaries of the Lahontan State Recreation Area and Fort Churchill State Historic Park, both considered Class III areas for this analysis.

Because DOE does not anticipate that it would make any modifications to this existing rail line (except during routine maintenance during the operations phase), DOE did not select key observation points along this portion of the Mina rail alignment. Figure 3-177 shows the existing line south of this segment through the Walker River Paiute Reservation as a point of reference for the appearance of an existing rail line in this general area.

3.3.3.3.2.2 Department of Defense Branchline North (Existing Rail Line from Wabuska to the Boundary of the Walker River Paiute Reservation). This existing rail line extends from the former town site of Wabuska to near the boundary of the Walker River Paiute Reservation. Along its route, the line borders the Mason Valley Wildlife Management Area. Department of Defense Branchline North passes exclusively through Class III areas.

Figure 3-177. View from Alternate U.S. Highway 95 along the existing Department of Defense Branchline through Schurz on the Walker River Paiute Reservation.

Because DOE does not anticipate that it would make any modifications to this existing rail line (except during routine maintenance during the operations phase), DOE did not select key observation points along this portion of the Mina rail alignment. Figure 3-177 shows the existing line south of this segment through the Walker River Paiute Reservation as a point of reference for the appearance of an existing rail line in this general area.

3.3.3.3.2.3 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross exclusively through areas considered Class III by DOE for the purpose of this analysis, primarily on the Walker River Reservation. At present, Department of Defense Branchlines North and South are linked by a rail line that runs near the western bank of the Walker River through the Reservation and the town of Schurz. DOE would remove this existing section of rail line, leaving the railbed and structures such as bridges and culverts in place. Figure 3-177 provides a view of this section of existing rail line from Alternate U.S. Highway 95.

Each Schurz alternative segment would begin in Campbell Valley west of the Walker River and south of the Desert Mountains, but each would take a different route shortly after crossing the Walker River.

Schurz alternative segment 1 would run east of the Walker River, passing within 1 kilometer (0.6 mile) of the Weber Reservoir. The alternative segment would travel through the Walker River Valley along the southeastern edge of the Calico Hills and around the northern end of the Gillis Range.

Schurz alternative segment 4 would run east of the Walker River, passing within 1 kilometer (0.6 mile) of the Weber Reservoir. The alternative segment would pass near the Calico Hills, and would travel east between the Terrill Mountains and the Calico Hills and around the northern end of the Gillis Range.

Schurz alternative segment 5 would skirt the southern edge of the Desert Mountains before crossing into Long Valley. From there, the alternative segment would run south down Long Valley and travel east between the Terrill Mountains and the Calico Hills and around the northern end of the Gillis Range.

Schurz alternative segment 6 would pass the southern edge of the Desert Mountains before crossing into Long Valley. The alternative segment would cross the Terrill Mountains into Rawhide Flats and travel east between the Terrill Mountains and the Calico Hills and around the northern end of the Gillis Range. Each Schurz alternative segment would connect to Department of Defense Branchline South near the northern edge of the Gillis Range.

Key observation points from U.S. Highway 95 include views toward the road-over-rail crossing of Schurz alternative segment 2 (M-4), north toward the road-over-rail crossing of Schurz alternative segment 5 in Long Valley (M-3), north toward the rail-over-road crossing of Schurz alternative segment 6 in the Terrill Mountains (M-2), southeast over Schurz alternative segment 6 crossing Rawhide Flats along the base of the Terrill Mountains (M-1), and south toward the road-over-rail crossing of Schurz alternative segment 1 in the Walker River Valley (M-5). A final point, east of the town of Schurz, looks northeast from Double Springs Road toward the ***at-grade crossing*** of Schurz alternative segment 1 (M-6).

3.3.3.3.2.4 Department of Defense Branchline South (Existing Rail Line, Walker Lake Area). Department of Defense Branchline South is an existing rail line extending south toward Walker Lake east of the Walker River. It comes no closer than 0.40 kilometer (.25 mile) from the shore as it traces the eastern edge of Walker Lake and proceeds southeast toward the Hawthorne Army Depot on the outskirts of the town of Hawthorne. The area around the Walker River north of the lake and the area around the Hawthorne Army Depot south of the lake are considered Class III areas. The eastern and western shores of Walker Lake are Class II areas. The existing rail line crosses the Class II lands on the eastern shore of the lake for 18 kilometers (11 miles).

A key observation point, in the town of Walker Lake on the western shore of Walker Lake, provides a view east over the lake toward the existing line (M-7). DOE chose this point to show the appearance of the existing rail line from the more heavily traveled western shore of Walker Lake and to demonstrate the view of an existing rail line at a distance (approximately 8 kilometers [5 miles]).

3.3.3.3.2.5 Mina Common Segment 1 (Hawthorne Army Depot to Blair Junction). Mina common segment 1 would cross through Class III lands as it heads southeast from Hawthorne between the Gabbs Valley Range and the Garfield Hills, and then south on the western side of the Pilot Mountains toward the Monte Cristo Range. Common segment 1 would then pass through Class IV areas as it passed the west and southwestern sides of the Monte Cristo Range. Key observation points provide views from U.S. Highway 95 looking west toward the potential Garfield Hills quarry site (M-8), from the town of Luning looking east toward Mina common segment 1 and the potential Gabbs Range quarry site (M-9), from a residential area in the town of Mina looking east toward Mina common segment 1 (M-10), and views both west and north across Mina common segment 1 from the intersection of State Route 265 and U.S. Highway 95 (M-11).

3.3.3.3.2.6 Montezuma Alternative Segments. Each Montezuma alternative segment would begin near Blair Junction (at the intersection of State Route 265 and U.S. Highway 95).

The southwestern segment, Montezuma alternative segment 1, would first pass south through a Class III area running the length of State Route 265 to the town of Silver Peak, and then turn east through the Class IV Clayton Valley and Montezuma Range. Parts of the Clayton Ridge and Montezuma Ranges are Class II, and Montezuma alternative segment 1 would come within 2.4 kilometers (1.5 miles) of the Class II Clayton Ridge area as it crossed Clayton Valley and within 2.1 kilometers (1.3 miles) of the Class II areas in the Montezuma Range as it crossed those mountains. Montezuma alternative segment 1 would continue in Class IV areas as it traveled through the hills near the town of Goldfield to a location just south of the intersection of U.S. Highway 95 and State Route 266. The BLM manages State Route 266 west of U.S. Highway 95 as a Class III area.

Montezuma alternative segment 2 would proceed northeast through Class IV areas along the Monte Cristo Range, and would come within 4 kilometers (2.5 miles) of the Class II Lone Mountain area. Montezuma alternative segment 2 would then cross exclusively through Class IV lands as it traveled south through the Montezuma Valley west of Tonopah to the hills near the town of Goldfield, then through Stonewall Flats near the border of the Nevada Test and Training Range, and finally west of Stonewall Mountain to just south of the intersection of U.S. Highway 95 and State Route 266. Montezuma alternative segment 2 would come no closer than 6.9 kilometers (4.3 miles) to the Class II Stonewall Mountain area.

Montezuma alternative segment 3 would proceed northeast through Class IV areas along the Monte Cristo Range, and would come within 4 kilometers (2.5 miles) of the Class II Lone Mountain area. Montezuma alternative segment 2 would then cross exclusively through Class IV lands as it traveled south through the Montezuma Valley west of Tonopah. Before leaving Montezuma Valley, the alternative segment would turn west into the Class IV Montezuma Valley area and south between Clayton Ridge and the Montezuma Range. Montezuma alternative segment 3 would come within 2.1 kilometers (1.3 miles) of the Class II areas in the Montezuma Range as it crossed those mountains. Montezuma alternative segment 3 would continue in Class IV areas as it traveled through the hills near the town of Goldfield to a location just south of the intersection of U.S. Highway 95 and State Route 266. The BLM manages State Route 266 west of U.S. Highway 95 as a Class III area.

Key observation points with views over Montezuma alternative segment 1 include the intersection of U.S. 95 and State Route 265 looking south (M-11), the main street in the town of Silver Peak looking east (M-14), and Silver Peak Road looking east (M-15). Key observation points with views over Montezuma alternative segments 2 and 3 are on U.S. Highway 95 looking west toward the proposed rail segment and

Lone Mountain (M-12), U.S. Highway 95 west toward the proposed rail segment and the Maintenance-of-way Facility (M-13), and Silver Peak Road east toward the proposed rail segment (M-16). A key observation point shows where Montezuma alternative segment 2 would cross U.S. Highway 95 at the south end of the town of Goldfield (31). A key observation point provides a view from the intersection of U.S. Highway 95 and State Route 266 over Montezuma alternative segments 1, 2, and 3 toward Stonewall Mountain (32).

3.3.3.3.2.7 Mina Common Segment 2 (Stonewall Flat Area). Common segment 2 would begin west of Stonewall Mountain and south of the intersection of U.S. Highway 95 and State Route 266. Mina common segment 2 would be in Class IV land and would never pass closer than 6.9 kilometers (4.3 miles) to the Class II Stonewall Mountain area.

Note: At this point, the Mina rail alignment becomes the same as the Caliente rail alignment. Although descriptions of the remaining alternative segments and common segments are the same as for the Caliente rail alignment, DOE has repeated them here for continuity. There are no Mina common segments numbered 3 and 4; instead, DOE has retained the numbering (common segments 5 and 6) used in the description of the Caliente alternative segment.

3.3.3.3.2.8 Bonnie Claire Alternative Segments. The Bonnie Claire alternative segments would cross Class IV lands to the southwest of the Nevada Test and Training Range and past Scotty's Junction at the intersection of U.S. Highway 95 and State Route 267, which the BLM manages as a Class III area west of U.S. Highway 95. A key observation point at Scottys Junction provides a view northeast toward the alternative segments (33).

3.3.3.3.2.9 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross Class IV land between the Bonnie Claire area and the Oasis Valley area. There are no visual resources of concern along this common segment and, therefore, no key observation points.

3.3.3.3.2.10 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross Class IV areas through Oasis Valley. A key observation point (35) is located north of Springdale, looking east over the Oasis Valley, showing a typical landscape. A key observation point (34) provides a view of a typical cut.

3.3.3.3.2.11 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would pass from the Oasis Valley area, near Beatty and across Beatty Wash, through the Nevada Test Site to the Yucca Mountain Site. State Route 374, entering Beatty, is a Class III area. Common segment 6 would cross approximately 10 kilometers (6.2 miles) of Class III lands before it entered the Nevada Test Site, but the segment is more than 15 kilometers (9.3 miles) from U.S. Highway 95 in this section. Land on the Nevada Test Site is not under BLM jurisdiction. Land on the Nevada Test Site that is visible from U.S. Highway 95 and which the rail alignment would cross is considered Class IV in this evaluation. A key observation point (36) is located north of Beatty, with views from U.S. Highway 95 over the Class IV lands surrounding the access road to Beatty Wash. The viewshed within the wash is considered a contributing element to cultural resources within the wash that are important to American Indians (DIRS 174205-Kane et al. 2005, p. 17). Beatty Wash and the rail alignment through it would not be visible from the highway. Therefore, DOE did not select key observation points in this area.

3.3.4 AIR QUALITY AND CLIMATE

This section describes the present air quality and climate characteristics along the Mina rail alignment and summarizes information from ***ambient air*** monitoring and meteorological data collection in the region. Section 3.3.4.1 describes the region of influence for air quality and climate; Section 3.3.4.2 describes general air quality characteristics in the Mina rail alignment region of influence; and Section 3.3.4.3 describes the climate characteristics in the Mina rail alignment region of influence.

3.3.4.1 Region of Influence

The region of influence of air quality and climate along the Mina rail alignment includes a small portion of Churchill County near Hazen, Lyon, Mineral (including the Walker River Paiute Reservation), Esmeralda, and Nye Counties. Historic data on pollutant emissions inventories and compliance status for the State of Nevada are calculated at the county level, and these data provide a basis for determining existing air quality in the region of influence and for use in analyzing potential impacts to air quality (see Section 4.3.4).

However, air-emissions fixed-point sources such as quarries and linear sources such as operating railroads can subject certain locations (known as receptors; for example, population centers) to higher localized levels of pollutants than a regional analysis would suggest. Therefore, DOE also selected more focused study locations within the region of influence in which to assess air quality impacts on specific receptors. These locations are the population centers near the Mina rail alignment (Schurz, Hawthorne, Mina, and Silver Peak) and two potential quarry sites northeast of Luning (Gabbs Valley Range) and southwest of Goldfield (Malpais Mesa).

3.3.4.2 Existing Air Quality

Air quality is determined by measuring concentrations of certain pollutants in the atmosphere. The U.S. Environmental Protection Agency designates an area as being ***in attainment*** for a particular pollutant if ***ambient*** concentrations of that pollutant are below the National ***Ambient Air Quality Standards***. The pollutants regulated under the State of Nevada and National Ambient Air Quality Standards are ***ozone***, ***carbon monoxide***, ***nitrogen dioxide***, ***sulfur dioxide***, ***particulate matter*** (***PM_{10}*** and ***$PM_{2.5}$***), and lead. Collectively, these pollutants are referred to as ***criteria air pollutants***. Table 3-95 lists the National Ambient Air Quality Standards for both the primary public health standard and the secondary public welfare standards in comparison to State of Nevada Ambient Air Quality Standards.

Areas in violation of one or more of these standards are classified as ***nonattainment areas***. If there is not enough air quality data to determine the status of a remote or sparsely populated area, then the U.S. Environmental Protection Agency lists the area as unclassifiable. However, for regulatory purposes, unclassifiable areas are considered to be in attainment. All portions of the Mina rail alignment would be within areas classified as in attainment for all National Ambient Air Quality Standards.

The most representative air quality data for the northern portion of the Mina rail alignment (Churchill, Lyon, and Mineral Counties and the Walker River Paiute Reservation) consists of historical monitoring data collected at three locations: Schurz for particulate matter; the Fort Churchill Power Plant (near Wabuska) for carbon monoxide, nitrogen dioxide, and sulfur dioxide (DIRS 182287-Hoelscher 2007, all); and Fallon for ozone (DIRS 179933-State of Nevada 2007, all). The Schurz data are recent ambient air quality data collected and reported on the Tribal Environmental Exchange Network; the Fort Churchill Power Plant data was collected in preparation for a Prevention of Significant Deterioration

Table 3-95. State of Nevada and National Ambient Air Quality Standards[a] (page 1 of 2).

Pollutant[b]	Averaging time over which pollutant is measured	Nevada standards concentration[b]	National primary standards[b]	National secondary standards[b]	Notes regarding the air quality standard
Ozone	1 hour	0.12 ppm (235 μg/m^3)	None	None	Not to be exceeded where the general public has access.
	8 hours	None	0.08 ppm (195 μg/m^3)	Same as primary	The 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations must not be exceeded.
Ozone, Lake Tahoe Basin	1 hour	0.10 ppm (195 μg/m^3)	None	None	Not to be exceeded where the general public has access.
Carbon monoxide	8 hours	9 ppm (10,500 μg/m^3) for elevations less than 1,500 meters[c] above mean sea level	9 ppm (10,500 μg/m^3) at any elevation	None	Not to be exceeded more than once per year.
		6 ppm (7,000 μg/m^3) for elevations greater than 1,500 meters above mean sea level			
Carbon monoxide (at any elevation)	1 hour	35 ppm (40,500 μg/m^3)	35 ppm (40,500 μg/m^3)		
Nitrogen dioxide	Annual arithmetic mean	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)	Same as primary	Not to be exceeded.
Sulfur dioxide	Annual arithmetic mean	0.03 ppm (80 μg/m^3)	0.03 ppm (80 μg/m^3)	None	Not to be exceeded.
	24 hours	0.14 ppm (365 μg/m^3)	0.14 ppm (365 μg/m^3)		Not to be exceeded more than once per year.
	3 hours	0.5 ppm (1,300 μg/m^3)	None	0.5 ppm (1,300 μg/m^3)	
Particulate matter as PM_{10}	Annual arithmetic mean	50 μg/m^3	None[d]	None[d]	The 3-year average of the weighted annual mean concentration at each monitor within an area.
	24 hours	150 μg/m^3	150 μg/m^3		Not to be exceeded more than once per year.[e]

Table 3-95. State of Nevada and National Ambient Air Quality Standards[a] (page 2 of 2).

Pollutant[b]	Averaging time over which pollutant is measured	Nevada standards concentration[b]	National primary standards[b]	National secondary standards[b]	Notes regarding the air quality standard
Particulate matter as $PM_{2.5}$	Annual arithmetic mean	None	15 μg/m³	Same as primary	The 3-year average of the weighted annual mean concentration from single or multiple community-oriented monitors.
	24 hours	35 μg/m³	35 μg/m³		The 3-year average of the 98th percentile of 24-hr concentrations at each population-oriented monitor within an area.[f]
Lead[g]	Quarterly arithmetic mean	1.5 μg/m³	1.5 μg/m³	Same as primary	Not to be exceeded.
Hydrogen sulfide[g]	1 hour	0.08 ppm (112 μg/m³)	None	None	Not to be exceeded.

a. Sources: Nevada Administrative Code Section 445B.22097 and 40 CFR 50.4 through 50.11.
b. PM_{10} = particulate matter with an aerodynamic diameter less than or equal to 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers; ppm = parts per million; μg/m³ = micrograms per cubic meter.
c. To convert meters to feet, multiply by 3.2808.
d. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006).
e. The 24-hour state standard is attained when the expected number of days per calendar year with a 24-hour average concentration above the standard is equal to or less than 1. The expected number of days per calendar year is based on an average of the number of exceedances per year for the last 3 years.
f. The 24-hour state standard is attained when the second highest of a 3-year rolling average of the 24-hour concentration at each monitor is less than the standard.
g. The proposed railroad would not emit lead or hydrogen; they are included here for completeness.

Permit Application for the Sierra Pacific Power Company during the late 1990s; and the nearest representative ozone data were data collected from Fallon by the Nevada Department of Environmental Protection. While the Fort Churchill air quality data are somewhat outdated, the little development or population growth in the region since that time strongly suggests that the Fort Churchill air quality data remains representative of the region in the vicinity of the Mina rail alignment. Additional air quality data are available, such as carbon monoxide from Minden and particulate matter from Fernley and Gardnerville, but these locations are more than 50 kilometers (30 miles), 18 kilometers (11 miles), and 50 kilometers, respectively, from the Mina rail alignment at its closest and are influenced by local emissions sources not representative of the region near the rail alignment.

The only gas-phase monitoring study made in the southern portion (Esmeralda and Nye Counties) of the Mina rail alignment is a special study at Yucca Mountain covering a 4-year period from October 1991 to September 1995 (DIRS 102877-CRWMS M&O 1999, all). The limited amount of air quality data reflects choices made by national and state agencies to focus monitoring resources either on population centers or pristine areas such as national parks. Additional data on particulate matter are available based on monitoring in the vicinity of Yucca Mountain from 1989 to 1997 (DIRS 102877-CRWMS M&O 1999, all; DIRS 102876-CRWMS M&O 1997, all; DIRS 147777-SAIC 1992, all; DIRS 147780-SAIC 1992, all), from three sites from 1998 to 2001 (DIRS 173738-DOE 2002, p. 42), and from two sites from 2002 through 2005 (DIRS 168842-DOE 2003, p. 42; DIRS 173740-DOE 2004, p. 36; DIRS 176801-Wills 2005, p. 38; DIRS 179948-DOE 2006, p. 40). While these data sets pertain to locations more than 110 kilometers (70 miles) from the Goldfield area, DOE believes they are representative of the ambient air quality along the southern portion of the Mina rail alignment, because no large emission sources or metropolitan areas are located in the region that would otherwise affect air quality. However, local natural sources of particulate matter, such as barren land or dry lake beds (such as Sarcobatus Flat), could generate higher localized concentrations of particulate matter.

In the vicinity of the southern portion of the Mina rail alignment, the closest location (other than the Yucca Mountain Site) for which there are recent air quality data is Pahrump, Nevada. However, Pahrump, which is in the extreme southern tip of Nye County, is 65 kilometers (40 miles) southeast of the Mina rail alignment and only monitors particulate matter. In recent years there have been exceedances of the National Ambient Air Quality Standards for particulate matter in Pahrump because there has been substantial construction activity and population growth in the Pahrump Valley. In September 2003, Pahrump entered into a Memorandum of Understanding (DIRS 178128-Nevada Division of Environmental Protection 2003, p. 5) with the U.S. Environmental Protection Agency, the State of Nevada, and Nye County to develop an air quality improvement plan, with quantified emission-reduction measures so that the emission reduction strategies will be adequate to ensure the area stays in attainment of the particulate matter standards and with the objective that the area would be in attainment by 2009. Pahrump has a background monitoring site intended to represent natural background concentrations of the northern Mojave Desert; however, some disturbed land in the vicinity of the monitor makes the site only representative of the local background in the Pahrump Valley. Because of Pahrump's distance from the Mina rail alignment and heavy construction activity and population growth, its air quality is not representative of the area of the Mina rail alignment.

Along the northern portion of the Mina rail alignment (Churchill, Lyon, and Mineral Counties, and the Walker River Paiute Reservation), the most representative air quality data was collected at three locations depending on the air pollutant. Particulate matter data for Schurz are available for the period 2004 to 2006 (DIRS 180073-Tribal Environmental Exchange Network 2007, all). Sierra Pacific Power Company collected data at the Fort Churchill Power Plant from January 1996 through May 1998; these data contain information on sulfur dioxide, nitrogen dioxide, and carbon monoxide (DIRS 182287-Hoelscher 2007, all). The nearest representative ozone information is data the Nevada Department of Environmental Protection collected at Fallon, Nevada, from 2000 through 2003 (DIRS 179933-State of Nevada 2007). Figure 3-178 shows meteorological and air quality monitoring station locations along the Mina rail alignment.

The Fort Churchill Power Plant data and the Nevada Bureau of Air Quality Planning data were designed to comply with the U.S. Environmental Protection Agency's *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (DIRS 101822-EPA 1987, all) and *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)* (DIRS 108989-EPA 1987, all).

DOE collected data from the Tribal Environmental Exchange Network. The data includes hourly meteorological and air quality monitoring data that starts in May 2003. Hourly air quality monitoring data includes PM_{10} and $PM_{2.5}$, using a method equivalent to the U.S. Environmental Protection Agency's integrated filter reference method, for continuous monitoring of PM_{10} and $PM_{2.5}$. DOE collected, processed, and conducted some limited quality assurance reviews on the meteorological and hourly air quality values to characterize the background PM_{10} and $PM_{2.5}$ concentration for the Walker River Paiute Reservation. To verify and assure the quality of the monitoring values, DOE performed statistical checks for reasonableness in the monitored values. Additionally, DOE prepared statistics on the rate of change to identify periods with possible equipment malfunction and remove data with extreme change in hourly concentrations.

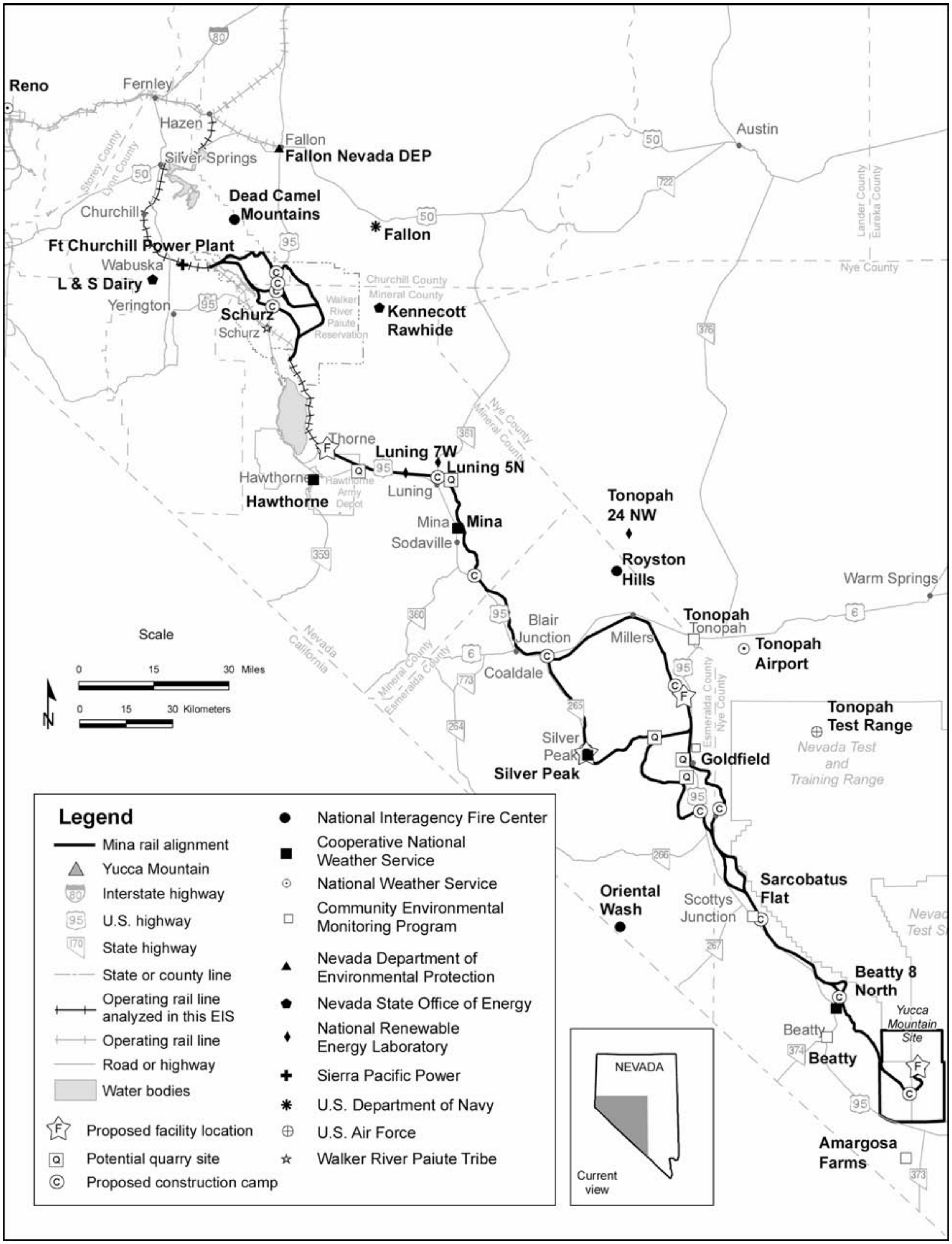


Figure 3-178. Meteorological and air monitoring stations along the Mina rail alignment.

DOE then screened the PM_{10} and $PM_{2.5}$ data for cases when the $PM_{2.5}$ was reported to be higher than the PM_{10} concentration. If the PM_{10} concentration was within three standard deviations of the mean hourly PM_{10} concentration, then the PM_{10} concentration was assumed correct and the $PM_{2.5}$ concentration set to missing; otherwise the PM_{10} was set to missing. After screening, DOE summarized both the PM_{10} and $PM_{2.5}$ concentrations for the daily and annual averages from the available dataset. To determine annual values, the Department determined quarterly averages of PM_{10} and $PM_{2.5}$ for those periods in which the hourly PM_{10} and $PM_{2.5}$ measurements, respectively, met a completeness criterion of at least 75 percent (DIRS 179932-EPA 1999, pp. 5 to 16).

Tables 3-96 through 3-98 summarize the particulate-matter air quality monitoring at Schurz, the air quality monitoring at Fort Churchill Power Plant, and the ambient ozone monitoring at Fallon, Nevada, respectively. These represent the best available information on the air quality along the northern portion of the Mina rail alignment. The second highest 24-hour and annual PM_{10} measurements were 99 and 23 micrograms per cubic meter, respectively. These measurements, made at Schurz in 2005, are approximately 66 and 46 percent of the national and state regulatory standard of 150 and 50 micrograms per cubic meter. Ambient concentrations of carbon monoxide, nitrogen dioxide, and sulfur dioxide measured at Fort Churchill were also well below the ambient air quality standards with their maximum percentages at 16, 8, and 18 percent of their respective national and state regulatory standards. For ozone there has been no exceedance of the 1- or 8-hour standard. The highest percentage was for the 8-hour ozone standard (0.08 parts per million), at 88 percent.

No ambient monitoring data were available for lead. However, DOE expects concentrations of lead to be far below the regulatory standard because there are no industrial sources in the region of influence (or near enough to transport this ***contaminant*** into the region of influence), and lead-based gasoline, previously the principal source of lead in the air, has been phased out.

Along the southern portion of the Mina rail alignment, the most representative data are from the DOE Environmental Safety and Health Department, which began air quality monitoring in the Yucca Mountain vicinity in 1989. The air quality network originally consisted of Sites YMP1 and YMP5; DOE added sites YMP6 and YMP9 in 1992.

Table 3-96. Maximum observed ambient air quality concentration at Schurz, Nevada (2004 to 2006) compared to the Nevada and National Ambient Air Quality Standards for particulate matter.[a,b]

Pollutant[c]	Averaging time	2004	2005	2006	High	Nevada and National Ambient Air Quality Standards
PM_{10}	24-hour highest	NA[d]	136	73	136	None
	24-hour second highest	NA	99	70	99	150
	Annual average	NA	23	11	23	50[e]
$PM_{2.5}$	24-hour 98th percentile	12	24	11	24[f]	35
	Annual average	3.4	3.9	5.4	5.4	15

a. Source: DIRS 180073-Tribal Environmental Exchange Network 2007, all.
b. Concentrations are shown in micrograms per standard cubic meter.
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers.
d. NA = not applicable.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 Federal *FR* 60853, October 17, 2006). The Nevada state standard remains in effect and is reported here.
f. For comparison to the air quality standard, the three-year average is 16 micrograms per cubic meter.

Table 3-97. Fort Churchill maximum observed ambient gaseous air quality concentration in comparison to the Nevada Standards for Air Quality and the National Ambient Air Quality Standards (in parts per million by volume).[a]

Pollutant	Nevada and NAAQS[b]	(1/10/96 to 12/31/96)	(1/1/97 to 12/31/97)	(1/1/98 to 03/1/98)	(4/1/98 to 5/11/98)
Carbon monoxide	35 (1 hour)	1.1	1.8	0.8	0.5
	9[c] (8 hour)	1.0	1.4	0.7	0.4
Nitrogen dioxide	0.053 (annual)	0.004	0.004	0.002	NA[d]
Sulfur dioxide	0.50 (3 hour)	0.072	0.020	0.005	0.004
	0.14 (24 hour)	0.025	0.019	0.003	0.003
	0.03 (annual)	0.002	0.002	0.002	NA

a. Source: DIRS 182287-Hoelscher 2007, all.
b. NAAQS = National Ambient Air Quality Standards.
c. Nevada Standards for Air Quality: less than 5,000 feet above mean sea level.
d. NA = not applicable.

Table 3-98. Fallon, Nevada, highest 1-hour and fourth highest 8-hour observed ozone concentration in comparison to the Nevada Standards for Air Quality and the National Ambient Air Quality Standards (in parts per million by volume).[a]

Pollutant	Nevada and NAAQS[b]	2000	2001	2002	2003
Ozone	0.12 (1 hour)	0.080	0.070	0.070	0.080
	0.08 (8 hour)	0.070	0.059	0.058	0.067

a. Source: DIRS 179933-State of Nevada 2007.
b. NAAQS = National Ambient Air Quality Standards; Nevada, federal standard is for 8-hour; state standard is for 1-hour.

DOE designed the air quality and meteorological monitoring program to comply with the U.S. Environmental Protection Agency's *On-Site Meteorological Program Guidance for Regulatory Modeling Applications* (DIRS 101822-EPA 1987, all) and *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)* (DIRS 108989-EPA 1987, all), and with U.S. Nuclear Regulatory Commission meteorological monitoring guidance (ANSI/ANS-2.5-1984, *Standard for Determining Meteorological Information at Nuclear Power Sites* and Regulatory Guide 1.23, Rev. 0, *Onsite Meteorological Programs*).

DOE monitored the criteria gaseous pollutants of carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide at YMP1 from October 1991 through September 1995. DOE also monitored the concentration of PM_{10} at YMP1; the ambient air quality monitoring program included sampling of PM_{10} every sixth day, based on the U.S. Environmental Protection Agency's representative schedule of sampling.

YMP5, the second site measuring PM_{10}, represented background conditions away from site activities at Yucca Mountain. Measurements at YMP5 began in April 1989 and continued until 2002.

In October 1992, DOE added two sites to measure PM_{10}:

- YMP6, along the western border of the Nevada Test Site where the Test Site meets the U.S. Air Force land in upper Yucca Wash, measured particulate matter that might be transported from Midway Valley toward the northwest through Yucca Wash (discontinued in September 1999)
- YMP9, at Gate 510 on the southern border of the Nevada Test Site, north of Amargosa Valley

Tables 3-99 and 3-100 summarize the results of the particulate-matter air quality monitoring programs. More information on the results of the sampling program is available in *Environmental Baseline File for Meteorology and Air Quality* (DIRS 102877-CRWMS M&O 1999, all); *Meteorological Monitoring Program Particulate Matter Ambient Air Quality Monitoring Report January through December 1996* (DIRS 102876-CRWMS M&O 1997, all); *Particular Matter Ambient Air Quality Data Report for 1989 and 1990* (DIRS 147777-SAIC 1992, all); and *Particular Matter Ambient Air Quality Data Report for 1991* (DIRS 147780-SAIC 1992, all).

Between 1989 and 1997, the highest 24-hour PM_{10} measurement was 67 micrograms per cubic meter. This measurement, made at Site YMP5 in 1995, is approximately 45 percent of the regulatory standard of 150 micrograms per cubic meter (40 CFR 50.4 through 50.11). The second-highest value at any site, which is the regulatory level for an exceedance of the air quality standard, was 49 micrograms per cubic meter at Site YMP1 in 1990, which is 33 percent of the standard (the second-highest value would be used to determine whether there was a violation of the PM_{10} standard).

The annual averages were between 6 and 13 micrograms per cubic meter (Site YMP9 [1998] and Site YMP5 [1989], respectively), which is less than 30 percent of the Nevada annual standard (50 micrograms per cubic meter).

Table 3-100 lists the annual highest and second-highest 24-hour concentrations, and the annual average PM_{10} concentration for the period 1998 to 2005 for YMP1, YMP5, and YMP9, and shows the measured levels of ambient particulate matter were well below the federal and Nevada particulate-matter standards.

Table 3-101 lists YMP1 results for monitoring of gaseous criteria pollutants (carbon monoxide, nitrogen dioxide, ozone, and sulfur dioxide) for each year of the 4-year monitoring period (1991 to 1995); for comparison, the National Ambient Air Quality Standards are also shown.

Ambient concentrations of carbon monoxide and sulfur dioxide were below the threshold of reliable detection of the instrument. Nitrogen dioxide occasionally registered values of a few hundredths of parts per million by volume, typically associated with nearby vehicle activity. The number of hours per operating quarter with measurements above the threshold was between 1 hour and 161 hours, which occurred from October through December 1993. The results listed in Table 3-101 are expressed in the units of the applicable standard (annual average of nitrogen dioxide), and the listed values are based on the threshold of reliable detection for that instrument.

DOE believes these measurements of particulate matter, carbon monoxide, nitrogen dioxide, and sulfur dioxide are representative of the air quality along the southern portion of the Mina rail alignment (Esmeralda County and south) because the region of influence has no large emission sources or metropolitan areas that would otherwise affect its air quality. However, in areas close to barren land or dry lake beds, there could be higher particulate-matter concentrations.

Ozone was the only gaseous criteria pollutant to routinely register ambient levels above the instrument threshold. Ozone levels never exceeded the regulatory limit for the 1-hour average standard (0.12 parts per million by volume). The highest 1-hour average was 0.096 parts per million. Note that the 1-hour average standard was withdrawn in 2005, and has now been replaced with an 8-hour average standard (0.08 parts per million). Ozone is formed in the atmosphere under the presence of sunlight, nitrogen oxides, and ***volatile organic compounds***. Ozone typically has the highest concentrations during warm weather because strong sunlight and high temperatures are more conducive to higher ambient concentrations. Approximately 90 percent of the warm-season hours had concentrations between 0.020 and 0.060 parts per million; only 44 hours had concentrations in excess of 0.080 parts per million.

Table 3-99. Summary of PM_{10} concentrations at sites in the vicinity of Yucca Mountain (1989 to 1997).[a,b,c]

Sampler	Averaging time	1989	1990	1991	1992	1993	1994	1995	1996	1997	High
Site YMP1	24-hour highest	41	62	33	30	30	39	21	60	31	62
	Second highest	27	49	25	24	22	26	20	23	21	49
	Annual average	12	12	10	12	10	10	10	10	9	12
Site YMP5	24-hour highest	40	51	45	49	21	42	67	57	26	67
	Second highest	38	43	33	27	20	23	21	35	19	43
	Annual average	13	10	10	12	9	9	10	10	9	13
Site YMP6	24-hour highest	NA	NA	NA	NA	21	25	14	32	59	59
	Second highest	NA	NA	NA	NA	21	20	13	21	18	21
	Annual average	NA	NA	NA	NA	9	7	7	9	8	9
Site YMP9	24-hour highest	NA	NA	NA	31	21	39	15	57	29	57
	Second highest	NA	NA	NA	31	21	19	14	28	19	31
	Annual average	NA	NA	NA	NA	9	8	7	10	8	10

a. Sources: DIRS 102877-CRWMS M&O 1999, p.13; DIRS 102876-CRWMS M&O 1997, p.13; DIRS 147777-SAIC 1992, p.13; DIRS 147780-SAIC 1992, p.13.
b. Concentrations are shown in micrograms per standard cubic meter ($\mu g/m^3$).
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; NA = samples were not taken during the corresponding monitoring period.

Table 3-100. Summary of PM_{10} concentrations at sites in the vicinity of Yucca Mountain (1998 to 2005).[a,b,c]

Sampler	Averaging time	1998	1999	2000	2001	2002	2003	2004	2005	High
Site YMP1	24-hour highest	30	18	38	23	52	33	24	32	52
	Second highest	17	34	34	19	37	17	19	29	37
	Annual average	8	8	11	8	10	8	8	9	11
Site YMP5	24-hour highest	26	24	45	27	NA	NA	NA	NA	45
	Second highest	18	21	39	25	NA	NA	NA	NA	39
	Annual average	7	8	12	10	NA	NA	NA	NA	12
Site YMP9	24-hour highest	22	18	36	22	43	39	27	26	43
	Second highest	20	17	33	19	39	38	21	26	39
	Annual average	6	8	11	9	10	11	9	9	11

a. Sources: DIRS 173738-DOE 2002, p. 42; DIRS 168842-DOE 2003, p. 44; DIRS 173740-DOE 2004, p. 36; DIRS 176996-DOE, 2005, p. 38; DIRS 179948-DOE 2006, p. 40.
b. Concentrations are shown in micrograms per standard cubic meter ($\mu g/m^3$).
c. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; NA = samples were not taken during the corresponding monitoring period.

Table 3-101. Site YMP1 maximum observed ambient gaseous air quality concentration in comparison to the Nevada Standards for Air Quality and the National Ambient Air Quality Standards (in parts per million by volume).[a]

Pollutant	Nevada and NAAQS[b]	Year 1 (10/91 to 9/92)	Year 2 (10/92 to 9/93)	Year 3 (10/93 to 9/94)	Year 4 (10/94 to 9/95)
Carbon monoxide	35 (1 hour)	0.2	0.2	0.2	0.2
	9[c] (8 hour)	0.2	0.2	0.2	0.2
Nitrogen dioxide	0.053 (annual)	0.0020	0.0020	0.0021	0.0021
Ozone[d] (for Nevada ambient air quality only)	0.12 (1 hour) 0.08 (8 hour)	0.096 (1 hour)	0.093 (1 hour)	0.081 (1 hour)	0.083 (1 hour)
Sulfur dioxide	0.50 (3 hour)	0.002	0.002	0.002	0.002
	0.14 (24 hour)	0.002	0.002	0.002	0.002
	0.03 (annual)	0.002	0.002	0.002	0.002

a. Source: DIRS 102877-CRWMS M&O 1999, p.14; 40 CFR 50.4 through 50.11.
b. NAAQS = National Ambient Air Quality Standards.
c. Nevada Standards for Air Quality: less than 5,000 feet above mean sea level.
d. The 1-hour ozone standard of 0.12 parts per million, in place during the listed years, was phased out in 2005 and replaced with an 8-hour ozone standard of 0.08 parts per million.

Available data for Death Valley National Park (for 1995 to 2004), 50 kilometers (30 miles) to the west of the southern portion of the Mina rail alignment, reported a highest 1-hour average concentration of 0.095 parts per million (DIRS 176115-EPA 2005, all), which is similar to the ozone values measured at Yucca Mountain. Ozone concentrations to the east are anticipated to be even lower because of their greater distance from emission sources.

Again, no ambient monitoring data were available along the southern portion of the rail alignment for lead. However, DOE expects concentrations of lead to be far below the regulatory standard because there are no industrial sources in the region of influence (or near enough to transport this contaminant into the region of influence), and lead-based gasoline, previously the principal source of lead in the air, has been phased out.

No ambient monitoring data were available for $PM_{2.5}$ and PM_{10}, but $PM_{2.5}$ can be estimated from measurements of ambient PM_{10}. In the region of influence, nearly all PM_{10} would be generated from the resuspension of surface-level soil and mineral materials. A U.S. Department of Agriculture study on wind erosion in the western United States found that over all soils, the fraction of PM_{10} as $PM_{2.5}$ was about 15 percent, ranging from 10 to 30 percent (DIRS 173838-Hagen 2001, p. 1). To be conservative, DOE applied the upper end of this range (30 percent) to the ambient PM_{10} data collected at Yucca Mountain (Sites YMP1, YMP5, and YMP9), and the resulting data indicated the highest expected 24-hour concentration of $PM_{2.5}$ would be 16 micrograms per cubic meter, and the highest expected annual average concentration would be 4 micrograms per cubic meter. These figures are 46 and 26 percent of the standards for $PM_{2.5}$. Table 3-102 summarizes these results and indicates that $PM_{2.5}$ would be well below the National Ambient Air Quality Standards at all locations along the Mina rail alignment.

3.3.4.3 Climate

The Mina rail alignment would cross desert and ***semi-desert*** areas that generally have abundant hours of cloud-free days, low annual precipitation, and large daily ranges in temperature.

Table 3-102. Maximum observed ambient air quality concentration at sites in the vicinity of Yucca Mountain (1998 to 2003) compared to the National Ambient Air Quality Standards for particulate matter.[a,b,c]

Sampler	Nevada and NAAQS[d]	1998	1999	2000	2001	2002	2003	2004	2005	High
PM_{10}	24 hour: 150	30	24	45	27	52	39	27	32	52
	Annual: 50[e]	8	8	12	10	10	11	9	9	12
Estimated[f] $PM_{2.5}$	24 hour: 35	9	7	14	8	16	12	8	10	16
	Annual: 15	2	2	4	3	3	3	3	3	4

a. Sources: DIRS 173738-DOE 2002, p. 42; DIRS 168842-DOE 2003, p. 44; DIRS 173740-DOE 2004, p. 36; DIRS 176996-DOE, 2005, p. 38; DIRS 179948-DOE 2006, p. 40; and 40 CFR 50.4 through 50.11.
b. PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers.
c. Concentrations are shown in micrograms per standard cubic meter.
d. NAAQS = National Ambient Air Quality Standards.
e. The U.S. Environmental Protection Agency revoked the annual PM_{10} standard effective December 18th, 2006 (71 Federal *FR* 60853, October 17, 2006).
f. Estimated based on upper-end range of PM_{10} data assuming 30 percent of PM_{10} is $PM_{2.5}$ (DIRS 173838-Hagen 2001, p 1).

To characterize the existing climate, DOE collected meteorological data from 41 meteorological monitoring stations within the Mina rail alignment region of influence (see Figure 3-178 and Table 3-103).

The following eight groups operated these stations:

- National Oceanic and Atmospheric Administration
- Community Environmental Monitoring Program
- DOE Environment, Safety and Health Programs Department Network
- Tribal Environmental Exchange Network
- National Renewable Energy Laboratories
- Nevada State Office of Energy
- National Interagency Fire Center - Remote Automated Weather Station
- U.S. Air Force

The Meteorological Data Acquisition Network is a network of meteorological stations operated by the National Oceanic and Atmospheric Administration, Air Resources Laboratory/Special Operations and Research Division. The Community Environmental Monitoring Program is a joint effort between the DOE Nevada Operations Office, the University of Nevada Desert Research Institute, and the Community College System of Nevada, and is a network of monitoring stations in communities surrounding the Nevada Test Site that check the ***environment*** for ***radioactivity*** and check a variety of meteorological parameters. The Walker River Paiute Reservation station is part of a national network of meteorological stations operated by each tribe and is reported through the Tribal Environmental Exchange Network. The National Renewable Energy Laboratories supports the collection of wind data operated by the Desert Research Institute for potential site locations for wind energy development. The Nevada State Office of Energy operates a similar program for the collection of wind monitoring data on potential site locations for wind energy development. The Remote Automated Weather Station operated by the National Interagency Fire Center is a network of meteorological stations that monitor weather data that assists land management agencies with a variety of efforts primarily directed at rating fire danger. The U.S. Air Force has historically operated a meteorological station from time to time on the Nevada Test and Training Range at the Tonopah Test Range and archives this data with the Air Force Combat Climatology Center.

Table 3-103. Meteorological stations in the Mina rail alignment air quality and climate region of influence[a,b] (page 1 of 2).

Station name	Elevation (in meters)[c]	Source	Wind data
Reno	1,341	WRCC	Yes
Fallon	1,199	WRCC	Yes
Dead Camel Mtn	1,369	RAWS	Yes
L & S Dairy	1,323	NSOE	Yes
Kennecott Rawhide	1,555	NSOE	Yes
Schurz	1,280	TREX	Yes
Hawthorne	1,286	WRCC	NA
Luning 7W	1,355	NREL	Yes
Luning 5N	1,524	NREL	Yes
Mina	1,386	WRCC	NA
Tonopah 24NW	1,535	NREL	Yes
Royston Hills	1,555	RAWS	Yes
Tonopah	1,836	CEMP	Yes
Tonopah Airport	1,655	WRCC	NA
Silverpeak	1,298	WRCC	NA
Goldfield	1,734	CEMP	Yes
Tonopah Test Range	1,691	Air Force	Yes
Sarcobatus Flat	1,226	CEMP	Yes
Oriental Wash	1,250	RAWS	Yes
Beatty 8 North	1,082	WRCC	NA
Beatty	1,007	CEMP	Yes
Amargosa Farms	746	CEMP	Yes
Mercury	1,009	WRCC	Yes
07	1,663	MEDA	NA
14	1,432	MEDA	NA
18	1,533	MEDA	NA
21	1,512	MEDA	NA
24	1,505	MEDA	NA
25	835	MEDA	NA
26	1,133	MEDA	NA
27	1,370	MEDA	NA
42	880	MEDA	NA
NTS 60 (YMP1)	1,136	DOE	NA
Gate 510 (YMP9)	838	DOE	NA
Fortymile Wash (YMP5)	952	DOE	NA
Knothead Gap (YMP8)	1,130	DOE	NA
Sever Wash (YMP7)	1,080	DOE	NA
Yucca Mountain (YMP2)	1,478	DOE	NA
Coyote Wash (YMP3)	1,278	DOE	NA

Table 3-103. Meteorological stations in the Mina rail alignment air quality and climate region of influence[a,b] (page 2 of 2).

Station Name	Elevation (in meters)[c]	Source	Wind data
Alice Hill (YMP4)	1,234	DOE	NA
WT-6 (YMP6)	1,315	DOE	NA

a. Sources: DIRS 165987-WRCC 2002; DIRS 180073-Tribal Council Exchange Network 2007, all.
b. CEMP = Community Environmental Monitoring Program; DOE = DOE Environment, Safety and Health Programs Department Network; MEDA = Meteorological Data Acquisition Network; NREL = National Renewable Energy Laboratory; RAWS = Remote Automated Weather Station, NSOE = Nevada State Office of Energy; NA = not available; NTS = Nevada Test Site; WRCC = Western Regional Climate Center; YMP = Yucca Mountain Project, TREX = Tribal Environmental Exchange Network.
c. To convert meters to feet, multiply by 3.2808.

DOE acquired data not directly available through these programs through the Western Regional Climate Center (DIRS 165987-WRCC 2002, all), which maintains historical climate databases for most of the climate stations and operational National and Military Weather Service stations throughout the western United States, including a network of stations that collect daily climate observations.

Table 3-103 lists the stations and their respective elevations in the Mina rail alignment air quality and climate region of influence. All stations collected temperature and precipitation data, and Table 3-103 also identifies those stations that collected wind speed and direction data. The range of elevations over which weather data were collected is approximately the same as the elevation range of the Mina rail alignment – from 747 meters (2,450 feet) at the Amargosa Farms Station to 1,836 meters (6,023 feet) at Tonopah.

The Mina rail alignment would cross a variety of topographic features, ranging from mountain passes to sage-covered deserts. The alignment elevations range from 1,280 meters (4,200 feet) near Schurz in Mineral County to 1,860 meters (6,090 feet) at Goldfield Summit in Esmeralda County and back down to 1,080 meters (3,540 feet) near the end of the Mina Rail Alignment at Yucca Mountain. These elevation changes drive a wide variation in temperature and precipitation.

From north to south, the Mina rail alignment would lie within and be exposed to the climatic conditions of Churchill, Lyon, Mineral (including the Walker River Paiute Reservation, the bulk of which lies within Mineral County), Esmeralda, and Nye Counties, as described in Sections 3.3.4.3.1 through 3.3.4.3.5. The climate discussion that follows is based on the climatic data collected from the sites listed in Table 3-103.

3.3.4.3.1 Churchill County

A small portion of the Mina rail alignment would cross through western Churchill County, at an elevation of approximately 1,200 meters (4,000 feet). Annual average temperature in this portion of Churchill County is approximately 13° Celsius (55° Fahrenheit). Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer. Daily temperature variations are smaller during the winter. Summertime mean maximum temperatures are approximately 33° Celsius (92° Fahrenheit), and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are approximately minus 5° Celsius (23° Fahrenheit) in December and January.

Precipitation occurs about equally throughout the year although slightly more occurs during the winter (November through March). Average annual precipitation is less than 130 millimeters (5 inches), but daily precipitation levels can be as high as 25 millimeters (1 inch), and historical maximums have exceeded 50 millimeters (2 inches) per day. Occasional summer thunderstorms can produce heavy rains that can cause flash floods. From November through April, precipitation might fall as snow. Mean average total snowfall is about 150 millimeters (6 inches).

Local topography influences winds in western Churchill County along the Mina rail alignment. Wind speeds are highest in the spring and occasionally generate dust storms. Annual average wind speed is 2.8 meters per second (6.3 miles per hour), with calm conditions (wind speeds of less than 0.58 meter per second [1.3 miles per hour]) occurring about 20 percent of the time.

3.3.4.3.2 Lyon County

The Mina rail alignment would cross through Lyon County from just west of the Lahontan Dam around Silver Springs and then past Wabuska and the Fort Churchill siding. The area lies to the east of the moisture-trapping Sierra Nevada Mountains. Mina rail alignment elevations through the county would range from about 1,200 meters (3,900 feet) to about 1,300 meters (4,300 feet). This area experiences abundant hours of cloud-free days, low annual precipitation (less than 150 millimeters [6 inches] per year), and large diurnal ranges in temperature.

Within Lyon County, the mean annual temperature along the Mina rail alignment is approximately 13° Celsius (55° Fahrenheit) north of Wabuska; south of Wabuska, temperatures are moderated due to cold air drainage along the Walker River, with a mean annual air temperature of 10° Celsius (50° Fahrenheit). Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer. Summertime mean maximum temperatures are approximately 41° Celsius (105° Fahrenheit); while in the vicinity of the Walker River they average approximately 34° Celsius (93° Fahrenheit). Winter mean minimum temperatures are approximately minus 12° Celsius (10° Fahrenheit) north of Wabuska, while in the vicinity of the Walker River they average approximately minus 8.9° Celsius (16° Fahrenheit). Annual precipitation in Lyon County averages less than 150 millimeters (6 inches) per year, with higher amounts found at higher elevations and lower amounts at lower elevations. During the summer, occasional thunderstorms can produce heavy rains and cause flash floods. Daily precipitation levels have occasionally exceeded 25 millimeters (1 inch), but generally are much less. Precipitation from November through April might fall as snow, particularly at higher elevations. Snowfall averages are around 76 to 180 millimeters (3 to 7 inches).

Local topography in Lyon County strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Highest wind speeds occur in the spring, and occasionally generate dust storms. Annual average wind speeds are around 2.3 meters per second (5.1 miles per hour), with calm conditions occurring more than 30 percent of the time, mostly during the night.

3.3.4.3.3 Mineral County and the Walker River Paiute Reservation

The Mina rail alignment would cross through Mineral County and the Walker River Paiute Reservation from just east of the Ft. Churchill Siding and then around Schurz and Walker Lake to Redlich Summit. The area lies to the east of the moisture-trapping Sierra Nevada Mountains. Elevations of the alignment through the county and reservation would range from about 1,300 meters (4,300 feet) to about 1,500 meters (5,000 feet). This area experiences abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large diurnal ranges in temperature.

Within Mineral County and the Walker River Paiute Reservation, the mean annual temperature along the Mina rail alignment in the vicinity of the Walker River is approximately 11° Celsius (52° Fahrenheit); south of Walker Lake the mean air temperature is slightly warmer at 13° Celsius (55° Fahrenheit). This is due to the absence of the nighttime cold air drainage winds along the Walker River. Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer. Summertime mean maximum temperatures are approximately 34° Celsius (93° Fahrenheit) at northerly locations and around 36° Celsius (96° Fahrenheit) at southerly locations, and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are approximately minus 8° Celsius (17° Fahrenheit) in the vicinity of Walker River and minus 6° Celsius (22° Fahrenheit) in the southern portion of the county.

Annual precipitation in Mineral County and the Walker River Paiute Reservation averages less than 130 millimeters (5 inches) per year, with higher amounts at higher elevations and lower amounts at lower elevations. During the summer, occasional thunderstorms can produce heavy rains and cause flash floods. Daily precipitation levels have occasionally exceeded 50 millimeters (2 inches), but generally are much less than 25 millimeters (1 inch) of rain. Precipitation from November through April might fall as snow, particularly at higher elevations. Snowfall averages are around 76 to 180 millimeters (3 to 7 inches).

Local topography in Mineral County and the Walker River Paiute Reservation strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Highest wind speeds occur in the spring and occasionally generate dust storms. Annual average wind speeds at the Schurz station on the Walker River Paiute Reservation, which are representative of the Mina rail alignment in the vicinity of Walker River, are around 1.7 meters per second (3.9 miles per hour); slightly more than 20 percent of the time the area experiences calm conditions. Farther south wind speeds are higher, with an annual average wind speed of 3.6 meters per second (8.1 miles per hour); slightly more than 4 percent of the time the area experiences calm conditions.

3.3.4.3.4 Esmeralda County

The Mina rail alignment would cross through Esmeralda County from Redlich Pass to Lida Junction and would be east of the highest peaks of the Sierra Nevada and White Mountain ranges. Elevations of the alignment through the county would range from about 1,300 meters (4,300 feet) to around 1,700 meters (5,500 feet). This area experiences abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large daily ranges in temperature.

Within Esmeralda County, the mean annual temperature along the Mina rail alignment is approximately 10° Celsius (50° Fahrenheit). Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer months. Summertime mean maximum temperatures are approximately 32° Celsius (90° Fahrenheit) at higher elevations and around 37° Celsius (98° Fahrenheit) at lower elevations, and are accompanied by low relative humidity (commonly less than 10 percent). Winter mean minimum temperatures are approximately minus 7° Celsius (20° Fahrenheit) in December and January.

Annual precipitation in Esmeralda County averages less than 180 millimeters (7 inches) per year, with higher amounts found at higher elevations and lower amounts at lower elevations. During the summer, occasional thunderstorms can produce heavy rains and cause flash floods. Daily precipitation levels have occasionally exceeded 50 millimeters (2 inches), but generally are less than 25 millimeters (1 inch) of rain. Precipitation from October through April might fall as snow, particularly at higher elevations. Snowfall averages are around 380 millimeters (15 inches) at higher elevations.

Local topography in Esmeralda County strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Highest wind speeds occur in the spring, and occasionally generate dust storms. Annual average wind speeds at the Goldfield station are around 2.7 meters per second (6 miles per hour); slightly more than 5 percent of the time the area experiences calm conditions.

3.3.4.3.5 Nye County

Through southern Nye County, the Mina rail alignment would lie to the east of the Grapevine and Funeral Mountains as well as the southern Sierra Nevada Mountains, a large mountain ***barrier*** that prevents much of the moist Pacific Ocean air from reaching the area. The result is that most of the area is largely desert. The Mina rail alignment through Nye County principally drops in elevation starting from approximately 1,400 meters (4,700 feet) at Stonewall Pass to 1,100 meters (3,500 feet) near the end of the Mina rail alignment at Yucca Mountain, and presents a wide variation in temperature and precipitation. In general, the climatic features can be described as abundant hours of cloud-free days, low annual precipitation (less than 250 millimeters [10 inches] per year), and large daily ranges in temperature.

In Nye County, the mean annual temperature along the Mina rail alignment ranges from approximately 16° Celsius (61° Fahrenheit) at lower elevations to approximately 13° Celsius (56° Fahrenheit) at the highest elevations. Because of the arid climate, it is common for strong daytime heating and rapid nighttime cooling to result in large variations in temperature, particularly during the summer months. Daily temperature variations are smaller during winter months, and less pronounced at higher elevations. At the lowest elevations along the Mina rail alignment, summertime maximum temperatures frequently exceed 38° Celsius (100° Fahrenheit), and are accompanied by low relative humidity (commonly less than 10 percent).

Annual precipitation averages less than 250 millimeters (10 inches) per year at all locations across southern Nye County, with most precipitation occurring during the winter months. Along the Mina rail alignment, precipitation is lowest from the Sarcobatus Flat station to the Beatty station, averaging just 76 to 100 millimeters (3 to 4 inches) per year because of the ***rain shadow*** effects from the Sierra Nevada and Amargosa Mountain Ranges. At higher elevations, a secondary peak in rainfall (associated with increased thunderstorm activity) occurs during the late summer months; at lower elevations, this precipitation often evaporates before reaching the ground. The thunderstorms occasionally produce heavy rains that can cause flash floods. Daily precipitation levels can be high, and historical maximums have reached 61 millimeters (2.4 inches) at the Sarcobatus Flat station, with a number of locations exceeding 41 millimeters (1.6 inches).

From November through April, precipitation in southern Nye County along the Mina rail alignment might fall as snow. Mean average snowfall is about 50 to 130 millimeters (2 to 5 inches).

Local topography in southern Nye County strongly influences winds along the Mina rail alignment. Local winds are generally channeled by topography, with prevailing wind direction oriented along valley axes. Wind speeds are highest in the spring, and occasionally generate dust storms at playas. The extreme highest wind speeds are along ridgetops. Winds of more than 40 meters per second (90 miles per hour) have been recorded along ridgetops at the Nevada Test Site station. Annual average wind speeds are much lower, with annual average speeds of 2.4 meters per second (5.4 miles per hour) at Sarcobatus Flat and 2.2 meters per second (4.9 miles per hour) at Beatty. Through southern Nye County, calm conditions are most frequent at Sarcobatus Flat station, and characterize wind conditions in the area about 7 percent of the time.

3.3.5 SURFACE-WATER RESOURCES

This section describes surface-water resources along the Mina rail alignment. Surface-water resources include streams, washes, playas, ponds, wetlands, floodplains, and springs. Section 3.3.5.1 describes the region of influence for surface-water resources along the Mina rail alignment; Section 3.3.5.2 is a general overview of surface-water features along the rail alignment; and Section 3.3.5.3 describes specific surface-water features for the alternative segments and common segments. Section 3.3.5.2.3 and 3.3.5.2.4 describe wetlands and floodplains, respectively, from a regulatory perspective; Section 3.3.7, Biological Resources, describes wetlands from a habitat perspective. Appendix F (Floodplain and Wetlands Assessment) addresses compliance with Executive Orders 11988, *Floodplain Management*, and 11990, *Protection of Wetlands*, in more detail.

3.3.5.1 Region of Influence

The Mina rail alignment region of influence for surface-water resources is limited in most cases to the nominal width of the construction right-of-way. Because of the types of land-disturbing activities that would take place during rail line construction, the construction right-of-way would be susceptible to erosion and changes in surface-water flow patterns. Spills (of, for example, fuel, paint, or lubricants) during railroad construction and operations could also affect this area.

In some cases, the region of influence for surface water extends beyond the construction right-of-way. In places where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage could carry eroded soil, sediment, or spills downstream, the region of influence extends beyond the construction right-of-way. Within the region of influence, there could be impacts to floodwaters such that they would back up on the upstream side of the rail line, while there could be impacts to water quality if potential pollutants travel downstream during a storm event without precipitating out (soils from erosion) or becoming too dilute (petroleum-based lubricants or fuels) to detect. For purposes of analysis, DOE screened the area within 1.6 kilometers (1 mile) of the centerline of the rail alignment for surface-water resources that could be indirectly affected.

Surface-Water Terms

An **ephemeral stream** or ephemeral drainage has a channel bed above the normal water table and only flows in direct response to precipitation or snowmelt within its drainage basin.

An **intermittent stream** or intermittent drainage has a channel bed that fluctuates above or below the normal water table along its length, and might or might not have flow within it during any particular time or at any particular location. The presence of flow within the channel is determined by its channel elevation in relation to the water table, precipitation events, or snowmelt within its drainage basin.

A **wash** or drainage in the western United States generally refers to the dry streambed of an intermittent or ephemeral stream. In this Rail Alignment EIS, wash is used interchangeably with intermittent and ephemeral streams.

A **perennial stream** or perennial drainage receives groundwater into its channel and its stream bed is normally below the water table. During years with normal precipitation, a perennial stream will have constant flow.

A **playa** is normally a dry lake bed that can contain water in response to seasonally high runoff.

Evapotranspiration is a combination of processes through which water is transferred to the atmosphere from evaporation from open water and bare soil, and transpiration from vegetation.

3.3.5.2 General Environmental Setting and Characteristics

Important characteristics of hydrologic systems in the region of influence include ***ephemeral streams*** and playas. Ephemeral surface-water features can be dry over multiple seasons or even years during droughts, but can have multiple periods of flow or standing water during wet periods, as during the winter of 2004-2005. Central and southern Nevada are characterized by low precipitation and high annual ***evapotranspiration*** rates typical of desert climates, as described in Section 3.3.4, Air Quality and Climate. Because of the arid climate and the terrain (that is, north-south trending, parallel mountain ranges with broad, intervening valleys) in this area, surface water generally evaporates before it can flow out of the drainage basin. Typically, surface drainage in this area remains within its topographically defined water basin; that is, surface water generally flows to low areas such as lakes, flats, or playas.

Surface water systems are typically defined in terms of watersheds (or basins). For water planning and management purposes, the State of Nevada is divided into discrete hydrologic units delineated by 14 major hydrographic regions that are subdivided into 256 hydrographic areas (DIRS 103406-Nevada Division of Water Planning 1992, p. all). In this Rail Alignment EIS, watersheds (or basins) are referred to as hydrographic regions. A region is defined as a geographic area drained by a single major stream or an area consisting of a drainage system comprised of streams and often natural or manmade lakes.

Overall, most surface-water features described in this section are ***ephemeral drainage*** features that intermittently contain flowing water. Walker River and some of its tributaries near the beginning of the Mina rail alignment are the exceptions, where surface-water flow is perennial. This section describes surface-water features in terms of the hydrographic regions in which they are located. Figure 3-179 shows the hydrographic basins within Nevada and the boundaries for the four hydrographic regions the Mina rail alignment would cross. Most of the existing Union Pacific Railroad Hazen Branchline would be within the Carson River Basin, while a small portion of this line, the existing Department of Defense Branchlines (North, through Schurz, and South), and a small portion of Mina common segment 1 would be within the Walker River Basin. The majority of the rail alignment (most of Mina common segment 1, the Montezuma alternative segments, Mina common segment 2, the Bonnie Claire alternative segments, and Mina common segment 5) would be within the Central Region. The Oasis Valley alternative segments and Mina common segment 6 would be in the Death Valley Basin.

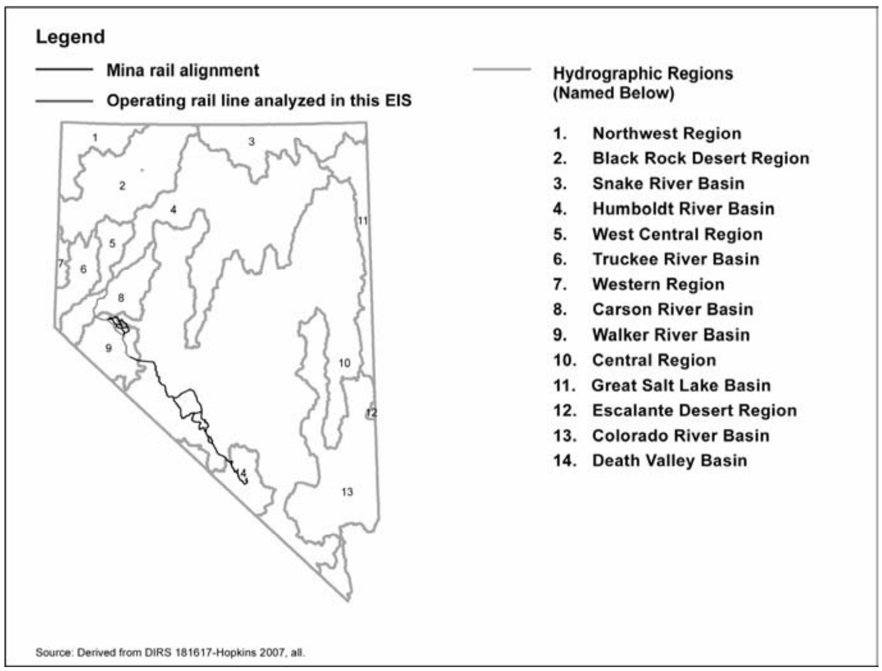


Figure 3-179. Nevada hydrographic areas crossed by the Mina rail alignment.

3.3.5.2.1 Surface Drainage Features (Streams and Playas)

As described in Section 3.3.1, Physical Setting, the Mina rail alignment would pass through numerous valleys and over or around numerous mountain ranges. The need for relatively gentle curves and gradients sets physical limitations on the design of the rail line that would require the alignment to follow valley floors that go around mountain ranges, or parallel the mountain ranges in transition zones to change elevation gradually (DIRS 176165-Nevada Rail Partners 2006, Appendix B). Within the valley floors, the rail alignment could parallel predominant drainage channels and cross through or near flats and playas. Some streams within low areas are braided channels where stream flow is divided among multiple channels, which the rail alignment could cross in several locations. Near or within mountain ranges, the rail alignment typically would be perpendicular to the predominant drainage direction. Therefore, the Mina rail alignment would encounter a wide variety of surface drainage features.

> **Notable drainage channels,** as referenced in the text and shown on figures in Section 3.3.5.3, were determined by choosing those channels with a stream order of 2 or greater based on Strahler's ordering system, with the National Hydrography Dataset as a base map.

Drainage features have been classified using Strahler's stream order system (DIRS 176728-Goudie et al. 1981, pp. 50 and 51), which is a method of classifying stream segments based on the number of upstream tributaries. Stream order ranks the size and potential power of streams. Orders range from small streams with no branches (1st Order) up to streams the size of the Mississippi River, which is a 10th Order stream. As two 1st Orders come together, they form a 2nd Order stream. Two 2nd Order streams converging form a 3rd Order stream. Streams of lower order joining a higher order stream do not change the order of the higher order stream.

DOE used stream order to define ***notable drainage channels*** and as a method to select the number of ***ephemeral washes*** shown on figures in Section 3.3.5.3. To improve the readability of these figures and provide a means to prioritize the drainage features, these figures depict only rivers, streams, and washes the rail alignment would cross that are 2nd Order streams or higher. Figures in Section 3.3.5.3 do not show all the washes and drainages the rail alignment would cross, but provide enough information to support the analysis of potential impacts to surface-water resources. Section 4.3.5 identifies the estimated number of drainage channels the rail alignment would cross by alternative segment and common segment.

3.3.5.2.1.1 Surface-Water Quality. Because of the ephemeral nature of surface water in the southwestern part of Nevada, water-quality data for the region of influence are limited. The State of Nevada does not formally monitor surface water in the Mina rail alignment region of influence.

Water-quality data for the state of Nevada are available through the Nevada District of the U.S. Geological Survey and the Nevada Division of Environmental Protection. Surface water samples are collected from several major river basins in the state and then analyzed for physical and chemical parameters. The routine water-quality monitoring network includes the following river/basin systems: Walker River, Humboldt River, Colorado River, Lake Tahoe Tributaries, Snake River, Truckee River, Carson River, and Steamboat Creek. The Carson River and Walker River Basins are the only basin systems in the Nevada Division of Environmental Protection's monitoring system relevant to the region of influence for the Mina rail alignment (DIRS 176306-NDEP 2005, all).

In accordance with federal regulations, each state is required to submit a report on overall water-quality conditions to the U.S. Environmental Protection Agency every 2 years. According to the Nevada Division of Environmental Protection report for 2005 (DIRS 176306-NDEP 2005, all), agriculture and grazing have the greatest impacts on Nevada's waters, mainly because of ***nonpoint source pollution*** (such as irrigation, grazing, and flow-regulation practices). Flow reductions have a great impact on streams, limiting dilution of salts, minerals, and pollutants. Temperature, ***pH***, dissolved oxygen, nutrients, and suspended solids are the main pollutants of concern in the state. Agricultural sources generate large sediment and nutrient loads. Surface-water quality in Nevada varies greatly from location to location and from month to month with changes in flow. In general, concentrations of dissolved solids are higher in the southern part of the state than in the northern part, depending largely on water discharge (DIRS 176316-Bostic et al. 2004, all). Because of dilution by precipitation or snowmelt, dissolved solids concentrations are usually highest during periods of low stream flow and lowest during periods of high stream flow.

According to the Nevada Division of Environmental Protection Agency 305(b) report, the Walker River experienced improvement in pH, nitrates, and phosphates during the 2004 reporting cycle (DIRS 176306-NDEP 2005, p. 2). The report cited temperature as a continuing problem in the system and total dissolved solids as a continuing problem for the lower reach, including Walker Lake. Near Wabuska, the Walker River is listed as an impaired stream and the types of pollutants affecting the water vary throughout the stream reach. Typical pollutants consist of total phosphorus, total iron, pH, and suspended solids (DIRS 180120-NDEP 2005, Appendix A and p. A-9). Walker Lake became at-risk because of upstream agricultural diversions; upstream diversions have caused Walker Lake to decline, thereby causing the total dissolved solids concentrations to increase (DIRS 176325-USGS 2004, all). Because of its high salt content, Walker Lake is listed as an impaired waterbody (DIRS 176306-NDEP 2005, p. 99).

No site-specific water chemistry data are available for the rest of the stream channels or washes the Mina rail alignment would cross. No other streams the alignment would cross are known to be impaired. DOE previously collected and analyzed surface-water samples for chemical characteristics in the Yucca Mountain region. These analytical data are provided in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-40).

3.3.5.2.1.2 Stream Flow. The U.S. Geological Survey has stream-gaging stations (many of which have been discontinued) throughout Nevada. Stream-flow data from these monitoring stations are available through the Geological Survey Nevada District. Table 3-104 lists the range of peak discharges for typical or major streams along the Mina rail alignment. DOE cross-referenced peak discharge measurements at and near the Nevada Test Site with a Geological Survey fact sheet that discusses significant flooding events in the Amargosa River drainage basin in 1995 and 1998 (DIRS 159895-Tanko and Glancy 2001, Table 2).

Most of the drainage channels the Mina rail alignment would cross typically flow only during significant (heavy) rainfall events, which generally occur only a few times a year. In many years, most of the streams listed in Table 3-104 have little or no flow. From late spring to early fall, precipitation patterns are dominated by convective, short-duration, and high-intensity thunderstorms. From late fall to early spring, precipitation patterns are dominated by long-duration, low-intensity, general storm events with both rain and snow possible throughout the area. These two types of precipitation events result in runoff that differs between smaller watersheds (up to 520 square kilometers [200 square miles]) and larger watersheds (greater than 520 square kilometers). For smaller watersheds, the summer thunderstorm events dominate the peak runoff rates, which occur in the tributary channels and washes. However, as watershed size increases, the general storm events eventually dominate the peak rates of runoff. In addition, for all watersheds, the volume of runoff will generally be greater for the general (winter) storm events than for the thunderstorm (summer) events (DIRS 180885-Parsons Brinckerhoff 2007, p. 12).

Generally, stream discharge in Nevada is low in late summer, and then increases through the autumn and winter until the snow melts in the spring. Maximum discharge for the year normally can be expected in May and June, although rain or snow has caused floods from November through March (DIRS 176308-Stockman et. al. 2003, p. 2). As shown in Table 3-104, the more significant peak-flow scenarios relevant to the Mina rail alignment occur within the Carson River, Walker River, and Upper Amargosa hydrologic units. The highest peak flows for Nevada's hydrographic regions generally occur during late winter due to snowmelt and late summer due to intense precipitation.

Table 3-104. U.S. Geological Survey annual peak flow measurements for selected sites in streams of hydrographic basins and areas along the Mina rail alignment[a] (page 1 of 2).

Hydrologic unit (gaging station number)	Drainage area (square kilometers)[b]	Annual peak flow range (cubic meters per second)[c]	Typical peak flow month(s)	Years of record (number of counts)
Areas along the alignment				
Carson River Basin (existing Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines North, through Schurz, and South)				
Carson River Basin near Fort Churchill (10312000)	3,400	1.0 to 31	January through June	1912-2006 (95)
Walker River Basin (Schurz alternative segments)				
Walker River near Wabuska (10301500)	6,700	1.1 to 93	May through June	1903-2005 (86)
Walker River near Mason (10300600)	6,200	9.2 to 79	May through June	1974-1984 (11)
Reese River Canyon near Schurz (10302010)	36	0 to 53	May through June	1963-1991 (22)
Walker River at Schurz (10302000)	7,400	1.7 to 72	May through June	1914-1933 (20)
Walker River above Weber Reservoir near Schurz (10301600)	7,000	2.2 to 57	May through June	1977-2006 (17)
Ralston-Stone Cabin Valleys (Mina common segment 2)				
Ralston Valley tributary near Tonopah (10249140)	0.52	0 to 1.4	July and August	1961-1981 (21)
Cactus-Sarcobatus Flats (Mina common segment 2; Mina common segments 4 and 5)				
Stonewall Flat tributary near Goldfield (10248970)	1.3	0 to 4.3	June through August	1963-1984 (20)
Areas in the Nevada Test Site				
Upper Amargosa (Oasis Valley alternative segments 1 and 3; Mina common segment 6)				
Pah Canyon Wash above Fortymile Wash Confluence (102512495)	16	2.6	February	1998 (1)
Unnamed Tributary to Fortymile Wash north of Delirium Canyon (102512496)	2.9	5.1	February	1998 (1)
Delirium Canyon Wash above Fortymile Wash Confluence (102512497)	6.2	3.4	February	1998 (1)
Unnamed Tributary to Fortymile Wash south of Delirium Canyon (102512499)	2.1	2.0	February	1998 (1)
Fortymile Wash at Narrows (10251250)	670	0 to 85	March	1982-1998 (8)
Yucca Wash near Mouth (10251252)	44	0 to 27	February and March	1982-1998 (10)
Pagany Wash near the Prow (102512531)	1.3	0.57 to 1.7	February and March	1995-1998 (2)
Pagany Wash #1 near Well UZ (4102512533)	2.1	0.48 to 1.7	February and March	1993-1998 (2)
Drillhole Wash above UZ (1102512535)	1.8	0 to 0.85	March	1994-1998 (3)

Table 3-104. U.S. Geological Survey annual peak flow measurements for selected sites in streams of hydrographic basins and areas along the Mina rail alignment[a] (page 2 of 2).

Hydrologic unit (gaging station number)	Drainage area (square kilometers)[b]	Annual peak flow range (cubic meters per second)[c]	Typical peak flow month(s)	Years of record (number of counts)
Areas in the Nevada Test Site (continued)				
Upper Amargosa (Oasis Valley alternative segments 1 and 3; Mina common segment 6)				
Wren Wash at Yucca Mountain (1025125356)	0.52	0 to 0.85	March	1994-1998 (3)
Split Wash below Quac Canyon Wash (102512537)	0.78	0 to 0.37	February	1994-1998 (3)
Split Wash at Antler Ridge (1025125372)	6.2	0 to 0.06	February	1994-1998 (3)
Drillhole Wash at Mouth (10251254)	42	0 to 22	July	1982-1998 (10)
Fortymile Wash near Well J (1310251255)	790	0 to 85	March through July	1984-1998 (7)
Dune Wash near Busted Butte (10251256)	18	0 to 0.40	August	1982-1995 (9)
Topopah Wash at Little Skull Mountain (10251260)	270	0 to 42	August	1984-1998 (8)
Beatty Wash near Beatty (10251215)	250	0 to 25	July through March	1989-1998 (5)
Amargosa River at Beatty (10251217)	1,200	0.03 to 28	March through August	1994-2004 (10)
Fortymile Wash near Amargosa Valley (10251258)	820	0 to 94	February through July	1969-2004 (23)
Topopah Wash at Highway 95 near Amargosa Valley (10251261)	390	0.57	February	1998 (1)

a. Sources: DIRS 176325-USGS 2006, all; DIRS 159895-Tanko and Glancy 2001, Table 2.
b. To convert square kilometers to square miles, multiply by 0.3861.
c. To convert cubic meters per second to cubic feet per second, multiply by 35.3.

The Carson River originates from the Sierra Nevada Mountains in California and flows generally northeast into Nevada where it passes through Carson City and terminates in the Carson Sink. Between Carson City and Fallon, the river is impounded by the Lahontan Dam and forms the Lahontan Reservoir, water from which is distributed throughout the Fallon area for agricultural, wildlife, and fisheries purposes (DIRS 103406-Nevada Division of Water Planning 1992, all).

The Walker River, with its headwaters in California, flows into Nevada through the Walker River Paiute Reservation before terminating at Walker Lake. Waters of the Walker River are predominantly used for agricultural purposes (DIRS 103406-Nevada Division of Water Planning 1992, all). Walker Lake is fed by the Walker River from the north and is a perennial, natural terminal lake. The lake became at-risk because of upstream diversions for irrigation purposes; between 1882 and 1994, upstream diversions caused Walker Lake to decline about 40 meters (140 feet) (DIRS 176325-USGS 2004, all), which has resulted in high salt concentration.

The washes that drain the Yucca Mountain Site discharge into the Amargosa River. This ephemeral drainage typically sees very low runoff rates due to minimal precipitation in its basin and, therefore, is usually dry (DIRS 159895-Tanko and Glancy 2001, p. 1). Precipitation is least along the Mina rail alignment in this area, from Sarcobatus Flat to Beatty, averaging just 75 to 100 millimeters (3.0 to 3.9 inches) per year. Most of the annual precipitation typically occurs in late spring to early fall. Fortymile Wash and Topopah Wash are significant tributaries draining the Nevada Test Site area into the Amargosa River, with maximum peak flows of 94 cubic meters (3,300 cubic feet) per second and 42 cubic meters (1,500 cubic feet) per second, respectively, during late winter to late summer (see Table 3-104). Section 3.3.5.2.4 describes two significant flooding events (March 1995 and February 1998) in the Amargosa River drainage basin on and near the Nevada Test Site.

3.3.5.2.2 Waters of the United States

The term **waters of the United States** is defined in 33 CFR 328.3a. The U.S. Army Corps of Engineers and the Environmental Protection Agency regulate the placement of dredged or fill material into these waters. The definition incorporates channels with ephemeral and intermittent flow that exhibit specific physical features, including channel shape and surrounding vegetation that would provide indications of an ***ordinary high water mark.***

Ordinary high water mark means that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3e).

Some of the surface-water features along the Mina rail alignment, such as ephemeral drainages, streams, ponds, and lakes, are considered waters of the United States, especially if there is an interstate connection to commerce. Section 404 of the Clean Water Act (33 U.S.C 1344) and implementing regulations (33 CFR Part 323) require the U.S. Army Corps of Engineers to regulate discharges of dredge or fill material into waters of the United States. Discharges of dredge or fill material essentially include all land-disturbing activities accomplished via the use of mechanized equipment. The placement of structures, such as bridge embankments, bridge piers and abutments, and culverts, would be activities potentially discharging fill materials into waters of the United States. Chapter 6 of this Rail Alignment EIS discusses compliance with Section 404 of the Clean Water Act in more detail.

DOE surveyed all drainages within 400 meters (0.25 mile) of the Mina rail alignment that are within interstate hydrologic basins to determine if those drainages could be classified as waters of the United States (DIRS 180889-PBS&J 2007, p. 1). This survey also identified and delineated wetlands along the Mina rail alignment. The alignment-specific discussions in Section 3.3.5.3 detail the results of the survey. Subsequent to DOE surveys performed along the rail alignment, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released new guidance to be used when making determinations of waters of the United States subject to jurisdiction under the Clean Water Act. This guidance provides criteria for making these determinations for adjacent wetlands and non-navigable tributaries of waters of the United States, particularly in relation to ephemeral waters. As a result of this guidance, it is likely that many of the drainages along the rail alignment would not be considered waters of the United States (see Section 4.2.5.2.1.4 for further discussion).

The U.S. Army Corps of Engineers is ultimately responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. If DOE pursued the Mina rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the alignment before beginning construction.

3.3.5.2.3 Wetlands

Generally, wetlands are lands where saturation with water is the dominant factor that determines how soil develops and the types of plant and animal communities living in the soil and on its surface (DIRS 178724-Cowardin et al. 1979, p. 11). Wetlands can support both aquatic and terrestrial species. The prolonged presence of water creates conditions that favor the growth of specially adapted plants and promote the development of characteristic wetland (***hydric***) ***soils***.

According to the U. S. Environmental Protection Agency and the U. S. Army Corps of Engineers, the regulatory definition of a Section 404 jurisdictional wetland is (33 CFR 328.3b) "those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." The U.S. Department of Agriculture Natural Resources Conservation Service and U. S. Fish and Wildlife Service define wetlands somewhat differently, but all four agencies include three basic elements for identifying wetlands: ***hydrology***, soils, and vegetation. Wetland communities are recognized as providing many valuable functions that improve the human environment. Wetlands that have surface-water connections to or are adjacent to (bordering, contiguous, neighboring) other waters of the United States are regulated under Section 404 of the Clean Water Act. Wetlands that are isolated – that is, they have no permanent or temporary surface-water connections to interstate water bodies or are not considered adjacent – are not typically regulated under Section 404 unless the use of these isolated wetlands could affect interstate commerce.

Surveys in support of this Rail Alignment EIS have identified wetlands along the Mina rail alignment (DIRS 180889-PBS&J 2007, all). Tables in Section 3.3.5.3 list wetlands identified during these surveys. Appendix F discusses wetlands along the Mina rail alignment in more detail, and Section 3.3.7, Biological Resources, discusses wetlands from a habitat perspective.

3.3.5.2.4 Floodplains

The presence of floodplains in the Mina rail alignment region of influence largely depends on the meteorology and hydrology of the area. Much of the rail alignment would be in areas that are subject to intense rainfall over a short duration (1 to 3 hours), which typically occurs in late spring to early fall. Precipitation in late fall to early spring is dominated by low-intensity rainfall or snow over a long duration (2 to 4 days). In both cases, precipitation has the potential to produce flooding (DIRS 180885-Parsons Brinckerhoff 2007, pp. 12 to 14). Evapotranspiration rates throughout the region of influence are high; therefore, most of the rainfall from summer storms is lost relatively quickly unless a storm is intense enough to produce runoff, or unless there are more storms before the water evaporates (DIRS 180885-Parsons Brinckerhoff 2007, p. 18). Evapotranspiration rates are lower during the winter, and water from precipitation or melting snow has a better chance of resulting in streamflow, thereby increasing the chances of flooding. Much of the runoff quickly infiltrates into rock fractures or into the dry soils, some is carried down alluvial fans in arroyos, and some drains onto dry lakebeds where it might stand for weeks as a lake (DIRS 180885-Parsons Brinckerhoff 2007, p. 17).

Although flow in most washes is rare, the area is subject to flash flooding from intense summer thunderstorms and sustained winter precipitation. When it occurs, intense flooding can include mud and debris flows in addition to water runoff. Thunderstorms in the area can be local and intense, creating runoff in one wash while an adjacent wash receives little or no rain. In rare cases, however, storm and runoff conditions can be extensive enough to result in flow being present throughout the drainage systems. For example, conditions recorded during March 1995 and February 1998 at the Amargosa River and its tributaries indicated that the channels all flowed simultaneously along its primary stream channels to Death Valley. The 1995 event was the first documented case of this flow condition. During the 1995 event, the peak flow near the location where the existing Yucca Mountain access road crosses Fortymile

Wash was approximately 100 cubic meters (3,500 cubic feet) per second (DIRS 180885-Parsons Brinckerhoff 2007, p. 18).

In accordance with the requirements of 10 CFR Part 1022, DOE reviewed available authoritative information to determine whether the Mina rail alignment would be located in wetlands or floodplains. The results of that effort (DIRS 180885-Parsons Brinckerhoff 2007, p. 9) indicated that the only flood map or flood studies available for the areas of the Mina rail alignment were those completed by the Federal Emergency Management Agency in the form of Flood Insurance Rate Maps. Furthermore, and consistent with the remoteness of the project area, DOE found that Federal Emergency Management Agency maps cover only about 20 percent of the rail alignment (see Appendix F, Table F-2). At present, there are no Federal Emergency Management Agency flood maps for areas northeast of Silver Springs, and the Agency has not mapped flood-prone areas east and west of where U.S. Highways 50 and 95 intersect, including a large portion of Lahontan Reservoir. Most of the mapped flood-prone areas are between Carson River and Wabuska. Federal Emergency Management Agency flood maps encompassing Department of Defense Branchline North indicate areas most prone to possible flooding correspond to emergent wetlands shown in the National Wetlands Inventory. The Federal Emergency Management Agency flood map shows no ***100-year flood***-prone areas next to the Walker River or any of its tributaries. There are limited flood-map data covering the southern-most section of Walker Lake and most of the area between Mina common segment 2 and the Yucca Mountain Site (DIRS 180119-Parsons Brinckerhoff 2003, all). DOE completed flood studies for several washes on the eastern slope of Yucca Mountain in support of the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-37 to 3-39).

In accordance with 10 CFR Part 1022, DOE prepared a floodplain and wetland assessment (see Appendix F) for the Mina rail alignment. Appendix F provides a detailed discussion of the floodplains and wetlands the Mina rail alignment would cross, including figures of the relevant floodplains identified on Federal Emergency Management Agency maps and those identified near the ***repository*** site.

3.3.5.2.5 Springs

With the exception of surface water bodies such as perennial streams and reservoirs, springs are the only other natural source of perennial surface water throughout the Mina rail alignment region of influence. Typically, these springs flow year round. The springs often infiltrate naturally into the ground or undergo evapotranspiration, or are captured near the source for local use (such as irrigation). DOE used the U.S. Geological Survey Geographic Names Information System, the National Hydrologic Dataset, and several DOE field studies completed in support of this Rail Alignment EIS to identify springs along the Mina rail alignment (DIRS 180889-PBS&J 2007, all; DIRS 180885-Parsons Brinckerhoff 2007, all).

3.3.5.3 Surface-Water Features along Alternative Segments and Common Segments

DOE compiled this information using the National Wetland Inventory database, a U.S. Geological Survey dataset of hydrologic features known as the National Hydrological Dataset, a dataset from the U.S. Environmental Protection Agency Geographic Names Information System (DIRS 176979-MO0605GISGNISN.000), and DOE wetland surveys conducted in support of this Rail Alignment EIS (DIRS 180889-PBS&J 2007, all). Specific hydrologic features are divided into two categories: those within 150 meters (500 feet) of the rail alignment centerline and those between 150 meters and 1.6 kilometers (1 mile) from the rail alignment centerline. Both of these categories fall within the region of influence for surface-water resources. The first category is also within the nominal width of the rail line construction right-of-way.

Sections 3.3.5.3.1 through 3.3.5.3.12 describe surface water-resources for each Mina rail alignment alternative segment and common segment moving along the rail line from north to south (from Hazen, Nevada, to Yucca Mountain). Tables in these sections provide summaries of surface-water features identified along the Mina rail alignment region of influence. Figures in these sections show the proposed rail line location as it crosses Nevada's physiographic features. A key for these map areas is provided in Chapter 2, Figure 2-12.

3.3.5.3.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska)

There would be no new construction and therefore no new land disturbance within or near the region of influence along this portion of the Mina rail alignment. Therefore, DOE has not characterized the surface-water features in this area.

3.3.5.3.2 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation)

Except for a new siding inside the existing rail line right-of-way, there would be no new construction or land disturbance along Department of Defense Branchline North within the region of influence (see Figure 3-180). Construction of this siding would not affect current drainage patterns. Therefore, DOE has not characterized surface-water features along this portion of the Mina rail alignment.

3.3.5.3.3 Department of Defense Branchline through Schurz

As part of the Mina Implementing Alternative, DOE would remove track, timber ties, and ballast, and grade the ballast section to a smooth surface along this branchline. This removal activity would not involve land disturbance outside the existing rail line right-of-way because these actions would be performed using equipment designed to move along the track. Therefore, DOE has not characterized surface-water features in this area.

3.3.5.3.4 Schurz Alternative Segments

3.3.5.3.4.1 Schurz Alternative Segment 1. From the northern end of Campbell Valley, Schurz alternative segment 1 would cross Walker River and two tributaries of the Walker River as it enters Sunshine Flat. The alternative segment would pass to the west of Painted Mesa, and east of Weber Reservoir and the northern end of the Wassuk Range before crossing U.S. Highway 95. It would then pass south of Calico Hills, enter an unnamed valley, and travel west of the Agai Pah Hills and the Gillis Range before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18A would be adjacent to Schurz alternative segment 1 approximately 75 meters (250 feet) east of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-4). The construction camp would not overlie any surface-water features. There are no potential quarry sites along Schurz alternative segment 1.

Schurz alternative segment 1 would run northeast from Campbell Valley, where it would cross the Walker River and two tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment 1 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 1 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). Schurz alternative segment 1 would continue eastward and then head south into Sunshine Flat, which receives drainage from the Desert Mountains and Painted Mesa.

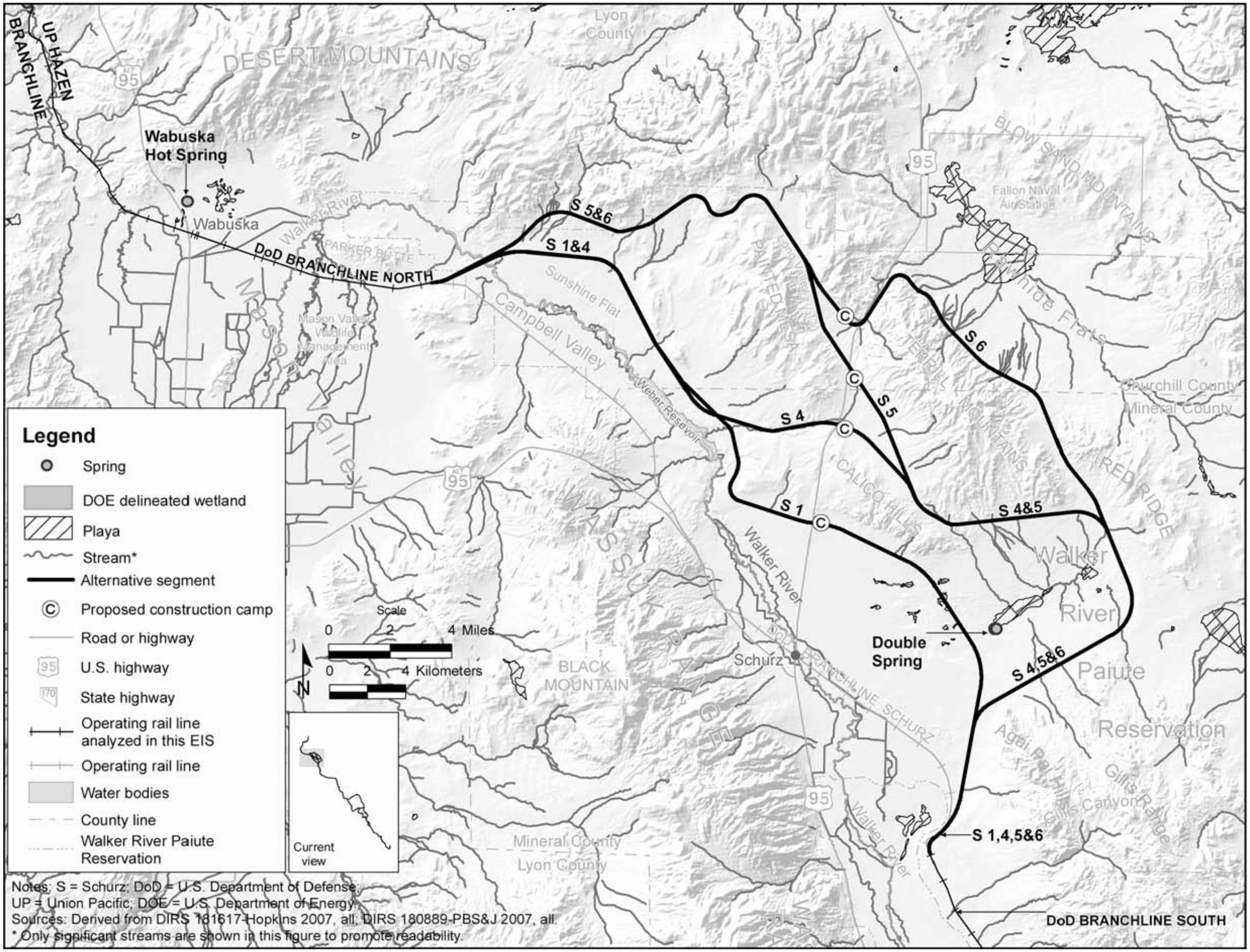


Figure 3-180. Surface drainage within map area 1.

Table 3-105. Hydrologic features potentially relevant to the Schurz alternative segments[a] (page 1 of 2).

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Schurz alternative segment 1		
Drainage from the Desert Mountain Range, Painted Mesa, and Calico Hills to Sunshine Flat. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills into the Schurz 1 region of influence. Surface runoff would generally drain west and toward the Walker River.	Segment would cross Walker River and 20 unnamed washes (some of these washes are tributaries to Walker River). Segment would enter Sunshine Flat. Segment would cross through two unnamed playas and pass within 80 meters west of two other unnamed playas. Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 110 meters north and 40 meters south of the alignment, respectively.	Weber Reservoir 1 kilometer west. Set of unnamed playas, within 1.6 kilometers west and 1.4 kilometers east of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory). Double Spring 1.5 kilometers east. Unnamed spring 1.4 kilometers east.
Schurz alternative segment 4		
Drainage from the Desert Mountain Range, Painted Mesa, and Calico Hills to Sunshine Flat. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills west toward Schurz 4.	Segment would cross Walker River and 41 unnamed washes (some of these washes are tributaries to Walker River). Segment would enter Sunshine Flat. Segment would cross through two unnamed playas and pass within 80 meters west of two other unnamed playas. Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 110 meters north and 40 meters south of the alignment, respectively.	Weber Reservoir 0.85 kilometer west. Two unnamed playas, within 1.3 kilometers west and 1.5 kilometers west of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory).
Schurz alternative segment 5		
Drainage from the Desert Mountain Range, Painted Mesa, and Terrill Mountains to Long Valley. The alignment would include the entire drainage basin of Long Valley. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills west towards the rail alignment.	Segment would cross Walker River and 60 unnamed washes (some of these washes are tributaries to Walker River). Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 7 meters north and 150 meters south of the alignment, respectively.	Two unnamed playas, within 1.3 kilometers west and 1.5 kilometers west of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory).

Table 3-105. Hydrologic features potentially relevant to the Schurz alternative segments[a] (page 2 of 2).

General hydrographic features/drainage	Hydrologic features within 150 meters of the centerline of the rail alignment[b]	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Schurz alternative segment 6		
Drainage from the Desert Mountain Range, Painted Mesa, and Terrill Mountains to Long Valley. The alignment would include the entire drainage basin of Long Valley. Drainage from Terrill Mountains to Rawhide Flat. Drainage from Calico Hills, Terrill Mountains, and Red Ridge into an unnamed valley. Drainage from the Agai Pah Hills west towards the rail alignment.	Segment would cross Walker River and 66 unnamed washes (some of these washes are tributaries to Walker River). Segment would enter Rawhide Flat. Segment would cross over two DOE-delineated wetlands and pass within two other wetlands 7 meters north and 150 meters south of the alignment, respectively.	Two unnamed playas, within 1.3 kilometers west and 1.5 kilometers west of the alignment in the unnamed valley. Set of unnamed playas, west of the alignment and adjacent to Walker River (identified as wetlands in the National Wetland Inventory).

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 51-53, and 58-59.
b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

The segment would pass within 1 kilometer (0.6 mile) to the east of Weber Reservoir and cross numerous tributaries to the Walker River. There are no water-quality data available for this area; however, there are regional data for the Walker River Basin (DIRS 180064-USGS 2005, all). Schurz alternative segment 1 would then turn southeast along the southwest edge of the Calico Hills and enter an unnamed valley that receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. After passing the Calico Hills, Schurz alternative segment 1 would cross through two unnamed playas and bypass several other unnamed playas situated east and west of the segment in the unnamed valley. For most of the year, these playas and ponds would be dry; however, runoff from ephemeral washes draining the Calico Hills, Terrill Mountains, and Gillis Range would be conveyed into and toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 1 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 1 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River and three other washes that Schurz alternative segment 1 would cross as waters of the United States, as regulated under Section 404 of the Clean Water Act. There are another four washes, also classified as waters of the United States, within 0.40 kilometer (0.25 mile) of the Schurz alternative segment 1, but the segment would not cross those washes (DIRS 180889-PBS&J 2007, p. 7, Table 2, and Figure 3A).

The National Wetland Inventory dataset indicates that wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of these wetlands along the Walker River. Schurz alternative segment 1 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 1 and adjacent to

the Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 1; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 1.

There are two springs within the Schurz alternative segment 1 region of influence – Double Spring and an unnamed spring. Double Spring and the unnamed spring are approximately 1.5 kilometers (0.93 mile) and 1.4 kilometers (0.88 mile) east of the alternative segment, respectively.

3.3.5.3.4.2 Schurz Alternative Segment 4. From the northern end of Campbell Valley, Schurz alternative segment 4 would cross Walker River and two tributaries of the Walker River as it enters Sunshine Flat. The alternative segment would pass to the west of Painted Mesa, and east of Weber Reservoir and the northern end of the Wassuk Range before crossing U.S. Highway 95. It would then pass south of Calico Hills, enter an unnamed valley, and travel west of the Agai Pah Hills and the Gillis Range before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18A would be adjacent to Schurz alternative segment 4 approximately 75 meters (250 feet) east of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-4). The construction camp would not overlie any surface-water features. There are no potential quarry sites along Schurz alternative segment 4.

Schurz alternative segment 4 would run northeast from Campbell Valley, where it would cross the Walker River and two tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment 4 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 4 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). Schurz alternative segment 4 would continue eastward and then head south into Sunshine Flat, which receives drainage from the Desert Mountains and Painted Mesa. The segment would pass within 0.85 kilometer (0.53 mile) to the east of Weber Reservoir and cross numerous tributaries to the Walker River. There are no water-quality data available for this area; however, there are regional data for the Walker River Basin (DIRS 180064-USGS 2005, all). Schurz alternative segment 4 would proceed east and follow along a tributary to the Walker River, crossing it several times. After passing through a valley between Painted Mesa and Calico Hills and then turning southeast, the alternative segment would turn toward the east and pass the southern edge of the Terrill Mountains and proceed into an unnamed valley that receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. In this valley, Schurz alternative segment 4 would pass two unnamed playas that would be west of the segment. For most of the year, these playas would be dry; however, runoff from unnamed ephemeral washes draining the Terrill Mountains, Red Ridge, and Gillis Range would be conveyed toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 4 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 4 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River and five washes that Schurz alternative segment 4 would cross as waters of the United States, as regulated under Section 404 of the Clean Water Act. There are another two washes, also classified as waters of the United States, within 0.40 kilometer (0.25 mile) of the Schurz alternative segment 4, but the segment would not cross those washes (DIRS 180889-PBS&J 2007, p. 3, Table 2, and Figure 3A). The National Wetland Inventory dataset indicates that emergent wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of emergent wetlands along the Walker River. Schurz alternative segment 4 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 4 and adjacent to the Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 4; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 4.

There are no springs identified within 1.6 kilometers (1 mile) of Schurz alternative segment 4.

3.3.5.3.4.3 Schurz Alternative Segment 5. From the northern end of Campbell Valley, Schurz alternative segment 5 would cross the Walker River, travel along the southern edge of the Desert Mountains, and then travel southeast through Long Valley between Painted Mesa and the Terrill Mountains. The segment would then cross U.S. Highway 95 as it continued around the southern edge of the Terrill Mountains, past the western edge of Red Ridge, through an unnamed valley, and past the western edge of the Agai Pah Hills before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18C would be adjacent to Schurz alternative segment 5 approximately 295 meters (970 feet) southeast of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-4). The construction camp would not overlie any surface-water features. There are no potential quarry sites along Schurz alternative segment 5.

Schurz alternative segment 5 would run northeast from Campbell Valley, where it would cross the Walker River and several tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment 5 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 5 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). As the alternative segment continued east, it would travel along the southern edge of the Desert Mountains, crossing several ephemeral washes draining the Desert Mountains and flowing toward Sunshine Flat. After rounding the northern edge of Painted Mesa, Schurz alternative segment 5 would travel southeast through Long Valley and over U.S. Highway 95. Long Valley receives its drainage from Painted Mesa, the Terrill Mountains, and Calico Hills. As the segment turned toward the east and passed the southern edge of the Terrill Mountains, it would proceed into an unnamed valley which receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. In this valley, Schurz 5 would pass two unnamed playas situated west of the rail alignment. For most of the year, these playas would be dry; however, runoff from unnamed ephemeral washes draining the Terrill Mountains, Red Ridge, and Gillis Range would be conveyed toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 5 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 5 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River as the only water of the United States, as regulated under Section 404 of the Clean Water Act, crossed by this alternative segment (DIRS 180889-PBS&J 2007, p. 3, Table 2, and Figure 3A).

The National Wetland Inventory dataset indicates that emergent wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of emergent wetlands along the Walker River. Schurz alternative segment 5 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 5 and adjacent to Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 5; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 5.

There are no springs identified within 1.6 kilometers (1 mile) of Schurz alternative segment 5.

3.3.5.3.4.4 Schurz Alternative Segment 6. From the northern end of Campbell Valley, Schurz alternative segment 6 would cross the Walker River, travel along the southern edge of the Desert Mountains, and then travel southeast through Long Valley between Painted Mesa and the Terrill Mountains. The segment would then cross U.S. Highway 95 as it continued around the southern edge of the Terrill Mountains, past the western edge of Red Ridge, through an unnamed valley, and past the western edge of the Agai Pah Hills before ending near Gillis Canyon (see Table 3-105 and Figure 3-180). Construction camp 18D would be adjacent to Schurz alternative segment 6 approximately 640 meters (2,100 feet) west of its junction with U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-1). A small ephemeral stream would run through the footprint for construction camp 18D. There are no potential quarry sites along Schurz alternative segment 6.

Schurz alternative segment 6 would run northeast from Campbell Valley, where it would cross the Walker River and several tributaries to Walker River that receive their drainage from the Desert Mountains and later combine into one stream. The Walker River is a perennial stream that flows through Weber Reservoir and conveys surface water to a terminal basin called Walker Lake. Schurz alternative segment

6 would lie entirely within the Walker Hydrographic sub-basin, which has a total drainage area of approximately 2,600 square kilometers (1,000 square miles) (DIRS 180885-Parsons Brinckerhoff 2007, p. 20). The U.S. Geological Survey gaging station closest to Schurz alternative segment 6 is at the Walker River above Weber Reservoir near the community of Schurz. At this station, the river has a drainage area of approximately 7,000 square kilometers (2,700 square miles) (see Table 3-104). As the alternative segment continued east, it would travel along the southern edge of the Desert Mountains, crossing several ephemeral washes draining the Desert Mountains and flowing toward Sunshine Flat. After rounding the northern edge of Painted Mesa, Schurz 6 would travel southeast through Long Valley and over U.S. Highway 95. Long Valley receives its drainage from Painted Mesa, the Terrill Mountains, and Calico Hills. After crossing U.S. Highway 95, the alternative segment 6 would turn to the northeast and pass through a gap in the Terrill Mountains, round the northern edge of the Terrill Mountains, and enter Rawhide Flats. Near the area of the alternative segment, Rawhide Flats receives its drainage from numerous ephemeral washes from the Terrill Mountains. After passing between the Terrill Mountains and Red Ridge, Schurz alternative segment 6 would enter an unnamed valley that receives its drainage from the Calico Hills, Terrill Mountains, Red Ridge, and Gillis Range. In this valley, Schurz alternative segment 6 would pass two unnamed playas west of the rail alignment. For most of the year, these playas would be dry; however, runoff from unnamed ephemeral washes draining the Terrill Mountains, Red Ridge, and Gillis Range would be conveyed toward these low-lying areas. During periods of intense precipitation, the size of the watershed and the number of ephemeral washes could provide enough runoff to create localized flooding. There is another set of playas at the southern end of Schurz alternative segment 6 adjacent to the Walker River. Additional surface runoff from ephemeral washes would drain from the Agai Pah Hills into the Schurz alternative segment 6 region of influence. Surface runoff would generally drain west toward Walker River.

The Walker River Basin is considered an interstate basin because it receives drainage from outside Nevada. During a survey of the washes along the Mina rail alignment in support of this Rail Alignment EIS, DOE identified the Walker River, which Schurz alternative segment 6 would cross, as a water of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, p. 3, Table 2 and Figure 3A).

The National Wetland Inventory dataset indicates that emergent wetlands border the Walker River. During field investigations in support of this Rail Alignment EIS, DOE confirmed the presence of emergent wetlands along the Walker River. Schurz alternative segment 6 would cross the Walker River and two DOE-delineated wetlands. There are two other wetlands (one north and one south of the alternative segment) adjacent to the Walker River (DIRS 180889-PBS&J 2007, Figure 4). Additionally, as the alternative segment continued south past Weber Reservoir, it would pass within approximately 1.6 kilometers (1 mile) of a small group of wetlands along the Walker River. The National Wetlands Inventory dataset identifies the playas at the southern end of Schurz alternative segment 6 and adjacent to the Walker River as wetlands; however, DOE field surveys in support of this Rail Alignment EIS confirmed that there are no wetlands in this area. Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Schurz alternative segment 6; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with Schurz alternative segment 6.

There are no springs identified within 1.6 kilometers (1 mile) of Schurz alternative segment 6.

3.3.5.3.5 Department of Defense Branchline South (Boundary of Walker River Paiute Reservation to Thorne)

Except for a new siding inside the existing rail line right-of-way and construction camp 17 (which would be on the Hawthorne Army Depot), there would be no new construction along Department of Defense Branchline South. Neither the siding nor the construction camp would overlie any surface-water features. No additional road construction would be required (see Figure 3-181). Therefore, DOE has not characterized surface-water features along this portion of the Mina rail alignment.

3.3.5.3.6 Mina Common Segment 1 (Gillis Canyon to Blair Junction)

Beginning east of Thorne, Nevada, Mina common segment 1 would travel south of the Gillis Range through Walker Lake Valley and Soda Springs Valley, with the Gabbs Valley Range to the north and east and Garfield Hills to the west. This common segment would continue to travel south through Soda Springs Valley and Alkali Flat and pass to the east of Rhodes Salt Marsh between the Excelsior Mountains and Pilot Mountains. Mina common segment 1 would then travel to the east of Columbus Salt Marsh between the Candelaria Hills and the Monte Cristo Range before ending near Blair Junction. The common segment would parallel U.S. Highway 95 (see Table 3-106 and Figures 3-181 and 3-182). There are three ***construction camps*** associated with Mina common segment 1. Construction camp 16 would be adjacent to the rail alignment, 40 meters (131 feet) southeast of the junction of Mina common segment 1 with State Route 361. Two ephemeral washes that receive drainage from Gabbs Valley Range would run through the footprint for construction camp 16. Construction camp 15 would be adjacent to and west of the rail alignment, east of Tonopah Junction and Rhodes Salt Marsh. The construction camp would not overlie any surface-water features. Construction camp 14 would be adjacent to and east of the rail alignment at Blair Junction. Two ephemeral washes that receive drainage from the Monte Cristo Range would run through the footprint for construction camp 14. There are two potential quarry sites along Mina common segment 1. The first (Garfield Hills) would be approximately 2.23 kilometers (1.4 miles) south of the rail alignment near Hawthorne. Ephemeral washes draining down from the Garfield Hills would pass within 20 meters (66 feet) of the quarry. The second potential quarry site (Gabbs Range) would be approximately 0.77 kilometer (0.48 mile) east of the rail alignment, near Luning. Ephemeral washes draining down from Gabbs Valley Range into Soda Springs Valley would cross through the Gabbs Range quarry site.

Mina common segment 1 would begin in Walker Lake Valley, which receives its drainage from the Wassuk Range and Garfield Hills to the south and numerous canyons (including Ryan Canyon, Sheeps Head Canyon, and Montreal Canyon) and ephemeral washes draining Gillis Range to the north. The segment would pass to the north of a playa. As Mina common segment 1 continued through Walker Lake Valley, it would pass two playas (one of which receives drainage from Sheeps Head Canyon in the Gillis Range and ephemeral washes from Garfield Hills) and cross one playa. As the segment entered Soda Springs Valley, it would cross over a large playa that receives drainage from numerous ephemeral washes from the Gillis Range to the north and Garfield Hills to the south and pass by a smaller playa to the north that receives drainage from Gillis Range. Intermittent surface water would flow into Soda Springs Valley from unnamed washes draining ravines and side canyons of mountainous areas bordering Mina common segment 1.

Continuing south through Soda Springs Valley, the segment would pass east of two large playas in Alkali Flat. The first playa, just east of Luning, receives flow from Black Dyke Mountain to the west and numerous ephemeral washes draining Gabbs Valley Range. Drainage from Cinnabar Canyon, Dunlap Canyon, Mac Canyon, Water Canyon, and other washes in the Pilot Mountains to the east and Douglas Canyon and other washes in the Excelsior Mountains to the west flow into or toward the second playa.

As Mina common segment 1 would leave Soda Springs Valley, it would pass to the east of Rhodes Salt Marsh. This playa receives drainage from Long Canyon and numerous unnamed ephemeral washes from the Pilot Mountains to the east. Additional drainage from Candelaria Hills and the Excelsior Mountains flows toward the playa. The segment would follow a ridgeline of the Monte Cristo Range and pass east of Columbus Salt Marsh. Several ephemeral washes drain downslope from the headwaters of the Monte Cristo Range and flow west into Columbus Salt Marsh, at which point the drainages develop a braided drainage pattern. After passing around the southern end of the Monte Cristo Range, Mina common segment 1 would turn south as it crossed over U.S. Highway 95 and end at the northern edge of Big Smoky Valley. There are no streamflow or water-quality data available for the streams and washes Mina common segment 1 would cross.

The first approximately 15 kilometers (9 miles) of common segment 1 would be within the Walker River Basin, which is an interstate drainage system. DOE field investigations determined that none of the washes along this portion of common segment 1 have characteristics of waters of the United States. The 2 playas crossed in this basin have no hydrologic connection to tributaries of Walker Lake or other drainages in that basin. The remainder of Mina common segment 1 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along this portion of common segment 1 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water (DIRS 180889-PBS&J 2007, all).

Table 3-106. Hydrologic features potentially relevant to Mina common segment 1.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Drainage from Wassuk Range, Garfield Hills, and numerous canyons (including Ryan Canyon, Sheeps Head Canyon, and Montreal Canyon) and ephemeral washes draining Gillis Range into Walker Lake Valley. Drainage from unnamed washes draining ravines and side canyons of mountainous areas into Soda Springs Valley. Drainage from Black Dyke Mountain, numerous ephemeral washes draining Gabbs Valley Range, Cinnabar Canyon, Dunlap Canyon, Mac Canyon, Water Canyon, and other washes in the Pilot Mountains, and Douglas Canyon and other washes in the Excelsior Mountains. Drainage from Long Canyon, numerous unnamed ephemeral washes from the Pilot Mountains, Candelaria Hills, and Excelsior Mountains into or towards Rhodes Salt Marsh. Drainage from Monte Cristo Range into Columbus Salt Marsh.	Segment would cross 141 unnamed washes. Segment would cross Alkali Flat. Segment would cross through two unnamed playas (one of which is identified as a wetland in the National Wetland Inventory) and pass within 150 meters of another unnamed playa (which is identified as a wetland in the National Wetland Inventory).	Alignment would pass within 1.6 kilometers of 6 unnamed playas (some of which are identified as wetlands in the National Wetland Inventory). Kinkaid Spring 0.23 kilometer north. Unnamed spring 0.54 kilometer east.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 51-53, and 58-59.
b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

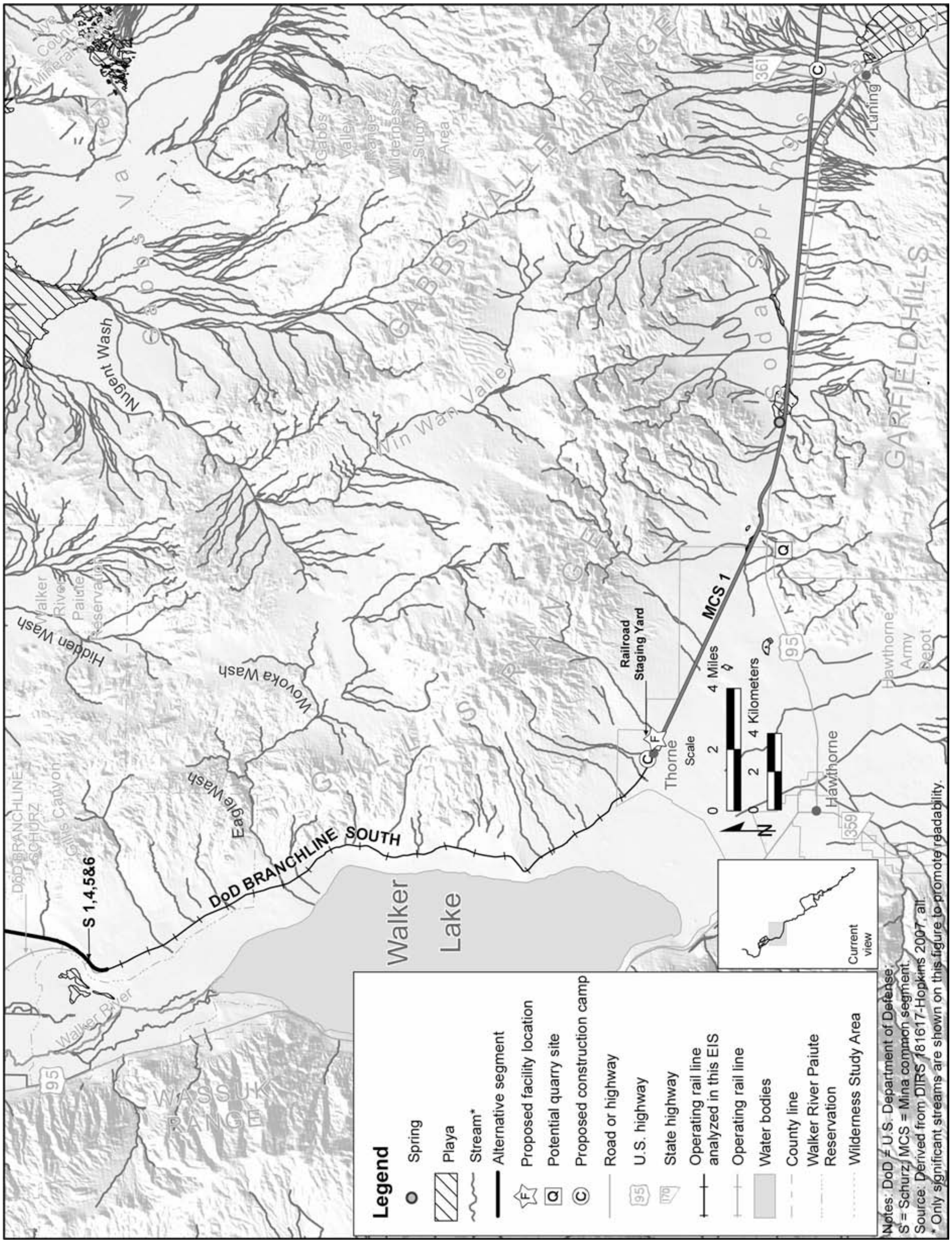


Figure 3-181. Surface drainage within map area 2.

Figure 3-182. Surface drainage within map area 3.

The National Wetland Inventory dataset identifies the playas in Soda Springs Valley and Alkali Flat as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas (DIRS 180889-PBS&J 2007, Figure 5B). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Mina common segment 1; however, the rail alignment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

There are two springs within the Mina common segment 1 region of influence – Kinkaid Spring and an unnamed spring. Kinkaid Spring is approximately 0.23 kilometer (0.14 mile) north of the common segment just west of the large playa in Soda Springs Valley (DIRS 180889-PBS&J 2007, p. 9). The unnamed spring is approximately 0.54 kilometer (0.34 mile) east of the common segment in the foothills of the Monte Cristo Range.

3.3.5.3.7 Montezuma Alternative Segments

3.3.5.3.7.1 Montezuma Alternative Segment 1. Montezuma alternative segment 1 would parallel State Route 265 as it traveled south from Big Smoky Valley past the Silver Peak Range and Mineral Ridge to the west and the Weepah Hills to the east. After entering Clayton Valley, the alternative segment would travel past Angel Island, Paymaster Ridge, Clayton Ridge, the Montezuma Range, Goldfield Hills, Cuprite Hills, Stonewall Flat, and Stonewall Mountain before ending near Lida Junction (see Table 3-107 and Figures 3-183 and 3-184). Construction camp 13A would be adjacent to Montezuma 1 just south of the community of Silver Peak. The construction camp would not overlie any surface-water features. Construction camp 9A would be adjacent to Montezuma alternative segment 1 approximately 290 meters (950 feet) northwest of where the rail segment would cross U.S. Highway 95. A small ephemeral wash draining downslope of Garfield Hills would run through the extreme southwest corner of the footprint for this construction camp (DIRS 180875-Nevada Rail Partners 2007, p. F-11). A potential quarry site, North Clayton, would be located along Montezuma alternative segment 1 near the Montezuma Range. The quarry would not overlie any surface-water features.

From Big Smoky Valley, Montezuma alternative segment 1 would travel south, paralleling State Route 265 to Silver Peak, and along the way, cross over numerous ephemeral washes flowing into Big Smoky Valley. Big Smoky Valley receives drainage from numerous ephemeral washes flowing downslope of the Monte Cristo Range to the north to join drainage from the Silver Peak Range and Mineral Ridge to the west and south via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes, and drainage from Weepah Hills to the east. Although Big Smoky Valley is an extensive topographic feature, Montezuma alternative segment 1 would only cross through the extreme western part. Once past Silver Peak, Montezuma alternative segment 1 would enter Clayton Valley, which receives drainage from the Silver Peak Range, Mineral Ridge, Palmetto Mountains, Clayton Ridge, Paymaster Range, and Weepah Hills via Lida Wash and unnamed washes. In Clayton Valley, the alternative segment would pass between Angel Island and Clayton Ridge, where it would cross numerous ephemeral washes flowing down from Clayton Ridge. As Montezuma alternative segment 1 passed through the gap between Paymaster Ridge and Clayton Ridge and rounded the southern portion of Clayton Ridge, it would cross over ephemeral washes flowing down from Paymaster Ridge, Clayton Ridge, and the Montezuma Range via Nevada Canyon and unnamed washes. After passing through a gap in the Montezuma Range, the segment would cross over Jackson Wash into an unnamed valley. Drainage from numerous ephemeral washes flows downslope of the Montezuma Range and the Goldfield Hills into this valley. Montezuma alternative segment 1 would skirt the western foothills of the Goldfield Hills, round the southern edge, cross over China Wash, and pass between the Goldfield Hills and the Cuprite Hills, crossing over several washes flowing down from both hills. Montezuma alternative segment 1 would pass between a gap in the Cuprite Hills and end near Lida Junction. There are no streamflow or water-quality data available for the streams and washes Montezuma alternative segment 1 would cross.

Montezuma alternative segment 1 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Montezuma 1 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

Table 3-107. Hydrologic features potentially relevant to the Montezuma alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Montezuma alternative segment 1		
Drainage from Monte Cristo Range, Silver Peak Range, Mineral Ridge, and Weepah Hills via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes to Big Smoky Valley. Drainage from Silver Peak Range, Mineral Ridge, Palmetto Mountains, Clayton Ridge, Paymaster Range, and Weepah Hills via Lida Wash and unnamed washes into Clayton Valley. Drainage from Paymaster Ridge, Clayton Ridge, and Montezuma Range via Nevada Canyon and unnamed washes. Drainage from numerous ephemeral washes flows downslope of the Montezuma Range and Goldfield Hills into an unnamed valley.	Segment would cross Jackson Wash, China Wash, and 185 unnamed washes.	Hot Spring 0.53 kilometer west.
Montezuma alternative segment 2		
Drainage from Monte Cristo Range, Silver Peak Range, Mineral Ridge, and Weepah Hills via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes to Big Smoky Valley. Drainage from Lone Mountain, General Thomas Hills, and San Antonio Mountains flows into Montezuma Valley. Drainage from Malpais Mesa, Goldfield Hills, Montezuma Range, and Chispa Hills flow into Alkali Lake Playa and Stonewall Flat.	Segment would cross Big Wash and 84 unnamed washes. Segment would cross Stonewall Flat.	Slaughterhouse Spring 0.92 kilometer west. Rabbit Spring 0.20 kilometer west.
Montezuma alternative segment 3		
Drainage from Monte Cristo Range, Silver Peak Range, Mineral Ridge, and Weepah Hills via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes to Big Smoky Valley. Drainage from Lone Mountain, General Thomas Hills, and San Antonio Mountains flows into Montezuma Valley. Drainage from numerous ephemeral washes flows down slope of the Montezuma Range and the Goldfield Hills into an unnamed valley.	Segment would cross Big Wash and 147 unnamed washes.	

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 52-53, 58-59.
b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

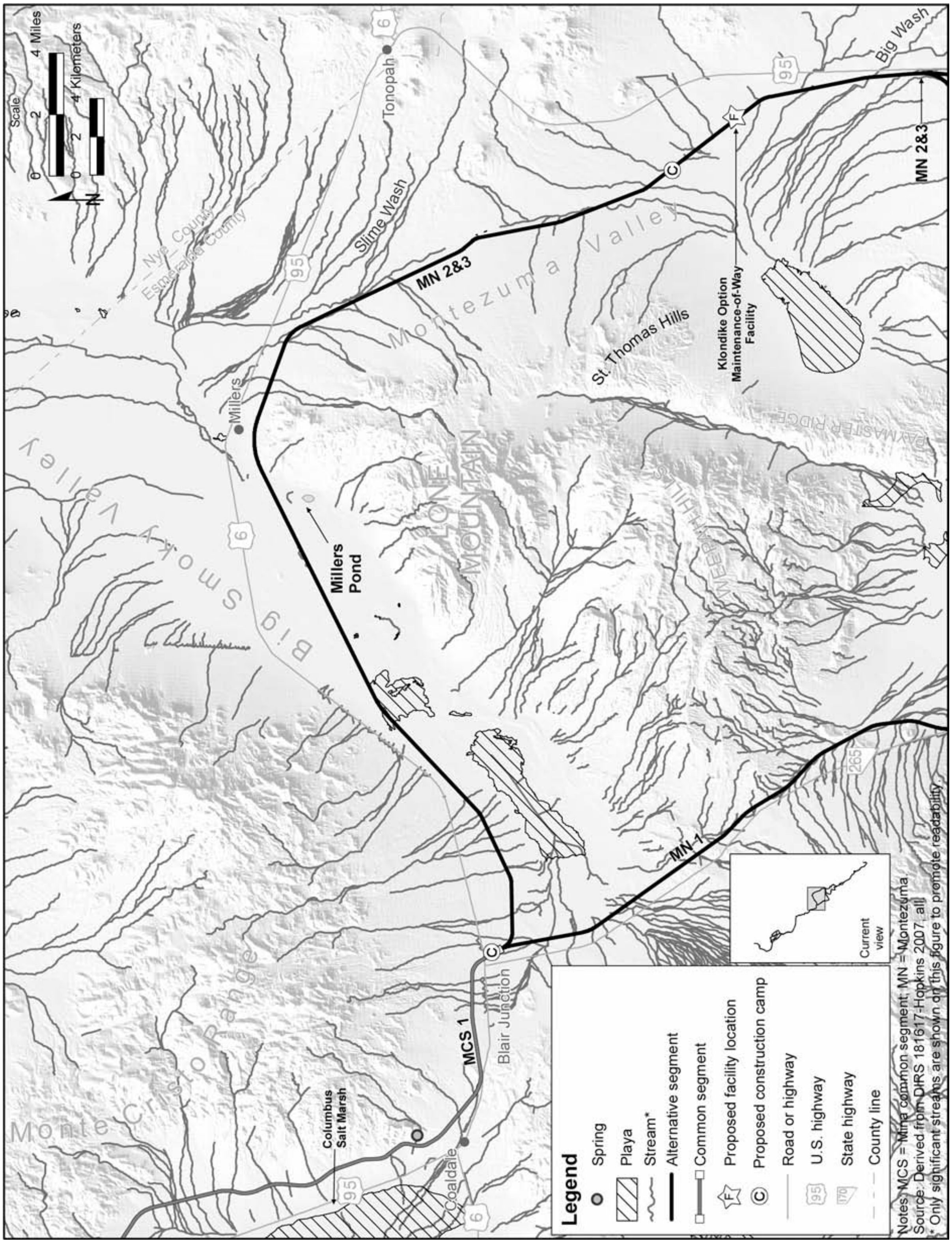


Figure -183. Surface drainage within map area 4.

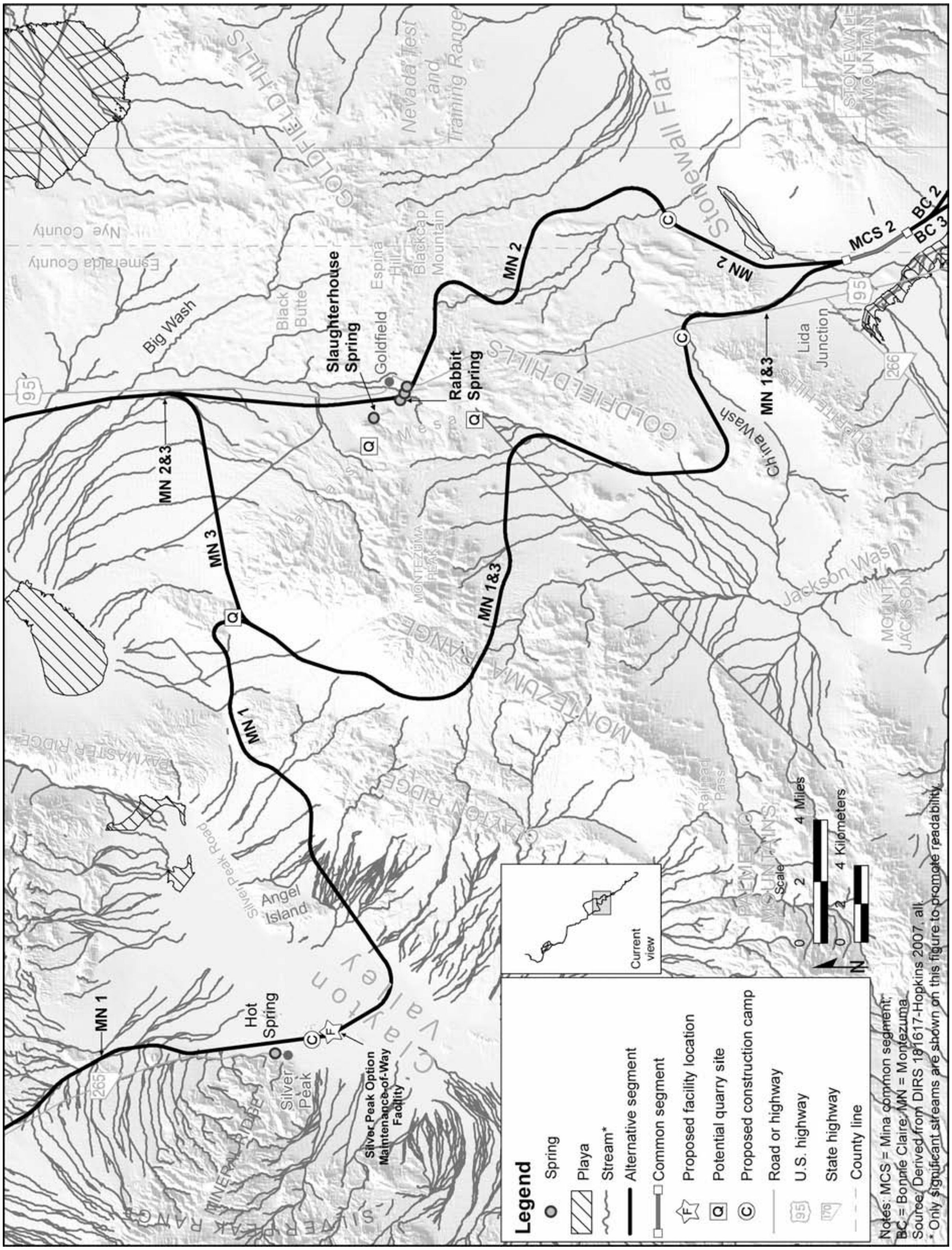


Figure 3-184. Surface drainage within map area 5.

The National Wetland Inventory dataset identifies a pond in the private, diked area near Silver Peak as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas (DIRS 180889-PBS&J 2007, all). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Montezuma 1; however, the rail alignment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

Hot Spring is within the region of influence for Montezuma alternative segment 1, approximately 0.53 meter (0.33 mile) west of the alternative segment near the Silver Peak.

3.3.5.3.7.2 Montezuma Alternative Segment 2. Montezuma alternative segment 2 would parallel U.S. Highway 95 as it traveled east from Big Smoky Valley past Lone Mountain. After passing Millers, the segment would head south and enter Montezuma Valley. It would pass Tonopah, General Thomas Hills, and Klondike and parallel U.S. Highway 95 for a short time before crossing it near Malpais Mesa, Goldfield Hills, and Goldfield. Montezuma alternative segment 2 would end near Stonewall Flat (see Table 3-107 and Figures 3-183 and 3-184). Construction camp 9 would be adjacent to Montezuma alternative segment 2 just north of Stonewall Flat. The construction camp would not overlie any surface-water features. Construction camp 13B would be adjacent to Montezuma alternative segment 1 in Montezuma Valley. A small ephemeral wash draining hills near Hasbrouck Peak into Montezuma Valley would run through the footprint for the construction camp (DIRS 180875-Nevada Rail Partners 2007, p. F-10). Two potential quarry sites, ES-7 and Malpais Mesa South, would be along the Montezuma alternative segment 2 in Malpais Mesa near Goldfield. Neither quarry would overlie any surface-water features.

Montezuma alternative segment 2 would parallel State Route 6 as it traveled east along the southern edge of the Monte Cristo Range and into Big Smoky Valley. Big Smoky Valley receives drainage from numerous ephemeral washes flowing downslope of the Monte Cristo Range to the north to join drainage from the Silver Peak Range and Mineral Ridge to the west and south via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes, and drainage from Weepah Hills to the east. Montezuma alternative segment 2 would cross several ephemeral washes flowing down from the Monte Cristo Range, pass a few small playas, and cross a large playa twice. These playas are actually part of a larger playa in Big Smoky Valley. The segment would pass within 0.42 kilometer (0.26 mile) of a smaller playa in Big Smoky Valley. After crossing private property known as Millers, the segment would pass approximately 1.3 kilometers (0.81 mile) north of a tailings pond located on the same property. The pond, approximately 0.17 square kilometer (0.07 square mile) in size, appears to receive a portion of its hydrology as seasonal runoff from Lone Mountain. No water-quality data are available for Millers tailings pond.

In the Millers area, there is a small playa identified as a dry lake, which would be approximately 1.5 kilometers (0.93 mile) north of Montezuma alternative segment 2. As the segment passed Millers, it would turn south, proceed past Slime Wash to the east, and enter Montezuma Valley. Montezuma Valley receives drainage from numerous ephemeral washes flowing downslope of Lone Mountain and General Thomas Hills to the west and San Antonio Mountains to the east. As the Montezuma alternative segment 2 continued south through Montezuma Valley, it would pass to the west of a set of three small playas. A few small ephemeral washes originating near Mt. Butte to the east and Lone Mountain to the west might convey seasonal waters toward these playas. Just north of Goldfield, the Montezuma alternative segment 2 would cross Big Wash. Once in Goldfield, the rail segment would pass to the west of a number of small playas that receive drainage from Goldfield Hills to the south. At the extreme southern end of the Montezuma alternative segment 2, near Ralston, the segment would pass to the west of a large playa named Stonewall Flat, which is northwest of Stonewall Mountain. Runoff from Stonewall Flat drains downslope into Lida Valley where it might remain as surface water for brief periods. The estimated runoff entering Stonewall Flat is 490,000 cubic meters (17.3 million cubic feet) per year (DIRS 101811-DOE 1996, Section 4.2.5.1). It is likely that ephemeral washes would convey seasonal runoff from Stonewall Mountain into the playa. Montezuma alternative segment 2 would end shortly after passing Stonewall Flat. There are no streamflow or water-quality data available for the streams and washes Montezuma 2 would cross.

Montezuma alternative segment 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Montezuma 2 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

The National Wetland Inventory dataset identifies the large playas in Big Smoky Valley and Stonewall Flat as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in this area (DIRS 180889-PBS&J 2007, all). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Montezuma alternative segment 2; however, the segment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

Slaughterhouse Spring and Rabbit Spring are located approximately 0.92 kilometer (0.57 mile) and 0.20 kilometer (0.12 mile), respectively, west of the rail alignment near the town of Goldfield. All three springs are within the Mina rail alignment region of influence but would be outside the construction right-of-way.

3.3.5.3.7.3 Montezuma Alternative Segment 3. Montezuma alternative segment 3 would parallel State Route 6 as it traveled east from Big Smoky Valley past Lone Mountain. After passing Millers, the segment would head south and enter Montezuma Valley. It would pass Tonopah, General Thomas Hills, and Klondike and parallel U.S. Highway 95 for a short time before turning west at the Montezuma Range, just north of Malpais Mesa. The segment would travel past Clayton Ridge, the Montezuma Range, Goldfield Hills, Cuprite Hills, Stonewall Flat, and Stonewall Mountain before ending near Lida Junction (see Table 3-107 and Figures 3-183 and 3-184). Construction camp 13B would be adjacent to Montezuma alternative segment 3 in Montezuma Valley. A small ephemeral wash draining hills near Hasbrouck Peak into Montezuma Valley would run through the footprint for the construction camp (DIRS 180875-Nevada Rail Partners 2007, p. F-10). Construction camp 9A would be adjacent to Montezuma 3 approximately 280 meters (920 feet) west of where the rail alignment would cross U.S. Highway 95 (DIRS 180875-Nevada Rail Partners 2007, p. F-11). A small ephemeral wash draining downslope of Garfield Hills would run through the extreme southwest corner of the construction camp. There are no potential quarry sites along Montezuma 3.

Montezuma alternative segment 3 would parallel State Route 6 as it traveled east along the southern edge of the Monte Cristo Range and into Big Smoky Valley. Big Smoky Valley receives drainage from numerous ephemeral washes flowing downslope of the Monte Cristo Range to the north to join drainage from the Silver Peak Range and Mineral Ridge to the west and south via Black Canyon, Eagle Nest Canyon, New York Canyon, Echo Canyon, Eagle Canyon, Custer Gulch, Great Gulch, and unnamed washes, and drainage from Weepah Hills to the east. The segment would cross several ephemeral washes flowing down from the Monte Cristo Range, pass a few small playas, and cross a large playa twice. These playas are actually part of a larger playa in Big Smoky Valley. Montezuma alternative segment 3 would pass within 0.42 kilometer (0.26 mile) of a smaller playa in Big Smoky Valley. After reaching

Millers, the segment would pass approximately 1.3 kilometers (0.81 mile) north of Millers Pond. The pond, approximately 0.17 square kilometer (0.07 square mile) in size, appears to receive a portion of its hydrology as seasonal runoff from Lone Mountain. No streamflow or water-quality data are available for Millers Pond. In Millers, there is a small playa identified as a dry lake, which would be approximately 1.5 kilometers (0.93 mile) north of Montezuma 3. As Montezuma alternative segment 3 passed Millers, it would turn south, proceed past Slime Wash to the east, and enter Montezuma Valley. Montezuma Valley receives drainage from numerous ephemeral washes flowing downslope of Lone Mountain and General Thomas Hills to the west and San Antonio Mountains to the east. As the segment continued south through Montezuma Valley, it would pass a set of three small playas to the east. A few small ephemeral washes originating near Mt. Butte to the east and Lone Mountain to the west might convey seasonal waters toward these playas. As Montezuma alternative segment 3 passed around the northern end of the Montezuma Range, it would cross over ephemeral washes flowing down from Paymaster Ridge, Clayton Ridge, and the Montezuma Range via Nevada Canyon and unnamed washes. After passing through a gap in the Montezuma Range, the Montezuma alternative segment 3 would cross Jackson Wash into an unnamed valley. Drainage from numerous ephemeral washes flows downslope of the Montezuma Range and the Goldfield Hills into this valley. Montezuma alternative segment 3 would skirt the western foothills of the Goldfield Hills, round the southern edge, and pass between Goldfield Hills and Cuprite Hills, crossing over several washes flowing down from both hills. Montezuma 3 would pass between a gap in the Cuprite Hills and end near Lida Junction. There are no streamflow or water-quality data available for the streams and washes Montezuma alternative segment 3 would cross.

Montezuma alternative segment 3 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Montezuma alternative segment 3 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

The National Wetland Inventory dataset identifies the large playa in Big Smoky Valley as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas (DIRS 180889-PBS&J 2007, all). Appendix F provides more information about wetlands.

The Federal Emergency Management Agency has not mapped floodplains in the area of Montezuma alternative segment 3; however, the rail alignment would cross floodplains associated with the valley floors and playas along its route. Appendix F further describes possible floodplains associated with the rail alignment.

There are no springs identified within 1.6 kilometers (1 mile) of Montezuma alternative segment 3.

3.3.5.3.8 Mina Common Segment 2

Mina common segment 2 would begin just east of Lida Junction and would cross Alkali Flat (within the Lida Valley) and end near the foot of Stonewall Mountain (see Table 3-108 and Figure 3-185). There are no proposed construction camps or potential quarry sites along Mina common segment 2.

Mina common segment 2 would begin in Lida Valley, south of Stonewall Flat, and cross over Alkali Flat. Runoff from Stonewall Flat drains downslope into Lida Valley where it might remain as surface water for brief periods. The estimated runoff entering Stonewall Flat is 490,000 cubic meters (17.3 million cubic feet) per year (DIRS 101811-DOE 1996, Section 4.2.5.1). Jackson Wash appears to be a notable drainage that contributes seasonal water to Lida Valley.

Table 3-108. Hydrologic features potentially relevant to Mina common segment 2.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[b] of the centerline of the rail alignment
Drainage from northwest side of Stonewall Mountain and the Cuprite Hills would drain into Lida Valley and Alkali Flat Playa.	Jackson Wash, China Wash. Segment would cross three washes.	Alkali Flat/Lida Valley Playa.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59.
b. To convert meters to feet, multiply by 3.2808; to convert kilometers to miles, multiply by 0.62137.

There are no perennial streams in any of the surrounding basins; rather, the many washes that drain the upland areas convey ephemeral flow that ponds on the playas during periods of intense precipitation. No streamflow or water-quality data are available for the streams and washes Mina common segment 2 would cross.

Mina common segment 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Mina common segment 2 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

There are no wetlands within the Mina common segment 2 region of influence.

Federal Emergency Management Agency flood maps provide coverage for the entire length of Mina common segment 2; however, the common segment would not cross any floodplains. Because Mina common segment 2 follows valley floors and crosses unnamed ephemeral washes and playas, it is feasible that a floodplain could exist in low laying areas along this segment. Appendix F further describes possible floodplains associated with the rail alignment.

There are no springs identified within 1.6 kilometers (1 mile) of Mina common segment 2.

3.3.5.3.9 Bonnie Claire Alternative Segments

Bonnie Claire alternative segment 2 would begin south of Stonewall Flat, exit Lida Valley, and turn to the east, entering Sarcobatus Flat, a large playa. Sarcobatus Flat is bounded by Pahute Mesa on the east and Gold Mountain to the west (see Table 3-109 and Figure 3-185). There are no construction camps or quarries proposed for Bonnie Claire 2.

Bonnie Claire alternative segment 2 would be in an area that receives drainage from Stonewall Mountain, the foothills of Gold Mountain, and the Northern Pahute Mesa, which flows toward Lida Valley, Alkali Flat, and the Bonnie Claire area of Sarcobatus Flat. Unnamed washes run northeast to southwest, providing a path for overland flow from Pahute Mesa, including the south and southeast sides of Stonewall Mountain to Sarcobatus Flat. Bonnie Claire 2 would cross a notable braided wash at the north end of Sarcobatus Flat before running adjacent to the same wash for several kilometers. This braided wash flows from Stonewall Pass to the Bonnie Claire area of Sarcobatus Flat. There are no streamflow or water-quality data available for the streams and washes Bonnie Claire 2 would cross.

Bonnie Claire 2 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3).

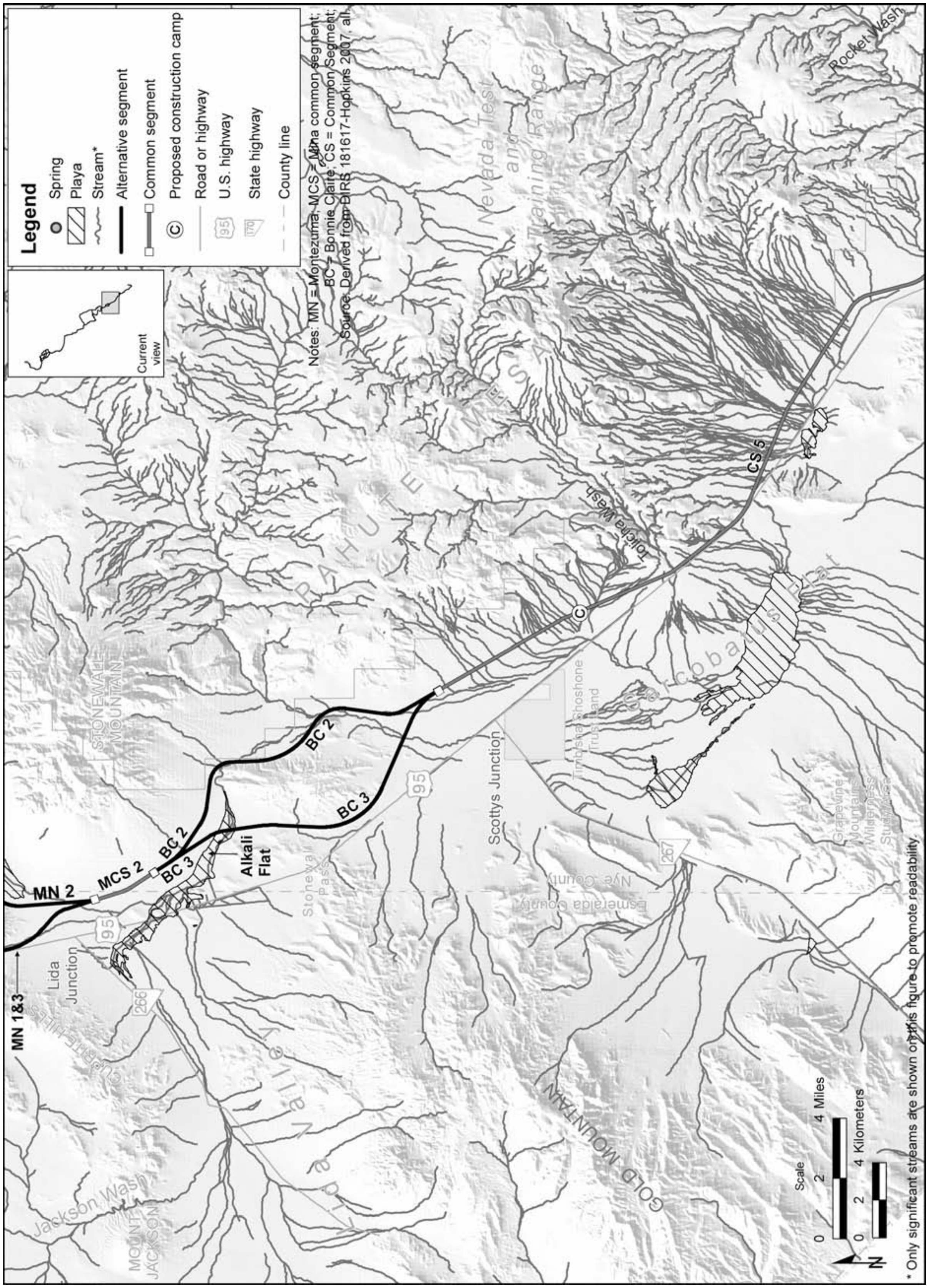


Figure 3-185. Surface drainage within map area 6.

Table 3-109. Hydrologic features potentially relevant to the Bonnie Claire alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Bonnie Claire alternative segment 2		
Drainage from Stonewall Mountain, the foothills of Gold Mountain, Stonewall Pass, and Northern Pahute Mesa to Lida Valley, Alkali Flat, and Bonnie Claire area within Sarcobatus Flat.	Segment would cross 31 washes, including an unnamed braided wash.	Alkali Flat/Lida Valley Playa.
Bonnie Claire alternative segment 3		
Drainage from the foothills of Gold Mountain, Stonewall Mountain, Stonewall Pass, and Northern Pahute Mesa to Lida Valley, Alkali Flat, and Bonnie Claire area within Sarcobatus Flat.	Segment would cross Alkali Flat/Lida Valley Playa. Segment would cross 23 washes.	None.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO06007NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59-60, and 68.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

Therefore, none of the washes along Bonnie Claire 2 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface water bodies with a connection to interstate water.

There are no wetlands within the region of influence for Bonnie Claire 2.

Federal Emergency Management Agency flood maps cover most of Bonnie Claire 2, but do not include a portion of the land on the eastern side of the alternative segment, which is shown on the maps as an old boundary of the Nevada Test and Training Range. Flood mapping does not extend east of this boundary. The flood maps also show a floodplain for an unnamed drainage feature from Pahute Mesa. The floodplain ends just south of Bonnie Claire 2 near one of the old Nevada Test and Training Range boundaries. It is possible that this floodplain would extend far enough to the northeast to be encountered by Bonnie Claire 2; however, the distance is too far to support such an assumption. In addition, Bonnie Claire 2 would run farther up in the foothill area where the wash would involve few tributaries. Appendix F provides additional information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of Bonnie Claire 2.

Bonnie Claire alternative segment 3 would begin south of Stonewall Flat, exit Lida Valley, and continue south into Sarcobatus Flat, a large playa. Sarcobatus Flat is bounded by Pahute Mesa on the east and Gold Mountain on the west (Table 3-112 and Figure 3-185). There are no potential quarry sites or proposed construction camps along Bonnie Claire alternative segment 3.

Bonnie Claire alternative segment 3 would be in an area that receives drainage from Stonewall Mountain, the foothills of Gold Mountain, and the Northern Pahute Mesa, which flows toward Lida Valley, Alkali Flat, and the Bonnie Claire area of Sarcobatus Flat. Unnamed washes run northeast to southwest, providing a path for overland flow from Pahute Mesa, including the south and southeast sides of Stonewall Mountain to Sarcobatus Flat. Bonnie Claire 3 would pass through Alkali Flat Playa, a major playa shown in Figure 3-185 and cross a notable braided wash in Sarcobatus Flat. This braided wash flows from Stonewall Pass to the Bonnie Claire area of Sarcobatus Flat. There are no streamflow or water-quality data available for the streams and washes Bonnie Claire 3 would cross.

Bonnie Claire alternative segment 3 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Bonnie Claire alternative segment 3 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface water bodies with a connection to interstate water.

There are no wetlands within the region of influence for Bonnie Claire alternative segment 3.

Federal Emergency Management Agency flood maps cover most of Bonnie Claire alternative segment 3, but do not include a portion of the land on the eastern side of the segment, which is shown on the maps as an old boundary of the Nevada Test and Training Range. Flood mapping does not extend east of this boundary. Bonnie Claire alternative segment 3 would cross a 100-year floodplain associated with Alkali Flat Playa. The flood maps also show a floodplain for an unnamed drainage feature from Pahute Mesa. The floodplain ends just south of Bonnie Claire alternative segment 3 at one of the old Nevada Test and Training Range boundaries. The floodplain is close enough to Bonnie Claire alternative segment 3 that it is reasonable to assume it would be at a similar width if it extended farther up the wash to where Bonnie Claire alternative segment 3 would cross. Appendix F provides additional information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of Bonnie Claire alternative segment 3.

3.3.5.3.10 Common Segment 5 (Sarcobatus Flat Area)

Common segment 5 would begin approximately 3.1 kilometers (1.9 miles) east of U.S. Highway 95 and trend generally southeast, through the Sarcobatus Flat Area, and along the east side of U.S. Highway 95 (Table 3-110 and Figures 3-185 and 3-186). Common segment 5 would end approximately 6.4 kilometers (4 miles) north of Springdale. Construction camp 10 would be adjacent to the rail alignment and east of U.S. Highway 95. Numerous ephemeral wash draining downslope of Pahute Mesa would run through the construction camp. There are no potential quarry sites along common segment 5 (DIRS 180875-Nevada Rail Partners 2007, pp. 3-5).

Common segment 5 would cross washes that drain the Tolicha Peak area of Pahute Mesa. Drainage from the Pahute Mesa flows from the east into Sarcobatus Flat. The alluvial flat terrain between Tolicha Peak and U.S. Highway 95 is characterized by numerous braided washes. Although Sarcobatus Flat is an extensive topographic feature, there is only one portion designated as a minor playa that would be close to the rail alignment. The northern edge of this small playa is adjacent to U.S. Highway 95, and would be approximately 1.7 kilometers (1.1 miles) south of common segment 5 to the southeast of the point where Tolicha Wash crosses Interstate Highway 95. The segment would then cross surface drainage originating from Tolicha Peak and Springdale Mountain. There are no streamflow or water-quality data available for the streams and washes common segment 5 would cross.

Common segment 5 would be in the Central Hydrographic Region of Nevada, which has surface hydrology characterized by internally draining sub-areas and is considered an intrastate basin (DIRS 180889-PBS&J 2007, p. 3). Therefore, none of the washes along Mina common segment 5 qualify as waters of the United States, as regulated under Section 404 of the Clean Water Act, because there are no connections to surface-water bodies with a connection to interstate water.

The National Wetlands Inventory map identifies the playas associated with Sarcobatus Flat as wetlands; however, field studies conducted in support of this Rail Alignment EIS confirmed that there are no ***hydric soils***, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near

Table 3-110. Hydrologic features potentially relevant to common segment 5.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters of the centerline of the rail alignment[b]	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from Pahute Mesa and Bullfrog Hills flows to playas within Sarcobatus Flat and Bonnie Claire Lake within Sarcobatus Flat.	Segment would cross Tolicha Wash and 123 other washes. The alluvial flat terrain between Tolicha Peak and U.S. Highway 95 is characterized by numerous braided washes. Washes within this type of soil and terrain can shift in number and geography with a variation of precipitation intensity.	Dry lake bed 0.5 kilometer south.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 59-60, 64, and 68.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

the rail alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 6). Appendix F provides more information about wetlands in this area.

Federal Emergency Management Agency flood maps provide coverage for almost all of common segment 5. The maps show that the segment would cross a 100-year floodplain associated with Tolicha Wash where it drains toward Sarcobatus Flat. Appendix F provides more information on this floodplain.

There are no springs identified within 1.6 kilometers (1 mile) of common segment 5.

3.3.5.3.11 Oasis Valley Alternative Segments

Oasis Valley alternative segment 1 would begin north of Oasis Mountain and would run southeast for approximately 9.8 kilometers (6.1 miles) before converging with common segment 6 (Table 3-111 and Figure 3-186). Construction camp 11 would be along the west side of Oasis Valley alternative segment 1 approximately 3.1 kilometers (1.9 miles) north of its junction with common segment 6. Several ephemeral washes flowing downslope from Bullfrog Hills and mountains to the east would run through the construction camp. There are no potential quarry sites along Oasis Valley alternative segment 1 (DIRS 180875-Nevada Rail Partners 2007, pp. 3-5).

Oasis Valley alternative segment 1 would cross the Amargosa River and its tributaries. Although referred to as a river, the Amargosa River and tributary branches and washes receive ephemeral flows from winter and summer storms, and perennial flows near springs and seeps. For most of the year, the tributaries carry no water. The Amargosa River has approximately 20 branches and 40 tributary washes in Oasis Valley. The main branch enters the valley from the north through Thirsty Canyon. Most of the drainage into Oasis Valley is from Pahute Mesa (including Oasis and Springdale Mountains to the north) and the Bullfrog Hills to the southwest. There are no streamflow or water-quality data available for this area; however, there is regional data for the Death Valley Basin (DIRS 176325-USGS 2006, all).

The Amargosa River interstate drainage system flows to Death Valley in California. A survey of the washes along the Mina rail alignment identified the Amargosa River and one tributary that Oasis Valley alternative segment 1 would cross as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, Figure 3B).

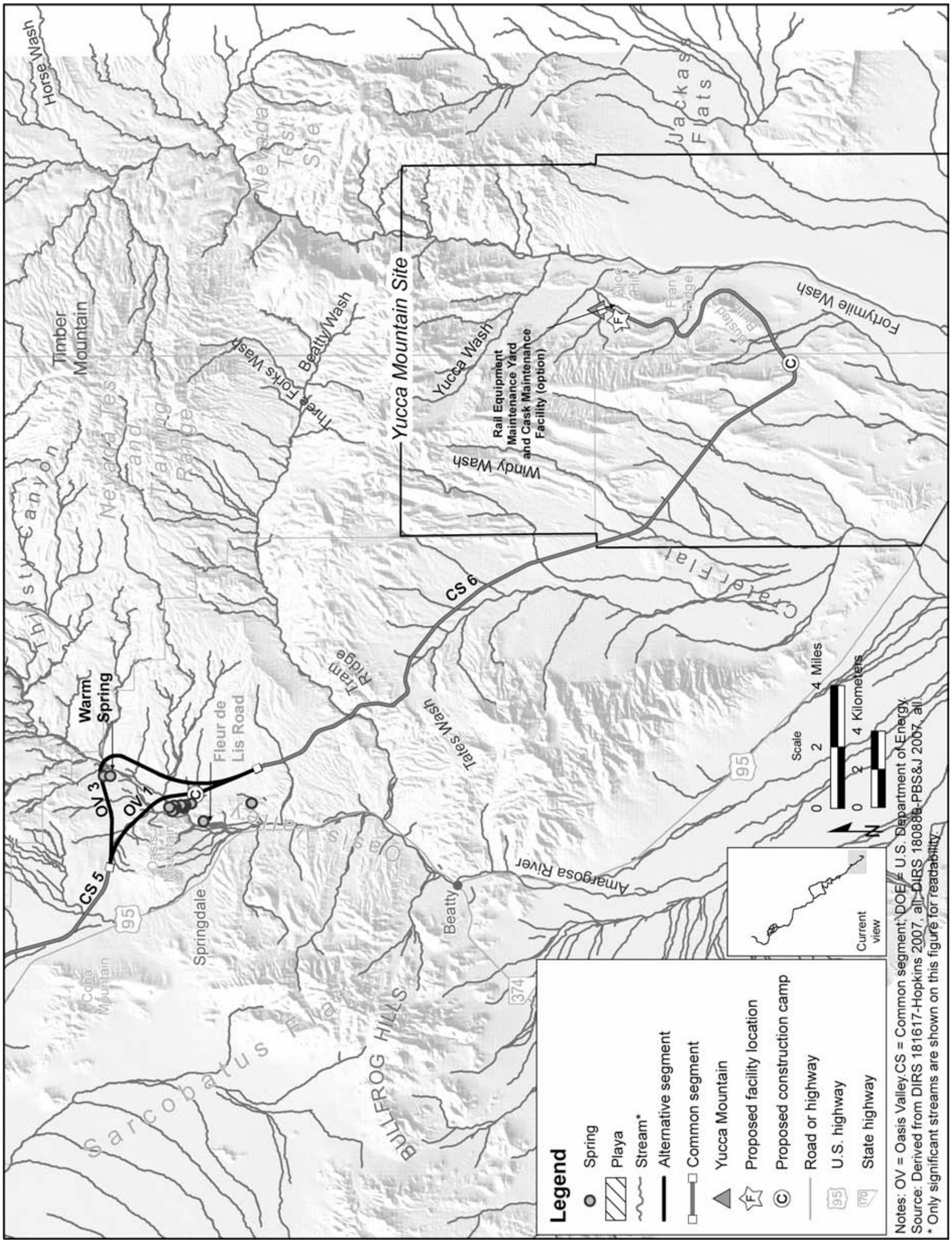


Figure 3-186. Surface drainage within map area 7.

Table 3-111. Hydrologic features potentially relevant to the Oasis Valley alternative segments.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of the rail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Oasis Valley alternative segment 1		
Drainage from Bull Frog Hills and the Pahute Mesa, including the Amargosa River and Amargosa River tributaries.	Segment would cross the Amargosa River and 23 unnamed washes.	Unnamed springs: 1.5 kilometers west 0.53 kilometer west 0.74 kilometer west 0.69 kilometer west 0.47 kilometer west 0.59 kilometer west 0.46 kilometer west 0.59 kilometer west 0.67 kilometer west 0.54 kilometer west 0.48 kilometer west 1.4 kilometers west 1.5 kilometers west
Oasis Valley alternative segment 3		
Drainage from Bull Frog Hills and the Pahute Mesa, including the Amargosa River and Amargosa River tributaries.	Segment would cross the Amargosa River, and 27 washes/tributaries to the Amargosa River.	Colson Pond (spring fed) 0.24 kilometer southwest. Small wetland 0.5 kilometer from Colson Pond. Unnamed springs: 0.20 kilometer west 1.1 kilometers west 1.2 kilometers west 1.2 kilometers west 1.3 kilometers west 1.3 kilometers west 1.3 kilometers west 1.4 kilometers west 1.4 kilometers west 1.5 kilometers west 1.5 kilometers west 1.6 kilometers west

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000; DIRS 176730-DeLorme 1996, p. 64.
b. To convert meters to feet, multiply by 3.2808.
c. To convert kilometers to miles, multiply by 0.62137.

There are no wetlands identified within the region of influence for Oasis Valley alternative segment 1.

Federal Emergency Management Agency flood maps provide complete coverage for Oasis Valley 1. The maps show that the segment would cross a 100-year floodplain associated with the Amargosa River. Appendix F provides more information about this floodplain.

There are numerous springs in Oasis Valley and Thirsty Canyon near where Oasis Valley alternative segment 1 would cross. Oasis Valley 1 would pass within 0.48 kilometer (0.30 mile) of several springs identified as the upper Oasis Valley Ranch Springs (DIRS 169384-Rainer et al. 2002, Figure 3).

These springs are near the narrows through which the Amargosa River leaves Oasis Valley. Table 3-111 lists these springs.

Oasis Valley alternative segment 3 would begin north of Oasis Mountain, generally run east and then south for approximately 14 kilometers (8.8 miles) and would cross Oasis Valley approximately 0.24 kilometer (0.15 mile) northeast of Colson Pond before converging with common segment 6 (Table 3-111 and Figure 3-186). There are no potential quarry sites or proposed construction camps along Oasis Valley 3.

Oasis Valley alternative segment 3 would cross the Amargosa River and its tributaries, as described above for Oasis Valley alternative segment 1.

A survey of washes performed along the Mina rail alignment identified the Amargosa River, which Oasis Valley alternative segment 3 would cross, as a water of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, Figure 3B).

DOE field studies identified a small wetland associated with an unnamed seep located approximately 0.5 kilometer (0.31 mile) from Colson Pond (DIRS 180914-PBS&J 2006, Figure 4T). Appendix F provides more information about this wetland.

Federal Emergency Management Agency flood maps provide complete coverage for Oasis Valley 3. The maps show that the segment would cross a 100-year floodplain associated with the Amargosa River. Appendix F provides more information about this floodplain.

There are numerous springs in Oasis Valley and Thirsty Canyon near where Oasis Valley alternative segment 3 would cross (see Table 3-111). Colson Pond is spring fed and would be within 0.24 kilometer (0.15 mile) of the alternative segment. This spring is commonly known as Colson Pond Spring (DIRS 169384-Reiner et al. 2002, Plate 2), but is also referred to as Warm Spring.

3.3.5.3.12 Common Segment 6 (Yucca Mountain Approach)

Common segment 6 would begin at the south juncture of the end of the Oasis Valley alternative segments and proceed to the southeast toward Yucca Mountain (Table 3-112 and Figure 3-186).

The proposed location for construction camp 12 is adjacent to the rail line approximately 9.7 kilometers (6 miles) south of the ***geologic repository*** operations area. There are no potential quarry sites along common segment 6 (DIRS 180875-Nevada Rail Partners 2007, pp. 3-5).

Table 3-112. Hydrologic features potentially relevant to common segment 6.[a]

General hydrographic features/drainage	Hydrologic features within 150 meters[b] of the centerline of therail alignment	Hydrologic features between 150 meters and 1.6 kilometers[c] of the centerline of the rail alignment
Drainage from northern Yucca Mountain Range, including Tram Ridge, and Timber Mountain. Drainage from Yucca Mountain Range to Crater Flat and Amargosa Valley.	Segment would cross Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash, and 39 unnamed washes.	Fortymile Wash. Midway Valley Wash.

a. Source: DIRS 177710-MO0607NHDWBDYD.000; DIRS 177714-MO0607NHDFLM06.000; DIRS 176979-MO0605GISGNISN.000, all; DIRS 176730-DeLorme 1996, p. 64-65.
b. To convert meters to feet, multiply by 3.2808
c. To convert kilometers to miles, multiply by 0.62137.

Common segment 6 would cross terrain that drains from the southern end of Pahute Mesa and the Yucca Mountain Range to Crater Flat and the Amargosa River. The first significant tributary common segment 6 would cross is Beatty Wash and its tributaries, which provide drainage from Timber Mountain and Tram Ridge at the northern reaches of Yucca Mountain, to Oasis Valley and the Amargosa River at a point approximately 4.8 kilometers (3 miles) northeast of the community of Beatty. Beatty Wash is one of the largest tributaries of the Amargosa River. Common segment 6 would cross Beatty Wash at the north end of the Yucca Mountain Range, approximately 5.4 kilometers (3.4 miles) southeast of Oasis Valley. After crossing Beatty Wash, common segment 6 would proceed to the southeast toward Yucca Mountain, where it would cross several tributaries of Tates Wash. Approximately 26 kilometers (16 miles) from the start of common segment 6, the segment would cross Windy Wash and unnamed washes carrying drainage from the eastern side of Yucca Mountain. The segment would then continue around the southern tip of the Yucca Mountain Range before turning northeast, skirting the eastern edge of Busted Butte and continuing between Bow and Fran Ridges.

Near the Yucca Mountain Site, Fortymile Wash, a major wash that flows to the Amargosa River, drains the eastern side of Yucca Mountain (DIRS 169734-BSC M&O 2004, p. 7.1-3). The tributaries draining into Fortymile Wash at Yucca Mountain include Yucca Wash to the north; Drill Hole Wash, which, together with a tributary in Midway Valley, drains most of the repository site; and Busted Butte Wash (also known as Dune Wash) to the south. Common segment 6 would cross Busted Butte Wash, some of its unnamed tributaries, and unnamed tributaries of Drill Hole Wash. Common segment 6 would not actually cross Drill Hole Wash, but the wash would be within the common segment 6 region of influence. Fortymile Wash runs parallel to the end of common segment 6 at the Yucca Mountain Site, but common segment 6 would not cross the wash. Fortymile Wash is the most prominent drainage through Jackass Flats to the Amargosa River (DIRS 155970-DOE 2002, p. 3-36, Figure 3-11).

All of common segment 6 is within the Amargosa River interstate drainage system. Of the numerous washes along common segment 6, 14 were identified as waters of the United States, as regulated under Section 404 of the Clean Water Act (DIRS 180889-PBS&J 2007, Figures 3B and 3C). The Rail Equipment Maintenance Yard would be where the proposed rail line ends at Yucca Mountain. There are no perennial streams, natural bodies of water, or naturally occurring wetlands at Yucca Mountain (DIRS 155970-DOE 2002, p. 3-35). The facility would overlie an ephemeral stream but would not cross any waters of the United States.

Slightly more than half of common segment 6 has coverage on Federal Emergency Management Agency flood maps. These maps show that common segment 6 would cross a short span of the 100-year floodplain associated with Beatty Wash. Although the flood maps do not provide coverage for the area of the repository on the eastern side of Yucca Mountain, DOE has performed flood studies on several washes in that area, as addressed in the Yucca Mountain FEIS. An overlay of the Mina rail alignment with Yucca Mountain FEIS Figure 3-12 indicates that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash. The rail line would terminate just before reaching a floodplain associated with Midway Valley Wash (also known as Sever Wash) (DIRS 155970-DOE 2002, pp. 3-38 and 3-39, and Figure 3-12). Appendix F further describes the floodplains associated with common segment 6.

There are no springs identified within 1.6 kilometers (1 mile) of common segment 6. Ute Springs, 270 meters (890 feet) west of U.S. Highway 95 in Oasis Valley, would be within about 0.6 to 0.88 kilometer (0.37 to 0.55 mile) of potential alternative well sites OV9 through OV12 (see Figure 3.7) near U.S. Highway 95 (DIRS 169384-Rainer et al. 2002, Plate 2).

3.3.6 GROUNDWATER RESOURCES

This section describes groundwater resources along the Mina rail alignment. Section 3.3.6.1 describes the region of influence for groundwater resources; Section 3.3.6.2 is a general overview of groundwater features along the Mina rail alignment; and Section 3.3.6.3 describes more specific features for each of the Mina rail alignment alternative segments and common segments.

3.3.6.1 Region of Influence

The region of influence for groundwater resources along the Mina rail alignment includes aquifers that would underlie areas of the proposed railroad construction and operations, portions of groundwater aquifers DOE would use to obtain water for construction and operations support and that would be affected by these groundwater withdrawals, and nearby springs that might be affected by such groundwater withdrawals. The horizontal extent of the region of influence varies depending on the particular aspects of the specific project activity, as follows:

- DOE used the nominal width of the rail line construction right-of-way and the footprints of the railroad construction and operations support facilities to define where there would be construction or other land disturbances. These areas could be susceptible to changes in groundwater ***infiltration***, discharge (for example, spring discharge), or quality. There could also be damage to, or loss of use of, an existing well (including potential need for well abandonment), if that well fell within the rail ***roadbed*** or was disturbed during railroad construction activities. Review of the available information on the locations of existing wells indicates that rail roadbed construction would not disturb any existing wells. However, the precise locations for existing wells have not been field-verified and actual well locations might vary from the coordinates identified and cataloged for the wells in State of Nevada and U.S. Geological Survey well databases (see Section 3.3.6.2.1).

- DOE used an initial screening-level distance of 1.6 kilometers (1 mile) on either side of the centerline of the rail alignment and an initial radius of 1.6 kilometers surrounding each proposed new well if that well would be outside of the nominal width of the construction right-of-way to define areas in the general vicinity of the rail alignment and proposed well locations that could also be affected by changes in groundwater discharge or quality at existing wells or springs, or in which there could be damage to, or loss of use of, an existing well if that well fell within the rail roadbed or was disturbed during rail construction activities.

- DOE considered both the individual groundwater basins (hydrographic areas) that underlie the Mina rail alignment and the railroad construction and operations support facilities and adjacent hydrographic areas for evaluating areas that might be affected by proposed groundwater withdrawals for construction or operations support. This would include areas that could be susceptible to changes in groundwater discharge or flow to an adjacent groundwater basin.

3.3.6.2 General Hydrogeologic Setting and Characteristics

This section is an overview of the general hydrogeologic setting and characteristics of groundwater underlying the area along the Mina rail alignment. Water-resource features, primarily those associated with groundwater, are described in relation to the hydrographic areas in which they lie.

Groundwater ***recharge*** in central and southern Nevada is affected by low precipitation and high annual evaporation rates typical of desert climates. Most recharge to aquifers in the region of influence is derived from precipitation falling in the higher parts of the inter-basin mountain ranges (DIRS 103136-Prudic, Harrill, and Burbey 1993, pp. 2, 58, 84, and 88).

3.3.6.2.1 Groundwater Hydrographic Areas and Groundwater Use in Nevada

To classify hydrographic regions and hydrographic areas and facilitate the management of groundwater resources within the State of Nevada, the state has been divided into a series of groundwater basins (designated as hydrographic areas) (DIRS 177741-State of Nevada 2005, all; DIRS 106094-Harrill, Gates, and Thomas 1988, all).

A total of 260 hydrographic areas are recognized within the Great Basin; all or parts of 232 hydrographic areas fall within Nevada (DIRS 106094-Harrill, Gates, and Thomas 1988, all; DIRS 177741-State of Nevada 2005, all).

Three types of aquifers are the principal sources of groundwater found in central and southern Nevada, as follows (DIRS 172905-USGS 1995, all):

- Alluvial valley fill: Composed primarily of unconsolidated alluvial sand and gravel. The distribution of sediment size is directly associated with distance from the mountains. In general, the coarsest materials (for example, gravel and boulders) were deposited near the mountains, and the finer materials (for example, sand, silt, and clay) were deposited in the central parts of the basins or in the lakes and playas. Alluvial fans are important hydrologic features within the hydrographic basins, sometimes serving as targets for groundwater development, and with alluvial valley fill portions of the basins receiving some of their recharge through the coarse sediment deposits in the alluvial fans. Alluvial deposits consisting of alluvial sand and gravel are present along the courses of modern ephemeral and intermittent streams or ancestral streams that generally parallel the long axes of the basins. Alluvial deposits underlie most of the Mina rail alignment.
- Volcanic-rock aquifers: Composed primarily of tuffs (ash flows, ash falls), rhyolite, or basalt. Groundwater movement in these materials is often controlled by the number and degree of joint interconnections, ***fractures*** or faults, or vesicle (void space) interconnection in lavas.
- Carbonate-rock aquifers: Composed primarily of limestones and dolomites. The carbonate rocks are commonly highly fractured and are locally fragmented. Groundwater flow in the carbonate rock aquifers is controlled by interconnected fractures.

Tectonic forces superimposed faulting on existing groundwater-bearing formations (aquifers) in this region. As a result, several aquifer units underlying the Mina rail alignment are fractured and faulted in some locations. These faults and fractures locally can influence groundwater flow patterns within the affected aquifer areas, with these features capable of acting as either barriers to, or conduits for, groundwater flow (see Appendix G).

Within the Basin and Range Province, any or all of the three basic aquifer types discussed above might be present within a particular area and might constitute three separate, hydraulically distinct, sources of water. Alternatively, any or all of the three aquifer types might underlie an area but might be hydraulically connected to form a single groundwater source.

Groundwater levels fluctuate seasonally and annually in response to changes in withdrawal (consumptive use) and climatic conditions, with levels generally rising from late winter to early summer and generally declining from summer to early winter (DIRS 172904-Berris et al. 2003, p. 6). In 2000, an estimated 1.75 billion cubic meters (1.42 million ***acre-feet***) of groundwater were pumped in Nevada (DIRS 175964-Lopes and Evetts 2004, p. 7).

Acre-foot is a unit commonly used to measure water volume. It is the quantity of water required to cover 4,047 square meters (1 acre) to a depth of 0.3048 meter (1 foot), and is equal to 1,233.5 cubic meters (325,851 gallons). Sections 3.3.6 and 4.3.6 list perennial yields, committed groundwater resources, and consumptive use in acre-feet because it is the common unit used by industry and government agencies.

Irrigation and stock watering was the primary groundwater use, accounting for approximately 46 percent of the total groundwater withdrawal, followed by mining (approximately 26 percent), drinking-water systems (approximately 14 percent), geothermal production (approximately 8 percent), self-supplied domestic (approximately 5 percent), and miscellaneous (1 percent) (DIRS 175964-Lopes and Evetts 2004, p. 7) (see Figure 3-187). Virtually all major groundwater development in Nevada has been in the alluvial valley fill, with withdrawals from approximately the upper 460 meters (1,500 feet) of these aquifers. The carbonate rock aquifers in eastern and southern Nevada supply water to numerous springs (DIRS 106094-Harrill, Gates, and Thomas 1988, all).

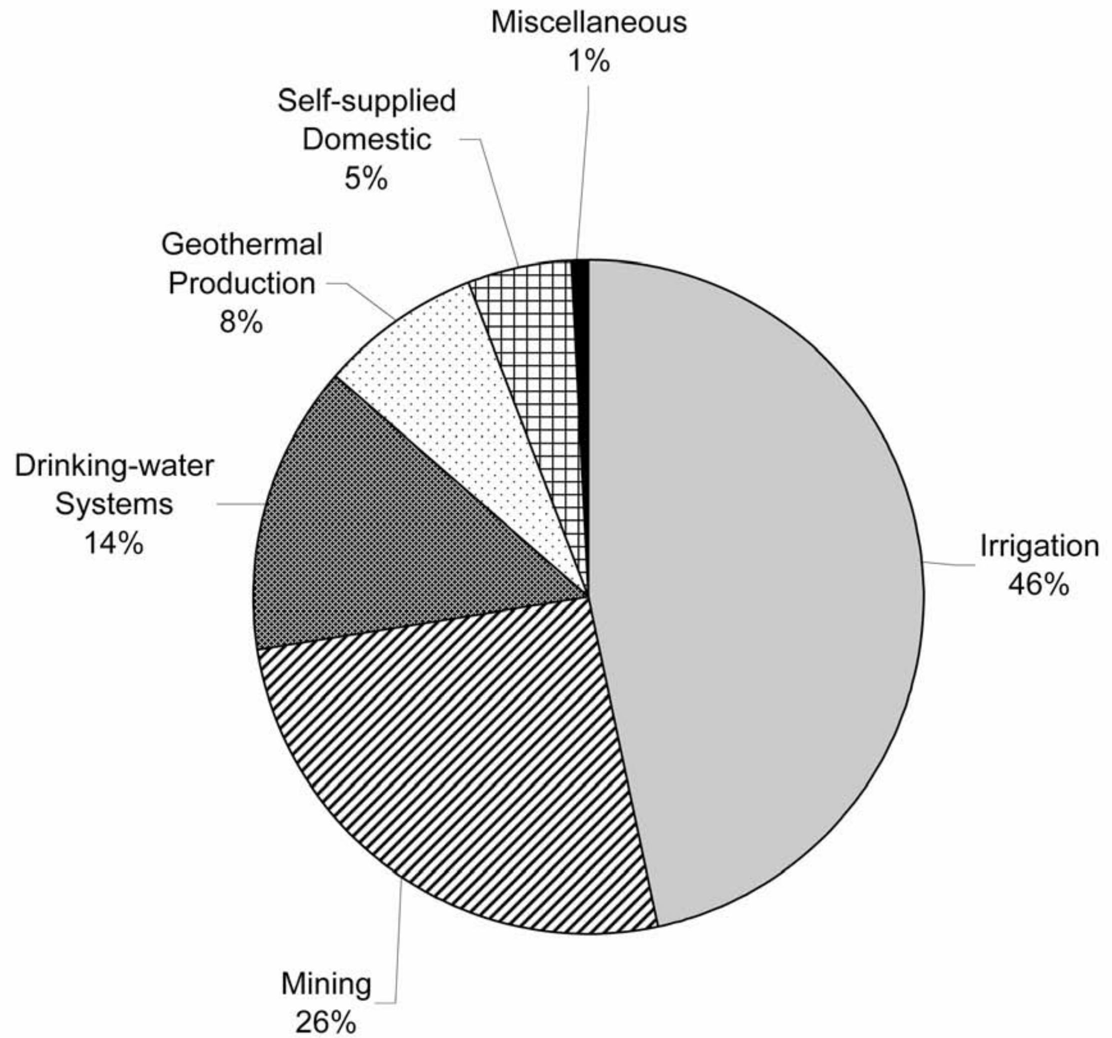


Figure 3-187. Groundwater usage in Nevada in 2000. (Source: DIRS 175964-Lopes and Evetts 2004, p. 7.)

Figure 3-188 shows generalized regional groundwater flow patterns in the vicinity of the Mina rail alignment. Available information regarding groundwater "interbasin" inflow and outflow (groundwater flow across hydrographic area boundaries) characteristics for hydrographic areas (groundwater basins) within central Nevada (DIRS 177524-Anning and Konieczki 2005, pp. 10 and 11, and Plate 1) indicates that interbasin groundwater outflow or groundwater inflow through alluvial valley-fill aquifer materials or through consolidated rock aquifers (lithified or cemented rock aquifers such as carbonate rock units, or

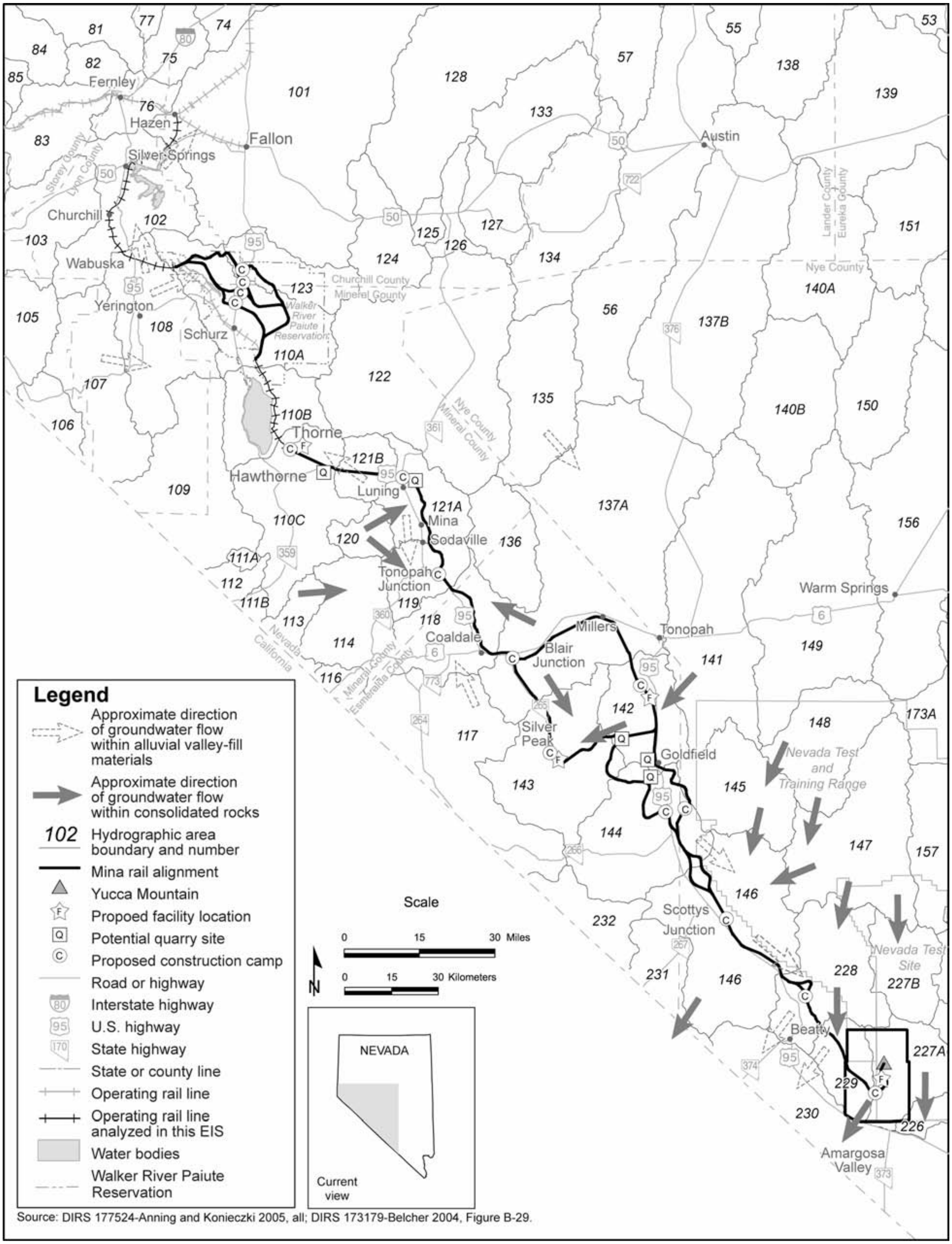


Figure 3-188. Generalized groundwater flow direction through alluvial valley-fill and consolidated rock aquifers in the vicinity of the Mina rail alignment.

clastic, metamorphic, igneous, or volcanic rock aquifers) appears to occur at some locations; at other locations, there appears to be no substantial interbasin groundwater flow occurring through either or both of these types of aquifer units. The figure depicts generalized flow directions within alluvial valley fill units and within consolidated rock aquifers, in areas where such flow is inferred to be occurring across hydrographic area boundaries.

This section describes groundwater resources in relation to hydrographic areas. Figure 3-189 shows the 18 hydrographic areas the Mina rail alignment would cross, depending on alternative segments selected. Table 3-113 lists the estimated annual ***perennial yields*** for the 18 hydrographic areas, and identifies which are State of Nevada-***designated groundwater basins***. The hydrographic areas are presented in the order the Mina rail alignment would cross them, beginning near Wabuska, moving southeast across Nevada toward Yucca Mountain.

> **Perennial yield** is the amount of useable water from a groundwater aquifer that can be economically withdrawn and consumed each year for an indefinite period. It cannot exceed the natural recharge to that aquifer and ultimately is limited to the maximum amount of discharge that can be utilized for beneficial use.
>
> The State of Nevada may identify a hydrographic area as a **designated groundwater basin** where permitted groundwater rights approach or exceed the estimated average annual recharge and the water resources are being depleted or require additional administration, including a state declaration of preferred uses (for example, municipal and industrial, domestic supply, etc.) (DIRS 103406-Nevada Division of Water Planning 1992, p. 18). Designated groundwater basins are also referred to as administered groundwater basins.

There are a number of published estimates of perennial yield for many of the hydrographic areas in Nevada, and those estimates often differ by large amounts. The perennial-yield values listed in Table 3-113 predominantly come from a single source, the Nevada Division of Water Planning (DIRS 103406-Nevada Division of Water Planning 1992, for Hydrographic Regions 10, 13, and 14); therefore, the table does not show a range of values for each hydrographic area.

In the Yucca Mountain area, the Nevada Division of Water Planning identifies a combined perennial yield for hydrographic areas 225 through 230. DOE obtained perennial yields from *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12) to provide estimates for hydrographic areas the Mina rail alignment would cross: hydrographic areas 227A, 228, and 229. That 1999 document presents perennial-yield estimates from several sources. Table 3-113 lists the lowest (that is, the most conservative) values cited in that document, which is consistent with the approach DOE used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, pp. 3 to 136).

Table 3-113 also summarizes existing annual ***committed groundwater resources*** for each hydrographic area along the Mina rail alignment. However, all committed groundwater resources within a hydrographic area might not be in use at the same time. Table 3-113 also includes information on pending annual duties within each of these hydrographic areas. A ***pending annual duty*** represents the amount of water for which an appropriation applications has been submitted to the State Engineer for consideration and that the State Engineer has classified as a pending annual ***duty*** value within a hydrographic area, in accordance with applicable state statutes. Unless otherwise noted, the source of data for pending annual duties in the hydrographic areas the alignment would cross is DIRS 182759-Converse Consultants 2007, all; DIRS 182900-NDWR 2007, all; and DIRS 182288-NDWR 2007, all.

These data were acquired on March 31, 2007: NDWR Data Update (DIRS 182759-Converse Consultants 2007, all) and either April 18, 2007: NDWR Water Rights Data Hydrographic Area 110B (DIRS 182900-NDWR 2007, all) or May 30, 2007: NDWR Water Rights Data Update (DIRS 182898-NDWR 2007, all).

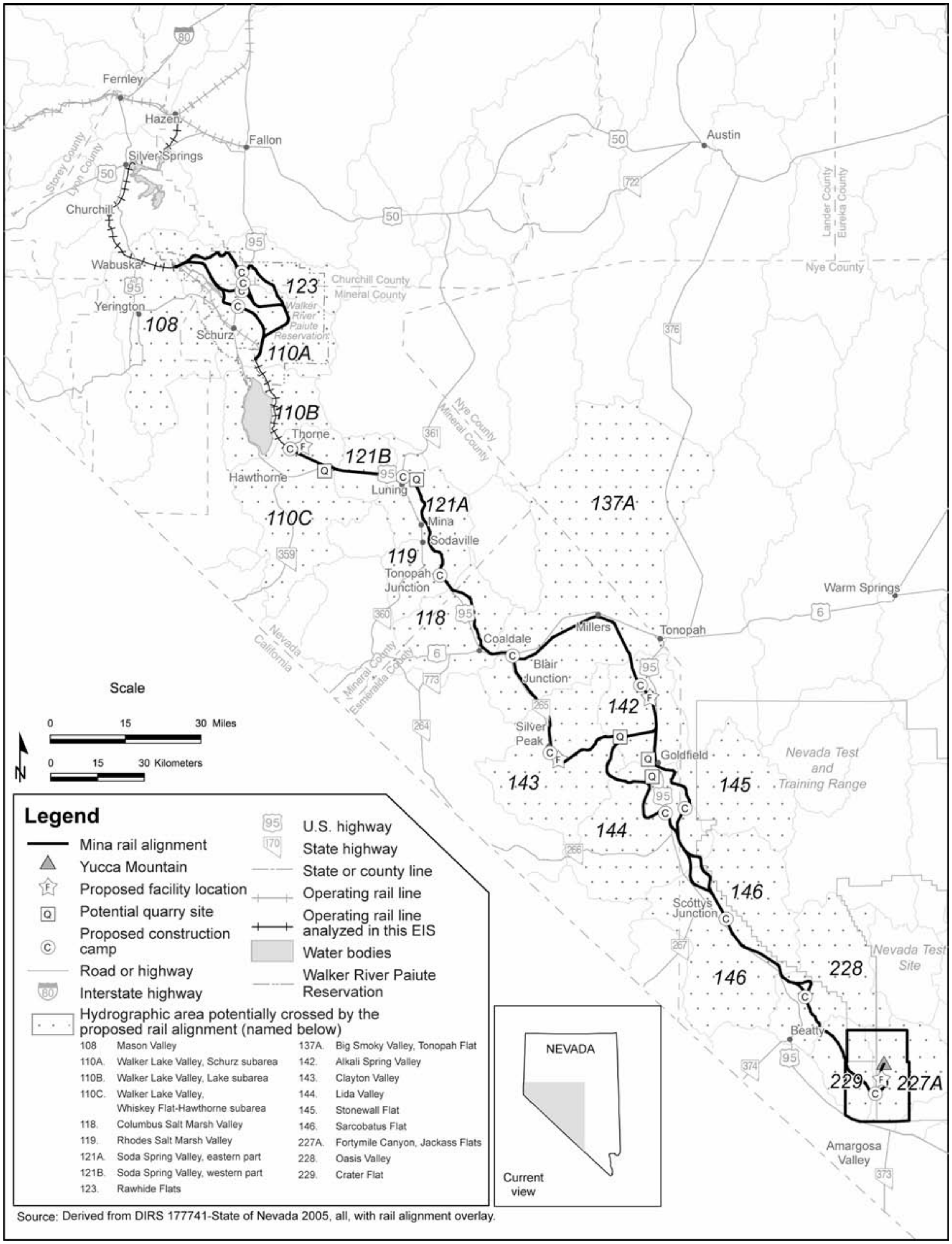


Figure 3-189. Hydrographic areas the Mina rail alignment would cross.

Table 3-113. Perennial yield and annual committed groundwater resources of hydrographic areas the Mina rail alignment would cross (page 1 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e,f]
Department of Defense Branchline North	108	Mason Valley	25,000	179,696/25,269	Yes
Schurz alternative segment 1, Department of Defense Branchline South	110A	Walker Lake Valley (Schurz subarea)	1,500	637/2	No
Schurz alternative segment 4, Department of Defense Branchline South					
Schurz alternative segment 5, Department of Defense Branchline South					
Schurz alternative segment 6, Department of Defense Branchline South					
Schurz alternative segment 5	123	Rawhide Flats	500	116/0	No
Schurz alternative segment 6					
Department of Defense Branchline South	110B	Walker Lake Valley (Lake subarea)	700	2,093/0	No
Department of Defense Branchline South, Mina common segment 1	110C	Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	5,000	12,709/0	Yes
Mina common segment 1	121 B	Soda Spring Valley (western part)	200	354/0	Yes
Mina common segment 1	121 A	Soda Spring Valley (eastern part)	6,000	3,168/0	Yes
Mina common segment 1	119	Rhodes Salt Marsh Valley	1,000	49/0	No
Mina common segment 1	118	Columbus Salt Marsh Valley	4,000	1,764/0	No
Mina common segment 1, Montezuma alternative segment 1	137A	Big Smoky Valley (Tonopah Flat)	6,000	19,638/0	Yes
Mina common segment 1, Montezuma alternative segment 2					
Montezuma alternative segment 1	143	Clayton Valley	20,000	23,882/0	No

Table 3-113. Perennial yield and annual committed groundwater resources of hydrographic areas the Mina rail alignment would cross (page 2 of 2).

Rail line segment	Hydrographic area[a] number	Hydrographic area name	Perennial yield (acre-feet)[b,c]	Annual committed groundwater resources/pending annual groundwater duties (acre-feet)[d]	Designated groundwater basin[e,f]
Montezuma alternative segment 1	142	Alkali Spring Valley	3,000	2,596/0	No
Montezuma alternative segment 2					
Montezuma alternative segments 1, 2, and 3					
Montezuma alternative segment 1, Mina common segment 2, Bonnie Claire alternative segment 2	144	Lida Valley	350	72/0	No
Montezuma alternative segment 1, Mina common segment 2, Bonnie Claire alternative segment 3					
Montezuma alternative segment 2	145	Stonewall Flat	100	12/0	No
Bonnie Claire alternative segment 2, common segment 5	146	Sarcobatus Flat	3,000	3,591/0	Yes
Bonnie Claire alternative segment 3, common segment 5					
Common segment 5, Oasis Valley alternative segment 1, common segment 6	228	Oasis Valley	1,000	1,299/0	Yes
Common segment 5, Oasis Valley alternative segment 3/common segment 6					
Common segment 6	229	Crater Flat	220	1,147/82	No
Common segment 6	227A	Fortymile Canyon/Jackass Flats	880[g]	58[f]/5	No

a. Source: DIRS 106094-Harrill, Gates, and Thomas 1988, Summary, Figure 3, with the proposed rail alignment map overlay.
b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12.
c. To convert acre-feet to cubic meters, multiply by 1,233.49; to convert acre-feet to gallons, multiply by 3.259×10^5.
d. Data for committed groundwater and pending annual duties are current as of March 31, 2007 (all hydrographic areas except areas 110B and areas 142, 144, 145, 146, 228, 229, and 227A) (DIRS 182759-Converse Consultants 2007, all); April 18, 2007 (hydrographic area 110B) (DIRS 182900-NDWR 2007, all); and May 30, 2007 (hydrographic areas 142, 144, 145, 146, 228, 229, and 227A) (DIRS 182288-NDWR 2007, all). Data for pending annual duties include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.
e. Sources: DIRS 176488-State of Nevada 2006, Regions 10, 13, and 14; DIRS 177741-State of Nevada 2005, all.
f. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in hydrographic area 227A. However, water-rights information from the Nevada Department of Water Resources indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 176600-Converse Consultants 2005, p. 29 and Tables 4 through 45). The perennial-yield value shown for hydrographic area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, p. 8), for the western two-thirds of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

As part of an effort to assess water resources in the vicinity of the Mina rail alignment, DOE performed studies to identify groundwater conditions, the locations of springs, and the locations, use, and water rights status of groundwater-supply wells within 32 kilometers (20 miles) of either side of the centerline of the rail alignment. Information on groundwater characteristics in hydrographic areas that the rail alignment would cross and identified groundwater uses and use types within the 64-kilometer (40-mile) search area are compiled in the *Water Resources Assessment Report, Mina Rail Corridor* (DIRS 180887-Converse Consultants 2007, all). DOE reviewed several other published reports and maps providing information regarding hydrogeologic and groundwater characteristics in hydrographic areas the rail alignment would cross to obtain information to support the groundwater resources impacts assessment.

DOE reviewed several well and spring databases, including Nevada Division of Water Resources (NDWR) and U.S. Geological Survey National Water Information System (USGS NWIS) databases. Unless noted otherwise, the sources for the spring and well data in this section are as follows: DIRS 176600-Converse Consultants 2005, all; DIRS 176979-MO0605GISGNISN.000; DIRS 177294-MO0607USGSWNVD.000, all; DIRS 176325-USGS 2006, all; DIRS 182759-Converse Consultants 2007, all; DIRS 180887-Converse Consultants 2007, all; DIRS 177712-DTNMO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000; DIRS 182898-NDWR 2007, all; DIRS 182899-NDWR 2007, all; and DIRS 182900-NDWR 2007, all. An initial screening process to identify existing wells within 1.6 kilometers (1 mile) of the centerlines of the respective alternative segments, or within 1.6 kilometers of DOE-proposed new water-supply wells. As described later in this section, before analyzing potential impacts to groundwater resources, DOE extended the search radius for identifying existing beneficial-use wells and springs up to 2.4 kilometers (1.5 miles) away from a proposed new well if the initial search for such wells or springs within 1.6 kilometers (1 mile) did not reveal the presence of any such wells or springs. Additionally, on a case-by-case basis (see Section 4.3.6 and Appendix G) for a selected set of new groundwater withdrawal wells specifically targeted for installation within a fault zone or an extensive fracture zone, DOE identified the locations of existing wells and springs up to 9.7 kilometers (6 miles) away from each such proposed well (to address the possibility of fault zones or extensive fracture zones acting as conduits for groundwater flow).

Information for completing this compilation included well-log data and water-rights information obtained from the NDWR. NDWR well-log database entries and water-rights database information include a general and legal description of the location of existing wells, along with ***borehole*** and well completion information, well testing data (if available), and information on the appropriated water right (diversion rate and/or annual duty). The NDWR water-rights database includes data on the locations, manner of use, and appropriations status of wells having appropriated water rights in Nevada. The USGS website generally includes site information (for example, well location coordinates, elevation, depth) and water-level data. DOE eliminated from consideration in the impacts analysis wells in the NDWR well-log database and the NDWR water-rights database that did not have appropriated water rights or were not domestic wells (such as abandoned or plugged wells, monitoring wells, thermal gradient test wells, oil or gas exploration or groundwater investigation wells). DOE considered all USGS-identified wells.

The compiled well locations had varying levels of accuracy. For example, well locations recorded in the NDWR water-rights database are generally considered to be at the center of each 0.16-square-kilometer (40-acre) parcel representing each quarter-quarter section. Additionally, the well driller might have mapped the well incorrectly, or a well might have been inadvertently recorded in the NDWR water-rights database in the wrong hydrographic area (for example, for wells very near a hydrographic area boundary). Figures 3-190 through 3-196 identify well locations within 1.6 kilometers (1 mile) of the centerline of the Mina rail alignment or proposed wells. As a result of the characteristics of the well location specifications, there might be more than one existing well at some locations on these figures. Table 3-114 lists hydrographic areas the Mina rail alignment would cross and the corresponding number of wells within 1.6 kilometers (1 mile) of the centerline of the rail alignment.

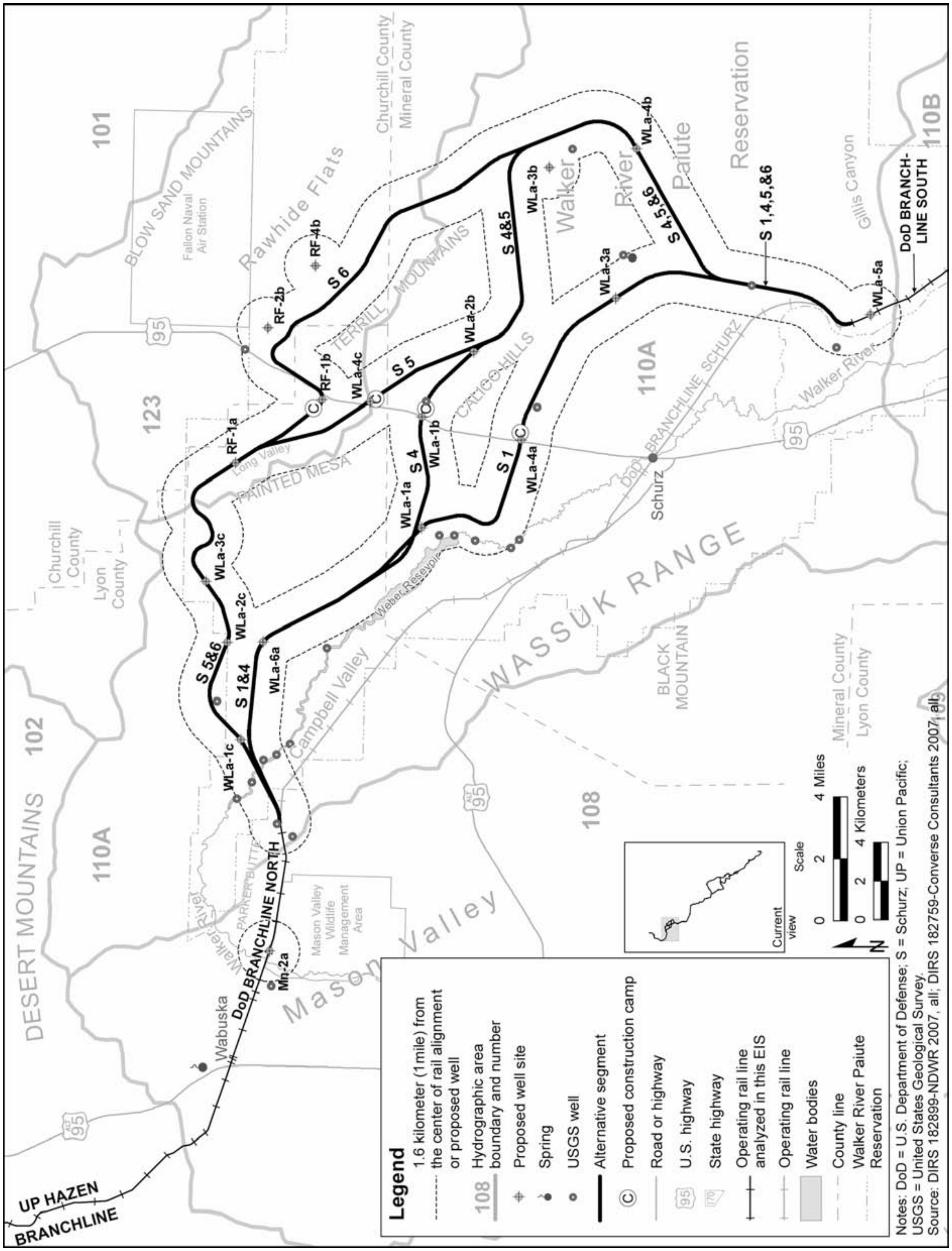


Figure 3-190. Proposed wells and existing USGS and NDWR wells and springs within map area 1.

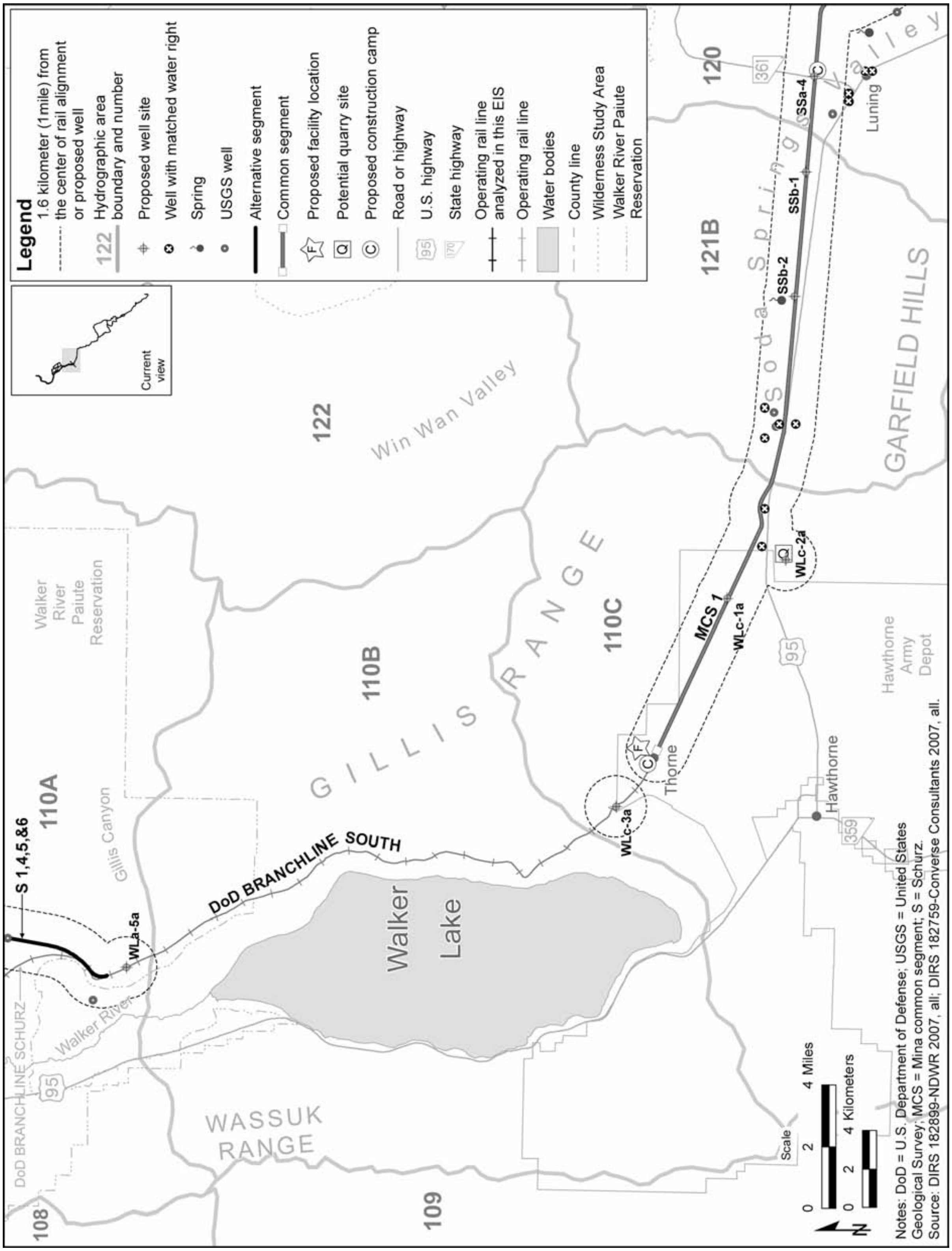


Figure 3-191. Proposed wells and existing USGS and NDWR wells and springs within map area 2.

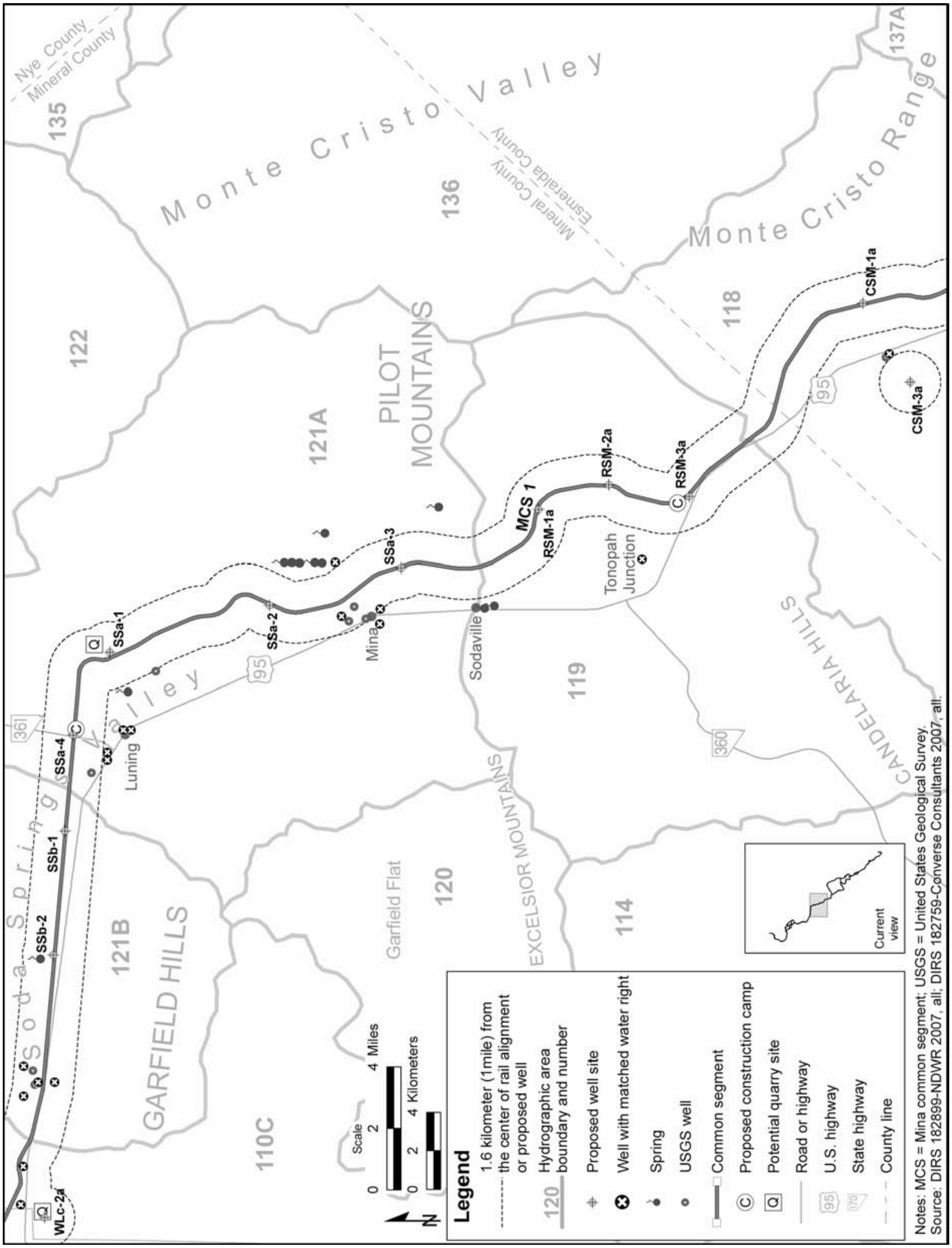


Figure 3-192. Proposed wells and existing USGS and NDWR wells and springs within map area 3.

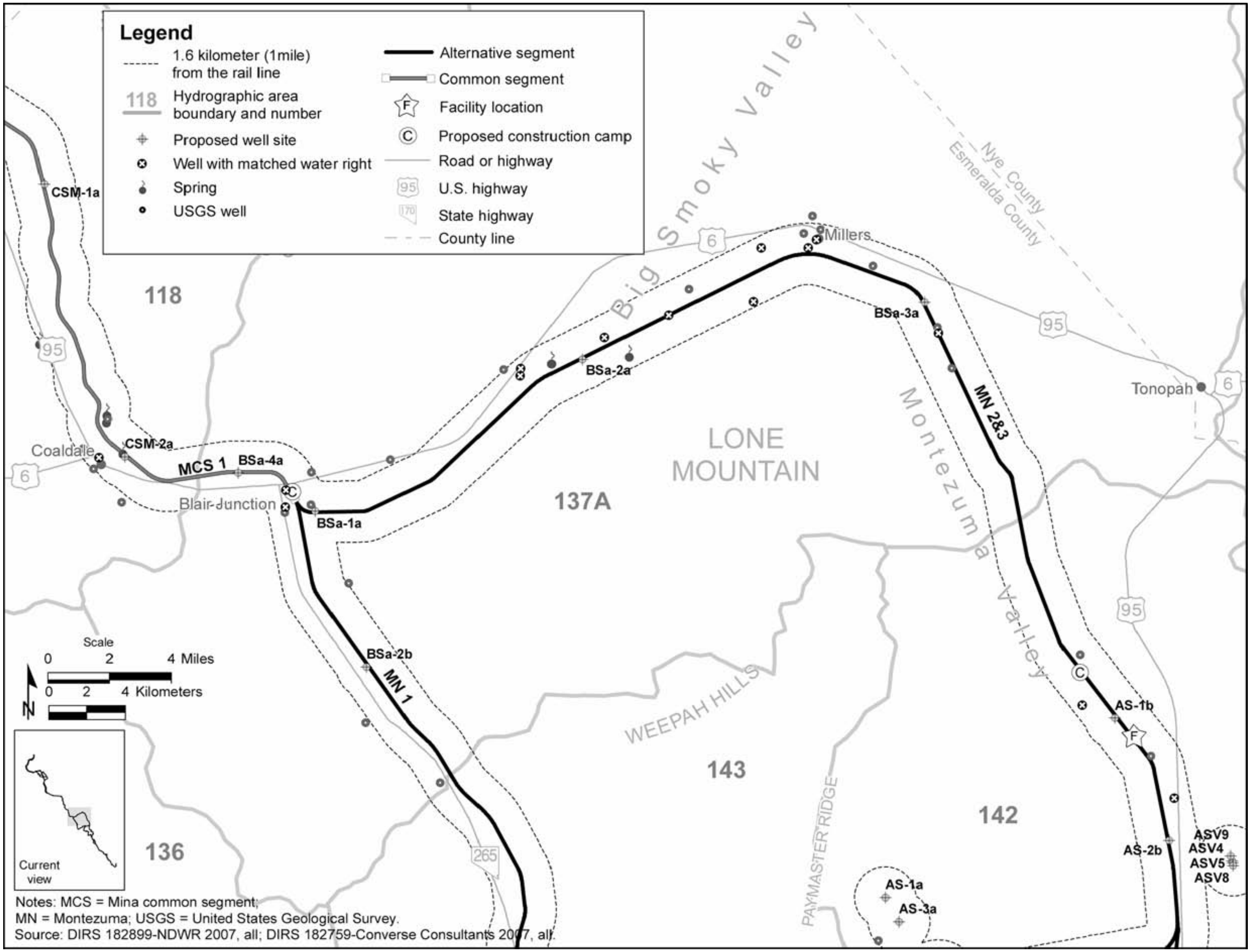


Figure 3-193. Proposed wells and existing USGS and NDWR wells and springs within map area 4.

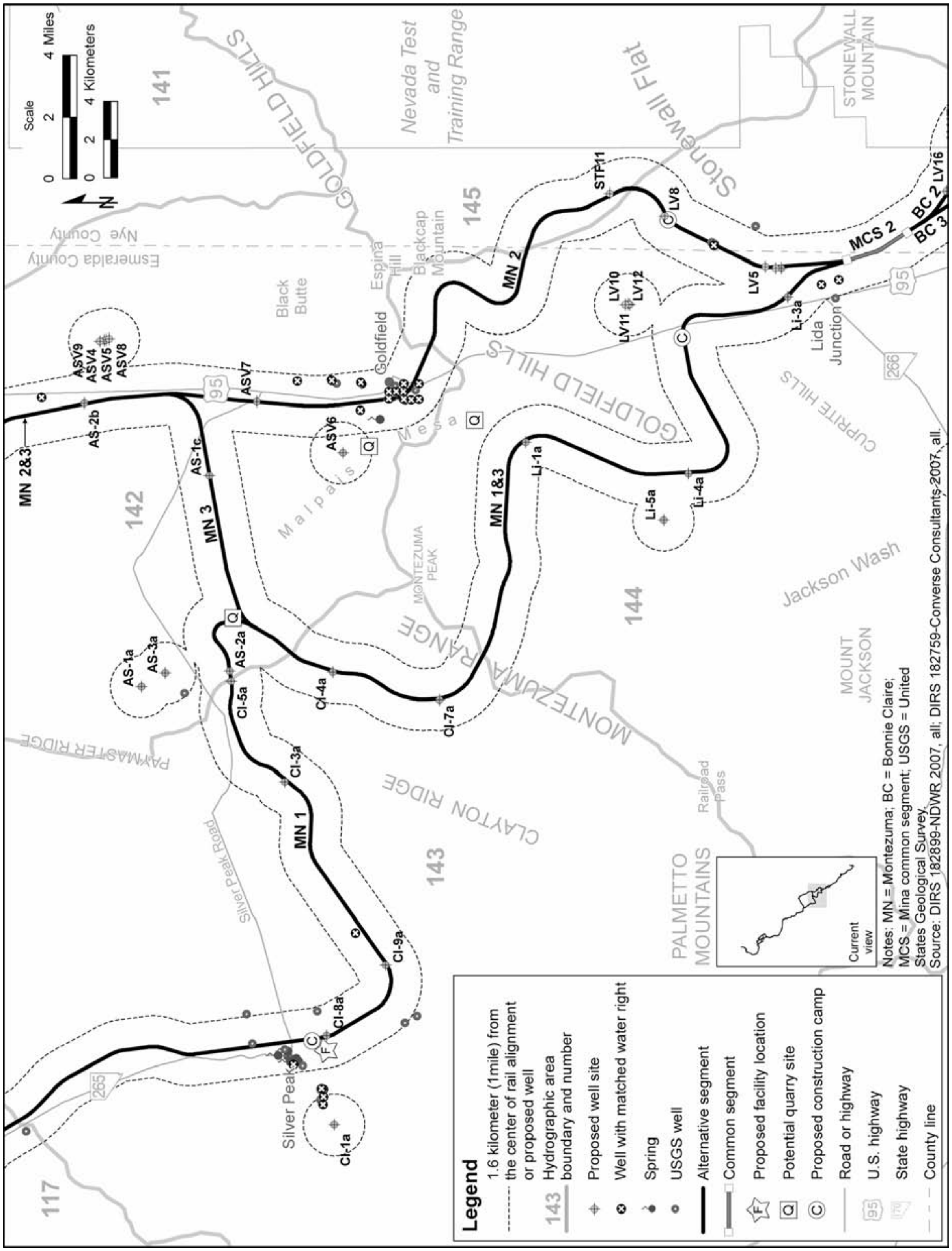


Figure 3-194. Proposed wells and existing USGS and NDWR wells and springs within map area 5.

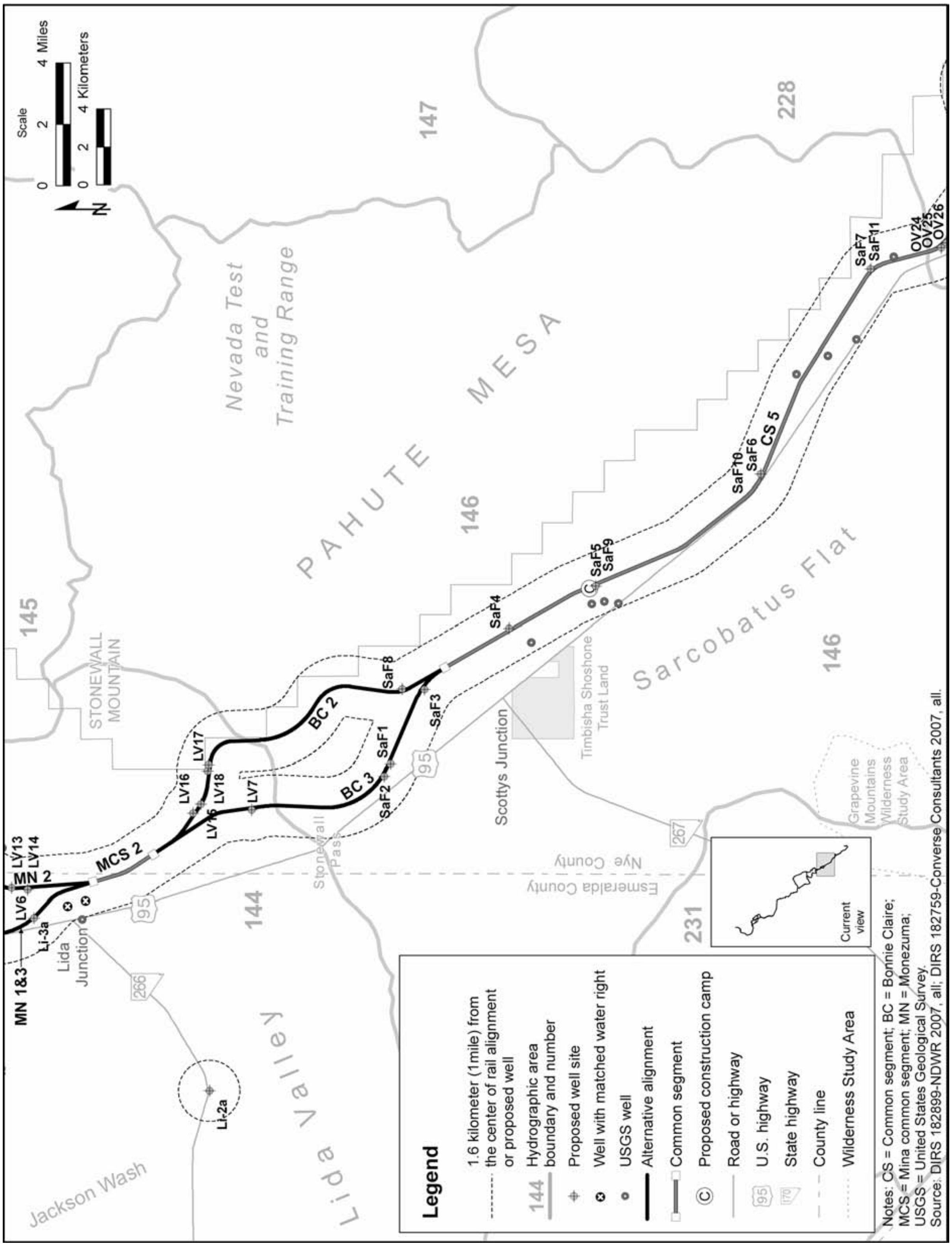


Figure 3-195. Proposed wells and existing USGS and NDWR wells and springs within map area 6.

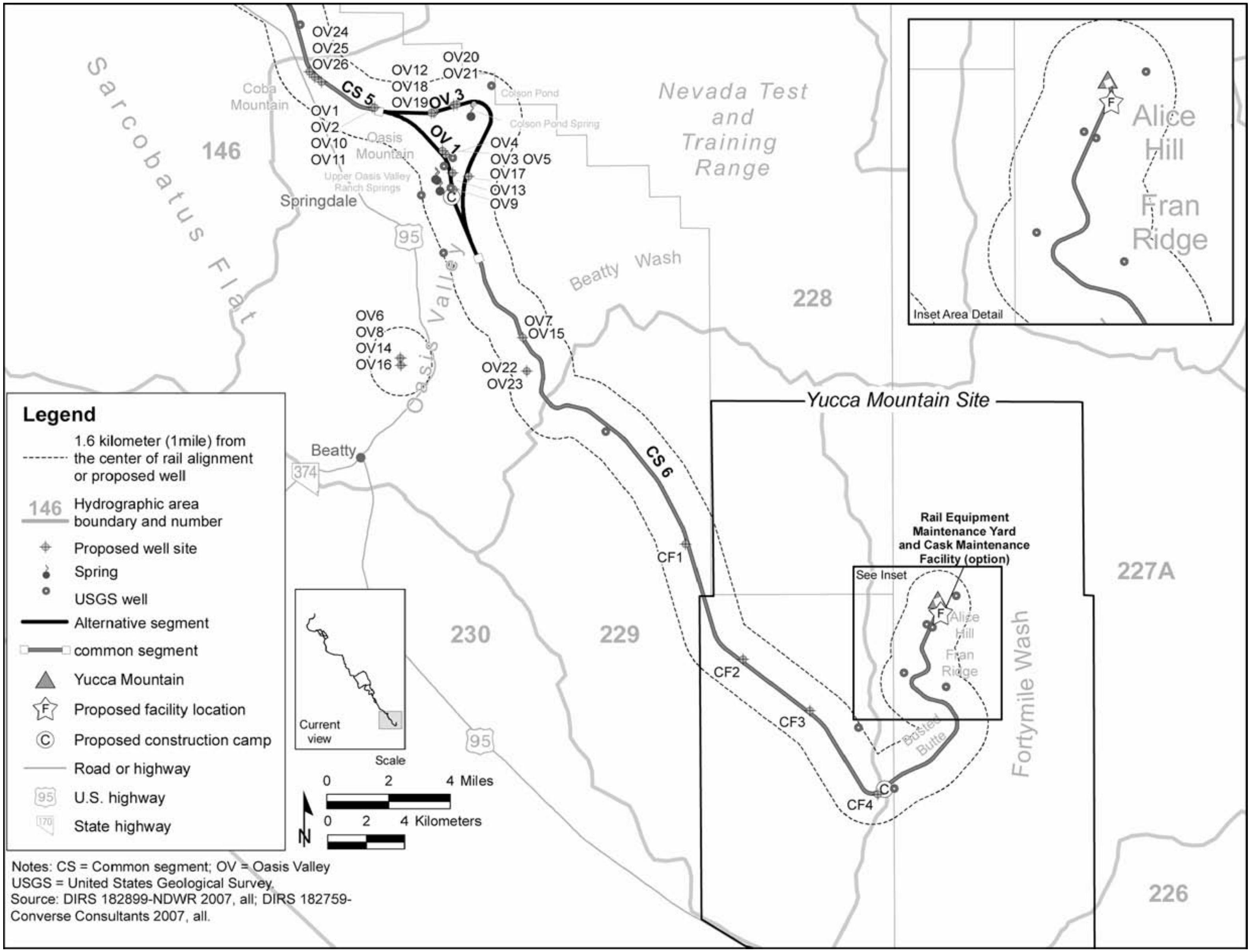


Figure 3-196. Proposed wells and existing USGS and NDWR wells and springs within map area 7.

Table 3-114. Existing wells and proposed new water-supply wells within 1.6 kilometers[a] of the centerline of the Mina rail alignment by hydrographic area and/or within 1.6 kilometers of proposed new wells outside the rail line construction right-of-way.

Hydrographic area		Total number of wells and number of NDWR[b] wells with water rights by proposed-use category[c,d]										
Name	Area number	Number of wells[e,f]	C	G	H	I	K	N	P	S	X	Z
Mason Valley	108	0	0	0	0	0	0	0	0	0	0	0
Walker Lake Valley (Schurz subarea)	110A	32	0	0	0	0	0	0	0	0	0	0
Walker Lake Valley (Lake subarea)	110B	0	0	0	0	0	0	0	0	0	0	0
Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	110C	2	2	0	0	0	0	0	0	0	0	0
Rawhide Flats	123	1	0	0	0	0	0	0	0	0	0	0
Soda Springs Valley (western part)	121B	7	0	0	0	0	4	0	0	1	0	0
Soda Springs Valley (eastern part)	121A	14	0	0	2	0	3	0	3	0	0	1
Rhodes Salt Marsh Valley	119	1	0	0	0	1	0	0	0	0	0	0
Columbus Salt Marsh Valley	118	5	0	0	0	0	0	0	1	1	0	0
Big Smoky Valley	137A	25	0	0	0	0	2	0	1	10	0	0
Clayton Valley	143	13	0	0	0	0	0	0	5	1	0	0
Alkali Spring Valley	142	36	0	0	0	1	5	0	13	5	0	0
Lida Valley	144	6	0	0	1	0	1	0	0	2	0	0
Stonewall Flat	145	0	0	0	0	0	0	0	0	0	0	0
Sarcobatus Flat	146	10	0	0	0	1	0	0	1	0	0	0
Oasis Valley	228	10	0	0	0	0	0	0	0	0	0	0
Crater Flat	229	4	0	0	0	0	1	0	0	0	0	0
Fortymile Canyon, Jackass Flats	227A	14	0	0	0	0	0	0	0	0	0	0
Totals		180	2	0	3	3	16	0	24	20	0	1

a. To convert kilometers to miles, multiply by 0.62137.
b. NDWR = Nevada Division of Water Resources.
c. C = commercial; G = monitoring wells; H = domestic; I = irrigation; K = mining and milling; N = industrial (includes those designated in the database as N for "industrial" and as J for "industrial-cooling"); P = municipal or quasi municipal; S = stock; X = test wells; Z = other (includes those designated in the database as Z for "other," R for "recreation," and U for "unused").
d. Proposed use categories are tabulated only for wells (69 of the 180 wells) listed as NDWR wells with water rights, NDWR domestic wells or NDWR wells with an associated water rights application number.
e. Includes total number of NDWR-documented existing wells with water rights, plus NDWR domestic wells, plus U.S. Geological Survey National Water Information System-listed wells within 1.6 kilometers from the centerline of the rail alignment or within 1.6 kilometers of any DOE-proposed new groundwater-supply well. Note that the number of NDWR wells listed by proposed use category applies only to NDWR wells with water rights and NDWR domestic wells. U.S. Geological Survey wells are not included in the well counts, the Geological Survey NWIS database does not provide information regarding well use category.
f. Well locations have not been field-verified. Therefore, some of the identified wells might be farther than 1.6 kilometers from the centerline of the rail alignment or proposed new groundwater-supply wells.

Table 3-114 identifies the associated proposed-use category of the NDWR-cataloged wells (as defined in the State of Nevada well-log database). The USGS NWIS database does not categorize wells according to their use.

The distance of 1.6 kilometers (1 mile) reflects the first two of three aspects considered in establishing the groundwater region of influence, as described in Section 3.3.6.1. The wells identified in these figures were compiled from information provided in the *Water Resources Assessment Report, Mina Rail Corridor* and an NDWR Data Update Technical Memorandum (DIRS 180887-Converse Consultants 2007, all; and DIRS 182759-Converse Consultants 2007, all) and databases administered by the NDWR and the USGS NWIS. DOE would field-verify the locations of wells that could be affected during rail line construction before starting construction activities.

DOE-compiled well data include data on well locations for well records coded as "new" or "replacement" wells in the Nevada well-log database. Because each entry in the well-log database represents an event at a well site (for example, installation, re-drilling, abandonment), there is a possibility that there is more than one record to represent a particular well. To preclude duplication, DOE summarized only records that identified wells as new or replacement. As a result of the characteristics of the well location specifications, there might be more than one existing well that plot at the same location on these figures.

Table 3-114 lists hydrographic areas the Mina rail alignment would cross and the corresponding number of NDWR wells with water rights and USGS wells within 1.6 kilometers (1 mile) of the centerline of the rail alignment, or within a 1.6-kilometer radius of any proposed new water well that would be outside the rail line construction right-of-way. Table 3-114 identifies the associated proposed-use category of the NDWR-cataloged wells with water rights (as defined in the State of Nevada well-log and water-rights databases). The USGS NWIS database does not categorize wells according to their use. For this reason, the existing USGS wells that are included on Figures 3-190 through 3-196 are not included in the well use categorization presented in Table 3-114.

As shown in Table 3-114, there are 180 NDWR wells with water rights and USGS NWIS wells within 1.6 kilometers (1 mile) of the centerlines of all of the Mina rail alignment segments (combined) and/or within 1.6 kilometers of proposed new groundwater-supply wells. For those hydrographic areas containing multiple (alternative) segments, the actual number of existing wells falling within 1.6 kilometers of the completed rail line within that hydrographic area would be less than the number listed in Table 3-114, since only one alternative segment or unique set of alignment segments would be constructed in that hydrographic area.

As part of the Proposed Action, DOE proposes to install a series of new wells within the nominal width of the rail line construction right-of-way to acquire water needed to support railroad construction and operation. In addition to these wells, DOE might install additional wells at selected locations outside this construction right-of-way to serve as alternative-use water wells, supplemental wells to be used in combination with other water wells installed within the construction right-of-way, or to support proposed quarry operations. The need for installing alternative-use or supplemental wells would be based on wells installed at or very near a certain water ***demand*** location within the construction right-of-way not being adequate for meeting construction or operations needs. The locations of the proposed new wells are depicted on Figures 3-190 through 3-196.

There are numerous existing wells in hydrographic area 108 that are not reflected in Table 3-114; however, except for construction of a new siding in this area, with installation of one associated new small-production rate well, there is no new construction planned along this portion of the Mina alignment (see Section 3.3.6.3.1). There are no existing wells with water rights, no USGS NWIS wells, and no springs within a 1.6-kilometer (1-mile) radius of this proposed new well. Most of the existing wells near the remaining alignment segments are in areas 142 and 137A. Table 3-114 lists public supply-municipal

(24 out of 69 NDWR-listed wells with water rights), stock-watering (20 of 69 NDWR-listed wells with water rights), and mining (16 of 69 NDWR-listed wells with water rights) as the predominant use categories for those NDWR-listed wells with water rights that are within the 1.6-kilometer distance from the Mina rail alignment or any proposed new groundwater-supply well location.

3.3.6.2.2 Groundwater-Quality Characteristics

Water quality in aquifers in Nevada varies with location (DIRS 106094-Harrill, Gates, and Thomas 1988, all). In the Basin and Range, total dissolved solids concentrations can range from less than 500 to more than 10,000 milligrams per liter (DIRS 172905-USGS 1995, all). In general, at hydrographic area margins and on the slopes of alluvial fans, groundwater quality is good. In discharge areas (such as playas) and other selected areas, groundwater quality can be brackish. However, groundwater in deeper alluvial valley-fill units underlying some playa areas can be of better quality (DIRS 172905-USGS 1995, all). Groundwater quality in the carbonate aquifers in southern and central Nevada, including total dissolved solids concentrations, is generally more uniform in character and with depth within the aquifer (DIRS 101167-Winograd and Thordarson, 1975, p. C103). Total dissolved solids concentrations in alluvial valley fill underlying the Mina rail alignment range from less than 500 to more than 10,000 milligrams per liter (mg/L), or approximately 500 to 10,000 parts per million (DIRS 172905-USGS 1995, Figure 70, with overlay of hydrographic area boundaries). The U.S. Environmental Protection Agency has set an aesthetic standard of 500 mg/L (approximately 500 parts per million) of total dissolved solids for drinking water (40 CFR Part 143). Water with a total dissolved solids concentration of 500 mg/L or less is regarded as acceptable and pleasing for general consumption. A secondary preferred drinking water standard for total dissolved solids concentrations of 500 mg/L per liter for public water supplies has been adopted for Nevada. If water supplies that meet the preferred standard are not available, the Maximum Contaminant Level of 1,000 mg/L is enforceable by the State of Nevada. At higher concentrations, general consumption issues (pertaining to hardness, deposits, color, staining, and salty taste) could develop, but the water could be used for other purposes (for example, agriculture or earthwork compaction as part of embankment construction). Another parameter of interest for gauging the quality of groundwater in Nevada is arsenic. A revised drinking water standard for arsenic (for water systems meeting certain specified criteria) of 0.010 mg/L became enforceable in January of 2006 (40 CFR 141.23).

3.3.6.3 Hydrogeologic Setting and Characteristics along Alternative Segments and Common Segments

3.3.6.3.1 Department of Defense Branchline North

The Mina rail alignment would commence with Department of Defense Branchline North, beginning near Fort Churchill, Nevada. The beginning of Department of Defense Branchline North would overlie a portion of Mason Valley (hydrographic area 108). Department of Defense Branchline North would then proceed eastward where it would cross into a small portion of the Walker Lake Valley-Schurz subarea (hydrographic area 110A) (Figure 3-190). Department of Defense Branchline North would predominately overlie alluvial valley fill (DIRS 180887-Converse Consultants 2007, pp. 89 and 101, and Plates 4-10 and 4-12).

Hydrographic area 108, Mason Valley, is a designated groundwater basin (see Table 3-113). Committed groundwater resources exceed estimated perennial yield of 30.8 million cubic meters (25,000 acre-feet). However, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 3.57 billion cubic meters (2.9 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 108 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are approximately 31.2 million cubic meters (25,269 acre-feet) of documented pending annual duties (see Table 3-113) in area 108 (DIRS 182759-Converse Consultants 2007; data acquired on March 31, 2007).

Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 108. The depth at which groundwater occurs varies from less than 3 meters (10 feet) to approximately 30.5 meters (100 feet) below ground along the portion of Department of Defense Branchline North that would lie within hydrographic area 108. Groundwater is primarily produced from the valley-fill sediments (DIRS 180697-Huxel and Harrill 1969, p. 11). Geologic units in the Mason Valley area include alluvial sediments, altered sediments, altered volcanic rocks, and granitic rocks.

Table 3-115. General groundwater-quality and aquifer characteristics – Department of Defense Branchline North.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
108 Mason Valley	Alluvial sediments, altered sediments, altered volcanic rocks, and granitic rocks	3 to 30	Upper 30.5 meters of alluvium: 2.9 million[f]	Total dissolved solids: Less than 500 to 97,100 mg/L [g] Fluoride: 7.7 mg/L (north of Wabuska)[g]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanics, altered volcanic rocks	0 to 150	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 102 and 89.
b. To convert meters to feet, multiply by 3.2808.
c. Source: DIRS 180887-Converse Consultants 2007, Plates 4-11 and 4-12. The listed depth ranges generally apply to areas underlying the alignment segments; groundwater may be deeper in the southern part of hydrographic area 108 (DIRS 180887-Converse Consultants 2007, p. 102).
d. To convert from acre-feet to cubic meters, multiply by 1,233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 90 and 102.

One new well (Mn-2a) is proposed along Department of Defense Branchline North in hydrographic area 108 (Figure 3-190). This well would be a small-production rate (less than 3.8 liters [1 gallon] per minute) well, and would supply water to support operation of a proposed rail siding. DOE determined that there are no existing NDWR wells with water rights and no USGS NWIS wells within a 1.6 kilometer (1 mile)-radius of this proposed well location (DIRS 180888-Converse Consultants 2007, Appendix B and Plate 4-12).

Hydrographic area 110A, Walker Lake Valley-Schurz subarea, is not a designated groundwater basin (see Table 3-113). Committed groundwater resources do not exceed estimated perennial yield of 1.85 million cubic meters (1,500 acre-feet). There could be approximately 1.85 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 110A (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are approximately 2,500 cubic meters (2 acre-feet) of documented pending annual duties (see Table 3-113) in area 110A.

Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110A. The depth at which groundwater occurs throughout hydrographic area 110A varies from 0 meters (0 feet) to approximately 150 meters (499 feet), with most groundwater being less than 30.5 meters (100 feet) below ground. Depth to groundwater is generally 15 meters (50 feet) along the segments of Department of Defense Branchline North that would lie within and along hydrographic area 110A (DIRS 180887-Converse Consultants 2007, p. 89 and Plate 4-11). Groundwater is primarily produced from the valley-fill sediments. Geologic units in hydrographic area 110A include alluvial sediments, volcanic and altered volcanic rocks, and granitic rocks.

There are no springs and no existing NDWR wells with water rights, and there is one USGS NWIS well within 1.6 kilometers (1 mile) of the centerline of Department of Defense Branchline North in hydrographic area 110A (see Figure 3-190). The land crossed by the short portion of Department of Defense Branchline North (and by the Schurz alternative segments [Section 3.3.6.3.2]) is part of the Walker River Paiute Reservation. There are existing wells on the Reservation rangeland for which there is currently no documentation or information on the wells on file at the Nevada Division of Water Resources. The Nevada Division of Water Resources Well Log and Water Rights Databases are therefore incomplete regarding existing wells present in hydrographic 110A (and in hydrographic area 123 [Section 3.3.6.3.2]). Therefore, DOE does not have a complete record of groundwater usage on the Reservation.

3.3.6.3.2 Schurz Alternative Segments

The Schurz alternative segments would overlie hydrographic area 110A and/or the western part of hydrographic area 123 (Rawhide Flats) as shown on Figure 3-190. These alternative segments would overlie various geologic materials, depending on the specific combination of alternative segments constructed, including alluvial valley-fill materials, volcanic rocks, altered volcanic rocks, and/or granitic rocks (DIRS 180887-Converse Consultants 2007, pp. 89 and 95 and Plates 4-10 and 4-11).

Section 3.3.6.3.1 describes the hydrogeologic characteristics of hydrographic area 110A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the Schurz alternative segments. Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110A.

Area 123 is not a designated groundwater basin. Committed groundwater resources do not exceed estimated perennial yield of 617,000 cubic meters (500 acre-feet) (see Table 3-113). There could be between approximately 74 and 666 million cubic meters (60,000 and 540,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 123 (DIRS 180754-Rush et al. 1971, all; DIRS 181394-Everett and Rush 1967, Table 6). NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 123. Table 3-116 summarizes general groundwater quality and aquifer characteristics in hydrographic area 123. The depth at which groundwater occurs in hydrographic area 123 varies from less than 15 to greater than 150 meters (less than 50 to greater than 500 feet).

The NDWR Water Rights database (DIRS 182899-NDWR 2007, all) does not include any wells for hydrographic area 123 (DIRS 180887-Converse Consultants 2007, p. 97). According to the NDWR records, there are a total of approximately 2,500 cubic meters (2 acre-feet) in pending annual duties assigned to hydrographic area 110A and no pending annual duties assigned to hydrographic area 123 (see Table 3-113). Similar to the case for hydrographic area 110A as discussed in Section 3.3.6.3.1, land across which Schurz alternative segments would cross in hydrographic area 123 is part of the Walker River Paiute Reservation and therefore the NDWR Well Log and Water Rights Database is incomplete with respect to existing wells that exist in hydrographic area 123. For example, the NDWR Well Log Database has no record of any existing wells in hydrographic area 123, whereas information in a published historical report (DIRS 181394-Everett and Rush 1967, Table 4-9) provide data on two wells in that area (DIRS 180887-Converse Consultants 2007, Table 4-44).

Table 3-116. General groundwater-quality and aquifer characteristics – Schurz alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanic rocks, altered volcanic rocks	0 to 140	Upper 30.5 meters: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]
123 Rawhide Flats	Alluvial valley fill and volcanic rocks	Less than 15 to more than 150	Upper 30.5 meters for both aquifer types: 60,000 to 540,000[f,h]	Total dissolved solids: 300 to 1,660 mg/L [g] Sulfate: 52 mg/L[g] Fluoride: 7.9 mg/L[g]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanic rocks, altered volcanic rocks	0 to 14	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]

a. Source: DIRS 180887-Converse Consultants 2007 pp. 90 and 96.
b. The listed depth ranges generally apply to areas underlying the alternative segments (DIRS 180887-Converse Consultants 2007, Plates 4-10 and 4-11); groundwater can vary over a wide range of depth depending on location in each hydrographic area (DIRS 180887-Converse Consultants 2007, p. 90).
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 90 and 96.
h. Source: DIRS 181394-Everett and Rush 1967, Table 6.

Three wells (RF-2b, RF-4b, and WLa-3b) could be installed in hydrographic area 123 at locations outside of the construction rights-of-way for the various alternative segments (Figure 3-190). Geologic materials underlying these potential well locations are comprised of alluvial slope and alluvial valley-fill materials (DIRS 180888-Converse Consultants 2007, Appendix B and Plate 4-11).

3.3.6.3.3 Department of Defense Branchline South (Walker Lake Valley Area)

Department of Defense Branchline South would overlie the southern part of hydrographic area 110A, continue southward across hydrographic area 110B (Walker Lake Valley – Lake subarea), and cross over a small portion of the northwestern part of hydrographic area 110C (Walker Lake Valley, Whiskey Flat-Hawthorne subarea).

Section 3.3.6.3.1 describes the hydrogeologic characteristics of hydrographic area 110A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed alignment segments. Table 3-115 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110A.

Area 110B is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of 860,000 cubic meters (700 acre-feet) (see Table 3-113). However, as noted previously, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 123 million cubic meters (100,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 110B. NDWR data indicate that there no documented pending annual duties (see Table 3-113) in area 110B.

Department of Defense Branchline South would cross alluvial valley fill in hydrographic area 110B. Adjacent mountain ranges in hydrographic area 110B are comprised primarily of volcanic rocks.

Groundwater quality within hydrographic area 110B varies according to location within the area (DIRS 180887-Converse Consultants 2007, Plate 4-10). Table 3-117 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110B.

Groundwater depth underlying the alignment in hydrographic area 110B (see Table 3-117) is on the order of 15 meters (50 feet). Groundwater depths reported in three wells in hydrographic area 110C, between 4.5 and 8.9 kilometers (2.8 and 5.5 miles) south of the southern boundary of subarea 110B, range from 15 to 31 meters (50 to 103 feet).

Hydrographic area 110C, Walker Lake Valley (Whiskey Flat-Hawthorne subarea), is a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 6.17 million cubic meters (5,000 acre-feet) (see Table 3-113). There could be approximately 1.11 billion cubic meters (900,000 acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 110C. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 110C.

Geologic units in the Walker Lake Valley (Whiskey Flat-Hawthorne subarea) area include alluvial valley fill, granitic rock, volcanics, altered volcanics and chert (see Table 3-117). The depth to groundwater in Walker Lake Valley (Whiskey Flat-Hawthorne subarea) near the proposed rail line is 15 to 150 meters (50 to 500 feet) (see Table 3-117). The primary source of groundwater in 110C is from unconfined aquifers of alluvial valley fill. Table 3-117 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 110C.

Most groundwater in hydrographic area 110C is a sodium sulfate type (DIRS 181394-Everett and Rush 1967, p. 32). The Hawthorne Army Depot property covers most of the Whiskey Flat-Hawthorne area. Contaminants have been reported in some groundwater monitoring wells underlying the Hawthorne Army Depot property, including explosives, volatile organic compounds, and inorganic nitrogen compounds. Areas of known impacted groundwater underlying the Hawthorne Army Depot property are approximately 4.5 kilometers (2.8 miles) to the west and southwest of the centerline of Department of Defense Branchline South and approximately 3.2 kilometers (2 miles) to the west and southwest of the centerline of Mina common segment 1 (DIRS 182749-Tetra Tech EM Inc., 2007 Figure 5).

Available information indicates that the groundwater flow direction in the areas of identified ***contamination*** and underlying the land surface between these areas and adjacent to Department of Defense Branchline South and Mina common segment 1 is westward to southwestward (DIRS 182749-Tetra Tech EM Inc., 2007, Figures 4A and 4B). On the basis of the groundwater flow directions underlying these areas and the distances to the proposed alignment and the impacted wells on the Hawthorne Army Depot property, it is extremely improbable that new wells installed within the rail alignment construction right-of-way to support construction of the proposed railroad (for example, well WLc-3a on Figure 3-191) would encounter the identified contaminated groundwater.

One new well (location WLa-5a) is proposed within hydrographic area 110A to support water needs associated with railroad construction and operation of a new rail siding. Figures 3-190 and 3-191 show the approximate location of this proposed new water well.

Available information indicates that there are no springs, no existing NDWR wells with water rights, and no USGS NWIS wells within 1.6 kilometers (1 mile) of the centerline of Department of Defense Branchline South or within 1.6 kilometers of the proposed new well location in hydrographic area 110A (see Figures 3-190 and 3-191).

Table 3-117. General groundwater-quality and aquifer characteristics – Department of Defense Branchline South.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters) [b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
110A Walker Lake Valley (Schurz subarea)	Alluvial valley fill, granitic rocks, volcanic rocks, altered volcanic rocks	0 to 14	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 500 to 1,800 mg/L[g] Fluoride: 9.3 mg/L[g]
110B Walker Lake Valley (Lake subarea)	Alluvial valley fill and volcanic rocks[h]	15 to 31	Upper 30.5 meters for both aquifer types: 100,000[f]	Total dissolved solids: 742 mg/L[i] Sulfate: 92 to 383 mg/L[i] Fluoride: 0 to 1.6 mg/L[i]
110C Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	Alluvial valley fill, granitic rocks, volcanics, altered volcanics, chert	15 to 150	Upper 30.5 meters of alluvium: 900,000[f]	Total dissolved solids: 191 to 1,033 mg/L [g] Sulfate: 19 to 502 mg/L [g] Fluoride: 6.8 mg/L [g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 82 and 90.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, pp. 89 and 90 and Plates 4-9 and 4-10, and based on water depths in three wells in adjacent hydrographic area 110C (DIRS 181394-Everett and Rush 1967, Table 9 and Plate 1). The listed depth range for hydrographic area 110B generally applies to valley floor areas underlying the general vicinity of the proposed alignment segment; groundwater depths in other portions of hydrographic area 110B might be substantially different.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, p. 90.
h. Source: DIRS 182289-Ross 1961, Plate 2.
i. Source: DIRS 181394-Everett and Rush 1967, Table 8 and Plate 1; data are for a spring in hydrographic area 110A about 1.2 kilometers (0.75 mile) north of the subarea 110B boundary and a well 4.4 kilometers (2.75 miles) south of the subarea 110B boundary.

However, as discussed previously, the NDWR Well Log and Water Rights Databases are incomplete with respect to existing wells that might exist on the Walker River Paiute Reservation for this hydrographic area.

3.3.6.3.4 Mina Common Segment 1

Crossing from north to southeast, Mina common segment 1 would overlie hydrographic areas 110C (Walker Lake Valley, Whiskey Flat-Hawthorne subarea), 121B (Soda Spring Valley, western part), 121A (Soda Spring, eastern part), 119 (Rhodes Salt Marsh Valley), 118 (Columbus Salt Marsh Valley), and a small portion of hydrographic area 137A (Big Smoky Valley) (Figures 3-191 through 3-193). Mina common segment 1 would predominantly cross alluvial deposits. The depth to groundwater and groundwater-quality characteristics underlying Mina common segment 1 vary according to location within the hydrographic areas the rail line would cross. Table 3-118 summarizes the groundwater-quality and aquifer characteristics in the hydrographic areas Mina common segment 1 would cross.

Section 3.3.6.3.3 describes the hydrogeologic characteristics of hydrographic area 110C, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed common segment. Table 3-116 and Table 3-117summarize general groundwater-quality and aquifer characteristics in hydrographic area 110A.

Table 3-118. General groundwater-quality and aquifer characteristics – Mina common segment 1.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
110C Walker Lake Valley (Whiskey Flat-Hawthorne subarea)	Alluvial valley fill, granitic rocks, volcanics, altered volcanics, chert	15 to 150	Upper 30.5 meters of alluvium: 900,000[f]	Total dissolved solids: 191 to 1,033 mg/L[g] Sulfate: 19 to 502 mg/L[g] Fluoride: 6.8 mg/L [g]
121B Soda Spring Valley (western part)	Alluvial valley fill, intrusive and metamorphic rock, minor clastic sandstones	15	Upper 30.5 meters for both aquifer types: 280,000 [f]	Total dissolved solids: Generally less than 500 to 1,170 mg/L[g] 6,500 mg/L (valley center discharge locations)[g] Sulfate: 350 to 372 mg/L[g]
121A Soda Spring Valley (eastern part)	Alluvial valley fill, intrusive and metamorphic bedrock units, and clastic sandstone	15 to 30	Upper 30.5 meters of alluvium: 430,000[f]	Total dissolved solids: 200 to 1,250 mg/L [g] 6,500 mg/L (valley center discharge locations) [g] Sulfate: 82 to 744 mg/L[g]
119 Rhodes Salt Marsh Valley	Alluvial valley fill deposits, altered volcanics, chert, limestone, dolomite with interbedded zones of sandstone and conglomerates	15 to less than 30	Upper 30.5 meters of alluvium: 340,000[f]	Total dissolved solids: 2,370 mg/L[g] Sulfate: 250 to 1,830 mg/L[g]
118 Columbus Salt Marsh Valley	Alluvial sediments, volcanic rocks and clastic rocks	3 to 30	Upper 30.5 meters of alluvium: 530,000[f]	Total dissolved solids: 5,556 mg/L[g] Sulfate: 250 to 2,600 mg/L[g]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/L[g] 6,500 mg/L (valley center discharge locations)[g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 81, 75, 68, 62, 56, and 51.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plates 4-4 to 4-10 and pp. 51 and 52.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 52, 57, 58, 63, 70, 76, and 83.

Two potential quarry sites have been identified along Mina common segment 1 (Figure 3-191 and Figure 3-192). A new well is proposed at each potential quarry location. The first potential quarry site is in the northeast part of hydrographic area 110C (Walker Lake Valley, Whiskey Flat-Hawthorne subarea), approximately 2.1 kilometers (1.3 miles) south of the centerline of Mina common segment 1. Proposed well WLc-2a would be installed adjacent to this quarry location. Geologic conditions found at this location include primarily volcanic rocks (DIRS 180881-Shannon & Wilson, Inc. 2007, p. 28*).* The quarry and the quarry well would be located partially on grazing land and partially on the Hawthorne Army Depot (Section 4.3.2).

There are two existing wells in hydrographic area 110C, both NDWR wells with water rights and within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1. One of these two wells is also within 1.6 kilometers of a proposed new well location (Figures 3-191 and 3-192). Figure 3-190 shows the locations of these wells. There are no springs within 1.6 kilometers of the centerline of Mina common segment 1 in hydrographic area 110C.

Hydrographic area 121B, Soda Spring Valley (western part), is a designated groundwater basin. Committed groundwater resources exceed its estimated perennial yield of 246,000 cubic meters (200 acre-feet) (see Table 3-113). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 345 million cubic meters (280,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 121B. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in the area.

The depth to groundwater in most parts of Soda Spring Valley (western part) ranges from approximately less than 15 to more than 90 meters (less than 50 to more than 300 feet) (DIRS 180887-Converse Consultants, p. 76). Depth to groundwater underlying the rail alignment in hydrographic area 121B is generally 15 meters (50 feet) (see Table 3-118) (DIRS 180887-Converse Consultants, Plate 4-8). Groundwater is generally low in dissolved solids with dominant ions of calcium and bicarbonate. The main use of groundwater in hydrographic area 121B is for mining (DIRS 180887-Converse Consultants, p. 77). The primary source of groundwater in Soda Spring Valley (western part) is inferred to be interbasin flow from the Soda Spring Valley-East Basin. Table 3-118 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 121B.

Geologic units in the Soda Spring Valley (western part) area include alluvial valley fill, metamorphic rocks, and clastic rocks. Alluvial valley fill comprises the best aquifers in hydrographic area 121B. There is an estimated 345 million cubic meters (280,000 acre-feet) of recoverable groundwater in the saturated aquifer material within this basin (see Table 3-118). There are a total of 7 existing NDWR wells with water rights and USGS NWIS wells in hydrographic area 121B within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1 (see Table 3-114). Figures 3-191 and 3-192 identify the locations of these wells. There are no springs within 1.6 kilometers of the centerline of Mina common segment 1 or proposed new well locations outside of the segment construction right-of-way.

Hydrographic area 121A, Soda Spring Valley (eastern part), is a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Table 3-113). There could be approximately 530 million cubic meters (430,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 121A. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 121A.

Geologic units underlying the Soda Spring Valley (eastern part) hydrographic area include alluvial valley fill, intrusive and metamorphic bedrock units, and clastic sandstone (see Table 3-118). Mina common segment 1 would primarily overlie alluvial valley (alluvial valley floor and alluvial slope) deposits. Table -192 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 121A.

Faulting is mapped predominantly on the alluvial aprons in hydrographic area 121A. Mapped fault traces (for example, part of the Benson Springs fault system) in alluvial valley fill to the south of one proposed new well site (SSa-3, see Figure 3-192) could project northeastward past the well location to the east; faults are also identified along the alluvial apron at the bedrock contact to the east (base of the Pilot

Mountains), about 1.6 kilometers (1 mile) east of this proposed well location (DIRS 180888-Converse Consultants 2007, Appendix B; DIRS 180975-Stewart, Carlson, and Johannessen 1982, all). The possible effects of such faults on groundwater flow in hydrographic area 121A in the vicinity of proposed well location SSa-3 (DIRS 180888-Converse Consultants 2007, Appendix B) were evaluated in hydrogeologic impact analyses (Appendix G).

The depth to groundwater beneath Soda Spring Valley (eastern part) is generally between 15 to 30.5 meters (50 to 100 feet) (see Table 3-118). Available data regarding characteristics of the valley-fill aquifer underlying hydrographic area 121A indicate that approximately 530 million cubic meters (430,000 acre-feet) of recoverable groundwater might exist within saturated aquifer material within this basin (see Table 3-118).

A second potential quarry location is in the Gabbs Range northeast of Luning along the northeastern side of Mina common segment 1. Proposed well location SSa-1 is adjacent to this potential quarry site. The geology in this area consists of sedimentary and plutonic rocks (DIRS 180881-Shannon & Wilson, Inc. 2007, p. 28*)*. The quarry and the quarry well would be located on grazing land (Section 4.3.2).

There are a total of 14 existing NDWR wells with water rights and USGS NWIS wells in hydrographic area 121A within 1.6 kilometers (1 mile) of either the centerline of Mina common segment 1 or any proposed new well outside of the segment construction right-of-way (see Table 3-118). There are no springs in hydrographic area 121A within 1.6 kilometers of the centerline of Mina common segment 1 or any proposed new well outside of the segment construction right-of-way.

Hydrographic area 119, Rhodes Salt Marsh Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 1.23 million cubic meters (1,000 acre-feet) (see Table 3-113). There could be approximately 420 million cubic meters (340,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 119. NDWR data indicate that that there are no documented pending annual duties (see Table 3-113) in hydrographic area 119.

In the portion of hydrographic area 119 the rail line would cross, groundwater is approximately 15 meters (50 feet) to less than 30 meters (100 feet) below ground surface (see Table 3-118). Groundwater chemistry within hydrographic area 119 is highly variable. Groundwater is primarily obtained from the alluvial valley-fill aquifer. The primary geologic units comprising Rhodes Salt Marsh Valley include alluvial valley fill, volcanic rocks, and older carbonate and clastic rocks. There is one NDWR well with a water right, and no other USGS NWIS wells within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1 or any proposed new well locations outside of the centerline (see Table 3-114). There are no springs in hydrographic area 119 within 1.6 kilometers of the centerline of Mina common segment 1 or within 1.6 kilometers of any proposed new well locations outside of the centerline (Figure 3-192). There are two existing springs in Sodaville, just north of hydrographic area 119 (Figure 3-192). These springs have documented discharge rates of approximately 280 liters (75 gallons) per minute but are more than 3.2 kilometers (2 miles) from the centerline of Mina common segment 1 (DIRS 180759-Vandenburgh and Clancy, p. 28 and Plate 1). Table 3-118 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 119.

Hydrographic area 118, Columbus Salt Marsh Valley, is not a designated groundwater basin. Committed groundwater resources do not exceed its estimated perennial yield of 4.9 million cubic meters (4,000 acre-feet) (see Table 3-113). There could be approximately 650 million cubic meters (530,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 118. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 118.

Groundwater derived within area 118 is primarily obtained from alluvial valley fill. Table 3-118 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 118.

The primary geologic units comprising Columbus Salt Marsh Valley are alluvial sediments, volcanic rock, and clastic rocks (see Table 3-118). Available data indicate that depth to groundwater beneath Mina common segment 1 in hydrographic area 118 could vary from about 3 to 30.5 meters (10 to 100 feet) (see Table 3-118).

There are two NDWR wells with water rights, three USGS NWIS wells, and four springs in hydrographic area 118 within 1.6 kilometers (1 mile) of the centerline of Mina common segment 1. Figure 3-192 shows the locations of the wells.

Big Smoky Valley (hydrographic area 137A) is a designated groundwater basin, and the committed groundwater resources exceed the perennial yield of 7.4 million cubic meters (6,000 acre-feet). There could be approximately 8.63 billion cubic meters (7 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 137A. NDWR data indicate that there are no documented pending annual duties (see Table 3-113) in area 137A. Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, and clastic rocks (see Table 3-118). The alluvial valley-fill materials include sands and gravels along alluvial fans and washes, and silts and clays along the valley floor; most of the available groundwater in Big Smoky Valley is found in unconfined and semi-unconfined aquifers comprised of these valley-fill sediments.

Depth to groundwater in hydrographic area 137A typically varies from less than 3 to greater than about 30.5 meters (10 to 100 feet) below ground surface (see Table 3-118), with values as deep as 220 meters (720 feet) below ground surface reported for some locations in the alluvial apron. Groundwater in hydrographic area 137A contains dominant ions of calcium and bicarbonate, and groundwater at higher elevations has total dissolved solids concentrations that are relatively low (500 mg/L or less), although discharge areas in the center of the valley may have higher concentrations (see Table 3-118) (DIRS 180887-Converse Consultants 2007, p. 52).

Groundwater in Big Smoky Valley is mainly used for irrigation and mining purposes (DIRS 180887-Converse Consultants 2007, p. 53). Besides groundwater pumping and evapotranspiration, groundwater in the basin flows out of the area as subsurface outflow to Clayton Valley and Columbus Salt Marsh.

There are 25 existing wells in hydrographic area 137A within 1.6 kilometers (1 mile) of the centerline of alternative segments passing through this basin and/or proposed pumping well locations for alternative segments. Twelve of these wells are USGS wells and thirteen are NDWR wells with active water rights. There are no springs within 1.6 kilometers of the centerline of the rail alignment and/or proposed pumping well locations. There are no proposed groundwater supply-well locations in Big Smoky Valley for Mina common segment 1 that are outside of the construction right-of-way (Figures 3-193).

3.3.6.3.5 Montezuma Alternative Segment 1

Starting near Blair Junction, Montezuma alternative segment 1 would proceed southeastward towards Silver Peak, then continue eastward and southward in a sinuous fashion on its way to a point where the segment would connect to the beginning of Mina common segment 2, southeast of the Cuprite Hills. Montezuma alternative segment 1 would cross the following hydrographic areas: 137A (Big Smoky Valley), 143 (Clayton Valley), 142 (Alkali Spring Valley), and 144 (Lida Valley). Figures 3-193 through 3.3.6-8 depict the proposed Montezuma alternative segment 1 configuration. Aquifer characteristics, such as aquifer type(s), groundwater quality, and depth to groundwater underlying Montezuma alternative segment 1 vary according to the locations within the hydrographic areas that the rail line would cross.

Table 3-119 summarizes the groundwater-quality and aquifer characteristics for each hydrographic area Montezuma alternative segment 1 would cross.

Section 3.3.6.3.4 describes the hydrogeologic characteristics of hydrographic area 137A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segments. Table 3-119 summarizes general groundwater-quality and aquifer characteristics in hydrographic area 137A.

Clayton Valley (hydrographic area 143) is a designated groundwater basin, and the total active annual duties for the basin exceed the perennial yield of 24.6 million cubic meters (20,000 acre-feet) (see Table 3-113). There could be approximately 1.6 million cubic meters (1.3 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 143 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 143 (see Table 3-113).

Alluvial valley deposits consisting of silts and clays comprise the center of the valley and are hundreds of feet thick. Alluvial valley-fill materials, volcanic rocks, and carbonate and clastic rocks are the major geologic units encountered (see Table 3-119). Most of the available groundwater in Clayton Valley is found in alluvial valley-fill materials, with some groundwater contained in fractured rock of the surrounding mountains. Subsurface inflow from Big Smoky Valley and Alkali Spring Valley contributes most of the recharge to groundwater in Clayton Valley. The majority of groundwater leaves this basin as evapotranspiration or through pumping wells (DIRS 180887-Converse Consultants 2007, p. 47).

Depth to groundwater in hydrographic area 143 ranges from about 3 to 72 meters (10 to 237 feet) below ground surface (see Table 3-119). Groundwater in Clayton Valley is highly mineralized (brackish) with elevated sodium and chloride concentrations, and total dissolved solids as high as 10,000 mg/L in lower parts of the basin (see Table 3-119) (DIRS 180760-Albers and Stewart 1981, p. 2; DIRS 180887-Converse Consultants 2007, p. 46).

The dominant use for groundwater in Clayton Valley is solution-mining of lithium from brines in the playa area (DIRS 180887-Converse Consultants 2007, p. 47). There are 13 existing wells in hydrographic area 143 within 1.6 kilometers (1 mile) of the centerline of Montezuma alternative segment 1 passing through this basin and/or proposed pumping well locations for this alternative segment (see Table 3-114). Seven of these wells are USGS wells, and five are NDWR wells with active water rights. There are six springs within 1.6 kilometers of the centerline of Montezuma alternative segment 1 and/or the proposed pumping well locations.

Proposed groundwater supply-well location Cl-1a is the only proposed well location for Montezuma alternative segment 1 that is outside the construction right-of-way in Clayton Valley (Figure 3-194). It is located on an alluvial fan, about 5.6 kilometers (3.5 miles) west of Montezuma alternative segment 1 (DIRS 180888-Converse Consultants 2007, Appendixes A and B). The quarry and the quarry well would be located on grazing land (Section 4.3.2).

Alkali Spring Valley (hydrographic area 142) is not a designated groundwater basin, and the total active annual duties for the basin do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). There could be approximately 1.6 billion cubic meters (1.3 million acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 142 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 142 (see Table 3-113).

Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, rhyolite, and clastic and carbonate rocks (see Table 3-119). The alluvial valley deposits of Alkali Spring Valley contain most of the available groundwater, and groundwater production comes mainly from valley-fill wells.

Table 3-119. General groundwater-quality and aquifer characteristics – Mina common segment 1 and Montezuma alternative segment 1.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters) [b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality [e]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/L[g] 6,500 mg/L (valley center discharge locations)[f]
143 Clayton Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks	Less than 3 to 15	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Up to 1,700 mg/L[g] (more than 10,000 mg/L lower parts of the basin) [g]
142 Alkali Spring Valley (Esmeralda)	Alluvial valley fill, clastic and subordinate carbonate rocks, rhyolite dikes, volcanic rocks	Less than 3 to 27	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Less than 1,000 mg/L[g] 1,000 to 3,000 mg/L (in playa area)[g]
144 Lida Valley	Alluvial valley fill, volcanic sediments, and older rock units including hornfels, phyllite, quartzite, limestone, and dolomite	49 to 61	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Source: DIRS 180887-Converse Consultants 2007, pp. 52, 46, 39, and 32.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plates 4-1 to 4-4 and pp. 32, 39, 45, 51, and 52; DIRS 176600-Converse Consultants 2005, Plates 4-3 and 4-5.
c. To convert meters to feet, multiply by 3.2808.
d. To convert from acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 34, 40, 46, and 52.

However, fractured rock is the source of groundwater discharging from small springs on the south side of the basin. Most aquifer recharge is from subsurface inflow from Ralston Valley, and groundwater in Alkali Spring Valley flows to the southwest, with the majority of groundwater leaving as outflow to Clayton Valley (DIRS 180887-Converse Consultants 2007, pp. 40 and 41).

Depth to groundwater in hydrographic area 142 varies from approximately 3 to 146.3 meters (10 to 480 feet) below ground surface (see Table 3-119). Depth to groundwater underlying the rail alignment in Alkali Spring Valley is approximately 27 meters (90 feet). Groundwater quality in Alkali Spring Valley varies throughout the basin. The northeastern part has the best water quality, with lower total dissolved solids; while the playa area and the vicinity of Alkali Hot Spring has groundwater that is high in sodium sulfate and total dissolved solids (see Table 3-119).

The dominant uses for groundwater in Alkali Spring Valley are for mining and municipal water supply. There are 36 existing wells in hydrographic area 142 within 1.6 kilometer (1 mile) of the centerline of alternative segments passing through this basin and/or proposed pumping well locations for the alternative segments. Twelve of these wells are USGS wells, and twenty-four are NDWR wells with active water rights. There are two springs within 1.6 kilometer of the centerline of the alternative segments.

Lida Valley (hydrographic area 144) is not a designated groundwater basin, and the committed groundwater resources are less than the perennial yield of 430,000 cubic meters (350 acre-feet). There could be approximately 1.9 billion cubic meters (1.5 million acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 144. NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 144 (see Table 3-113).

Geologic units in hydrographic area 144 include primarily alluvial valley fill, volcanic rocks, limestone and dolomite, hornfels, phyllite, and quartzite (see Table 3-119). Groundwater is mostly found in unconfined aquifers of the alluvial valley-fill materials. Most aquifer recharge is derived from precipitation and subsurface inflow from Stonewall Basin, and groundwater exits the basin in the form of outflow to Sarcobatus Flat (DIRS 180887-Converse Consultants 2007, pp. 34 and 35).

Depth to groundwater in hydrographic area 144 varies from approximately 7.9 to 110 meters (26 to 360 feet) below ground surface. Depth to groundwater underlying the rail alignment in Lida Valley ranges from 50 to 61 meters (160 to 200 feet). Groundwater quality is reflected in the total dissolved solids (see Table 3-119).

The dominant uses for groundwater in hydrographic area 144 (Lida Valley) include mining, stockwatering, and municipal water supply. There are six existing wells in hydrographic area 144 within 1.6 kilometers (1 mile) of the centerline of the alternative segments passing through this basin and/or proposed pumping well locations for the alternative segments. Two of these wells are USGS wells, and four are NDWR wells with active water rights. There are no springs within 1.6 kilometers of the centerline of the alternative segments.

Proposed groundwater-supply wells for Montezuma alternative segment 1 in the Alkali Spring Valley and Lida Valley hydrographic areas that might be required outside the construction right-of-way (Figure 3-194) and which are not related to water-supply requirements for potential quarries include AS-1a and AS-3a and LV10/LV11/LV12 in hydrographic area 144. The AS-1a and AS-3a proposed well locations lie about 4.8 kilometers (3 miles) and 3.7 kilometers (2.3 miles) north, respectively, of the centerline of Montezuma alternative segment 1, on an alluvial valley-fill slope in an area without a history of much groundwater production. These two proposed well locations would be located on grazing land (Section 4.3.2). For both locations, there are north-northeast striking faults in bedrock to the southwest of these proposed well locations, which could impact groundwater flow and pumping conditions in the area (DIRS 180888-Converse Consultants 2007, Appendix B).

Another proposed groundwater supply-well location (Li-5a) that is in hydrographic area 144 for Montezuma alternative segment 1 that is outside of the construction right-of-way (Figure 3-194) is a proposed alternate quarry water-supply well in the central part of an alluvial fan, about 2.4 kilometers (1.5 miles) west of Montezuma alternative segment 1. This well site might be used in lieu of another proposed new well (Li-1a) located within the Montezuma alternative segment 1 construction right-of-way due to the possibility of encountering a sufficient thickness of alluvial valley-fill materials and a thicker ***saturated zone*** at location Li-5a than at location Li-1a (DIRS 180888-Converse Consultants 2007, Appendix B and Plate 4-1). This proposed alternate quarry well would be located on grazing land (Section 4.3.2).

3.3.6.3.6 Montezuma Alternative Segment 2

Montezuma alternative segment 2 would begin near Blair Junction and proceed from west to east through hydrographic area 137A (Big Smoky Valley), then proceed generally southward or southeastward through hydrographic areas 142 (Alkali Spring Valley), 145 (Stonewall Valley), and 144 (Lida Valley), passing west of the community of Goldfield (Figures 3-193 through 3-195). Aquifer characteristics, such as aquifer type(s), groundwater quality and depth to groundwater underlying Montezuma alternative segment 2, vary according to the locations within the hydrographic areas that the rail line would cross. Table 3-120 summarizes the groundwater-quality and aquifer characteristics for each hydrographic area through which the alternative segment would pass.

Section 3.3.6.3.4 describes the hydrogeologic characteristics of hydrographic area 137A, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segments. This information is again presented here for convenience.

Big Smoky Valley (hydrographic area 137A) is a designated groundwater basin, and the committed groundwater resources exceed the perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Tables 3.3.6-1 and 3.3.6-8). As described previously in Section 3.3.6.3.4, there are no documented pending underground annual duties in area 137A. Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, and clastic rocks (see Table 3-120). The alluvial valley-fill materials include sands and gravels along alluvial fans and washes, and silts and clays along the valley floor; most of the available groundwater in Big Smoky Valley is found in unconfined and semi-unconfined aquifers comprised of these valley-fill sediments (DIRS 180887-Converse Consultants 2007, p. 51). Depth to groundwater in hydrographic area 137A typically varies from less than 3 to more than about 30.5 meters (10 to 100 feet) below ground surface (see Table 3-120), with values as deep as 220 meters (720 feet) below ground surface reported for some locations in the alluvial apron. Groundwater in hydrographic area 137A contains dominant ions of calcium and bicarbonate, and total dissolved solids is relatively low, under 500 mg/L (see Table 3-120), although discharge areas in the center of the valley may have higher concentrations.

Section 3.3.6.3.5 describes the hydrogeologic characteristics of hydrographic areas 142 and 144, including groundwater-quality and aquifer characteristics, as well as information regarding existing wells and springs in the vicinity of the proposed alternative segments. This information is again presented here for convenience.

Alkali Spring Valley (hydrographic area 142) is not a designated groundwater basin, and the total active annual duties for the basin do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 142. Geologic units in hydrographic area 142 include primarily alluvial valley fill, volcanic rocks, rhyolite, and clastic and carbonate rocks (see Table 3-120).

The alluvial valley deposits of Alkali Spring Valley contain most of the available groundwater, and groundwater production comes mainly from valley-fill wells. However, fractured rock is the source of groundwater discharging from small springs on the south side of the basin. Most aquifer recharge is from subsurface inflow from Ralston Valley, and groundwater in Alkali Spring Valley flows to the southwest, with the majority of groundwater leaving as outflow to Clayton Valley (DIRS 180887-Converse Consultants 2007, pp. 40 and 41).

Depth to groundwater in hydrographic area 142 varies from less than 3 to 146.3 meters (10 to 480 feet) below ground surface (see Table 3-120). Groundwater quality in Alkali Spring Valley varies throughout the basin.

Table 3-120. General groundwater-quality and aquifer characteristics – Montezuma alternative segment 2.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/~~L[g]~~-L[g] 6,500 mg/L (valley center discharge locations)[g]
142 Alkali Spring Valley (Esmeralda)	Alluvial valley fill, clastic and subordinate carbonate rocks, rhyolite dikes, volcanic rocks	Less than 3 to 146	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Less than 1,000 mg/L[g] 1,000 to 3,000 mg/L (in playa area)[g]
145 Stonewall Flat	Alluvial valley-fill deposits, volcanic rocks, older sedimentary rocks[h]	37 to 60	Upper 30.5 meters: 820,000[f]	Total dissolved solids: Less than 300 mg/L[i]
144 Lida Valley	Alluvial valley fill, rhyolite volcanic sediments (including tuffs of the stonewall flat and tuffs of the Thirty Canyon Group), older rock units including claystone, siltstone, and limestone	50 to 85	Upper 30.5 meters: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 52, 39, and 32; DIRS 173842-Shannon and Wilson, 2005, pp. 23 and 24, 29, 30, and 33 to 35.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plates 4-1 through 4-4 and pp. 32, 39, 45, 51, and 52; DIRS 176600-Converse Consultants 2005, p. 49 and Plate 4-5.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 34, 40, 46, and 52.
h. Source: DIRS 173179-Belcher 2004, p. 28 and Figure B-1.
i. Source: DIRS 176600-Converse Consultants 2007, p. 49.

The northeastern part has the best water quality, with lower total dissolved solids; while the playa area and the vicinity of Alkali Hot Spring has groundwater that is high in sodium sulfate and total dissolved solids (see Table 3-120).

Lida Valley (hydrographic area 144) is not a designated groundwater basin, and the committed groundwater resources are less than the perennial yield of approximately 432,000 cubic meters (350 acre-feet) (see Tables 3.3.6-1 and 3.3.6-8). As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. Geologic units in hydrographic area 144 include primarily alluvial valley fill, rhyolite volcanic rocks, (including tuffs of the Stonewall Flat and tuffs of the Thirty Canyon Group), and older rock units including claystone, siltstone, and limestone (see Table 3-120). Groundwater is mostly found in unconfined aquifers of the alluvial valley fill materials (DIRS 180887-Converse Consultants 2007, p. 32). Most aquifer recharge is derived from precipitation and subsurface inflow from Stonewall Basin, and groundwater exits the basin in the form of outflow to Sarcobatus Flats (DIRS 180887-Converse Consultants 2007, pp. 34 and 35).

Depth to groundwater in hydrographic area 144 varies from approximately 7.9 to 110 meters (26 to 360 feet) below ground surface (see Table 3-120). Depth to groundwater underlying the rail alignment varies from 73 to 85 meters (240 to 280 feet). Groundwater quality is reflected in the total dissolved solids, which are given in Table 3-120.

Two proposed groundwater supply-well locations for Montezuma alternative segment 2, BSa-2a and BSa-3a, both in Big Smoky Valley, are within several kilometers of faults that may act as conduits for a significant amount of groundwater, thus influencing groundwater flow and pumping conditions in the area (DIRS 180888-Converse Consultants 2007, Appendix B).

There are four locations where wells are proposed to support construction of Montezuma alternative segment 2 that would be outside the construction right-of-way. All of these proposed well locations would be located on grazing land (Section 4.3.2). A proposed set of groundwater supply-well locations (ASV4/ASV5/ASV8/ASV9) east of Montezuma alternative segment 2 in hydrographic area 142 (Figure 3-194) are at the same location as a set of wells of the same name that were proposed to support construction of Goldfield alternative segments, as described in Section 3.2.6.3.7 (DIRS 180888-Converse Consultants 2007, Appendix C). A proposed set of groundwater supply-well locations in hydrographic area 144 (LV10/LV11/LV12) west of the Montezuma alternative segment 2 in hydrographic area 144 are the same set of wells of the same name as those proposed for Caliente common segment 4, as described in Section 3.2.6.3.8. Up to two wells each at either proposed well site ASV6, or at a proposed alternate well site ASV7, if needed, west and northwest of Goldfield, respectively (Figure 3-194), could supply water to a potential quarry site (quarry ES-7) in that area. These wells would only be required if Montezuma alternative segment 2 were selected (DIRS 180875-Nevada Rail Partners 2007, pp. 3 and 4). Geologic conditions present at these proposed well sites include fractured volcanic rock units (ASV6 site) and alluvial fan deposits (ASV7 site) (DIRS 180888-Converse Consultants 2007, Appendix D).

Hydrographic area 145 (Stonewall Flat) is not a designated groundwater basin. Committed groundwater resources as of September 2006 do not exceed the perennial yield of approximately 120,000 cubic meters (100 acre-feet) (see Table 3-113). There could be approximately 1 billion cubic meters (820,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 145. NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 145 (see Table 3-113). Geologic units underlying hydrographic area 145 include alluvial valley-fill deposits, volcanic rocks, and older sedimentary rocks (DIRS 173179-Belcher 2004, p. 28 and Figure B-1).

Only a small portion (less than 8 kilometers [5 miles]) of Montezuma alternative segment 2 would overlie hydrographic area 145, and there are no proposed water supply-well locations within this hydrographic area (DIRS 180888-Converse Consultants 2007, Appendix A and Plate 4-1). Depth to groundwater is uncertain along Montezuma alternative segment 2 where it would cross a small portion of Stonewall Flat. However, based on projections from nearby areas, depth to groundwater could be approximately 37 to 60 meters (120 to 200 feet) (see Table 3-120). Groundwater quality is relatively good, with low total dissolved solids concentrations (see Table 3-120). Alluvial valley-fill material, volcanic rock, and older sedimentary rocks are the primary geologic units in the basin (see Table 3-120). There are no existing wells (USGS and NDWR) or springs in Stonewall Flat that are within 1.6 kilometers (1 mile) of Montezuma alternative segment 2.

3.3.6.3.7 Montezuma Alternative Segment 3

Montezuma alternative segment 3 would initially follow the same path as the first portion of proposed Montezuma alternative segment 2, proceeding eastward/northeastward from near Blair Junction through a portion of Big Smoky Valley (hydrographic area 137A) and then proceed southeastward and southward, passing through Alkali Spring Valley (hydrographic area 142). In the Alkali Spring Valley hydrographic area, Montezuma alternative segment 3 would proceed westward beginning at a point along Montezuma alternative segment 2 to where it would intersect with a portion of a segment that would be the same as the eastern and southeastern portion of Montezuma alternative segment 1. Montezuma alternative segment 3 (comprised of the northern portion of Montezuma alternative segment 2, the short connecting Montezuma alternative segment 3, and the southern portion of Montezuma alternative segment 1) would then follow the same path as the southern portion of Montezuma alternative segment 1 through the Clayton Valley and Lida Valley areas, to the beginning of Mina common segment 2, southeast of the Cuprite Hills (Figures 3-193 and 3-194).

Aquifer characteristics, such as aquifer types(s), groundwater quality, and depth to groundwater underlying the portions of Montezuma alternative segments 1 and 2 would be the same as the northern and southern portions of Montezuma alternative segment 3 previously described in Sections 3.3.6.3.4 and 3.3.6.3.5, but this information is again presented here for convenience.

Big Smoky Valley (hydrographic area 137A), which the northern portion of Montezuma alternative segment 3 would cross, is a designated groundwater basin, and the committed groundwater resources exceed the perennial yield of 7.4 million cubic meters (6,000 acre-feet) (see Tables 3.3.6-1 and 3.3.6-9). There are existing groundwater-rights appropriations in hydrographic area 137A, but there are no pending underground annual duties (see Table 3-113). Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, and clastic rocks (see Table 3-121). The alluvial valley-fill materials include sands and gravels along alluvial fans and washes, and silts and clays along the valley floor; most of the available groundwater in Big Smoky Valley is found in unconfined and semi-unconfined aquifers of these alluvial valley-fill sediments.

Depth to groundwater in hydrographic area 137A typically varies from less than 3 to more than about 30 meters (10 to 100 feet) below ground surface (see Table 3-121), with values as deep as 220 meters (720 feet) below ground surface reported for some locations in the alluvial apron. Groundwater in hydrographic area 137A contains dominant ions of calcium and bicarbonate, and total dissolved solids are relatively low, under 500 mg/L (see Table 3-121), although discharge areas in the center of the valley may have higher concentrations.

Alkali Spring Valley (hydrographic area 142), which Montezuma alternative segment 3 would cross, is not a designated groundwater basin, and the total active annual duties for the basin do not exceed the perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). There are existing groundwater-rights appropriations in hydrographic area 142, but there are no pending underground annual duties (see Table 3-113) (DIRS 182288-NDWR 2007).

Geologic units in this hydrographic area include primarily alluvial valley fill, volcanic rocks, rhyolite, and clastic and carbonate rocks (see Table 3-121). The alluvial valley deposits of Alkali Spring Valley contain most of the available groundwater, and groundwater production comes mainly from valley-fill wells. However, fractured rock is the source of groundwater discharging from small springs on the south side of the basin. Most aquifer recharge is from subsurface inflow from Ralston Valley, and groundwater in Alkali Spring Valley flows to the southwest, with the majority of groundwater leaving as outflow to Clayton Valley (DIRS 180887-Converse Consultants 2007, pp. 40 and 41).

Depth to groundwater in hydrographic area 142 varies from approximately 3 to 150 meters (10 to 480 feet) below ground surface. Depth to groundwater underlying the rail alignment in Alkali Spring Valley varies from 27 to 61 meters (90 to 200 feet) (Table 3-120). Groundwater quality in Alkali Spring Valley varies throughout the basin. The northeastern part has the best water quality, with lower total dissolved solids, while the playa area and the vicinity of Alkali Hot Spring has groundwater that is high in sodium sulfate and total dissolved solids (see Table 3-121).

Table 3-121. General groundwater-quality and aquifer characteristics – Montezuma alternative segments 1, 2, and 3.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
137A Big Smoky Valley	Alluvial valley fill, volcanic rocks, intrusive and metamorphic rocks, clastic rocks	Less than 3 to more than 30	Upper 30.5 meters of alluvium: 7 million[f]	Total dissolved solids: 300 to 4,000 mg/L[g] 6,500 mg/L (valley center discharge locations)[g]
142 Alkali Spring Valley (Esmeralda)	Alluvial valley fill, clastic and subordinate carbonate rocks, rhyolite dikes, volcanic rocks	Less than 27 to 61	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Less than 1,000 mg/L[g] 1,000 to 3,000 mg/L (in playa area)[g]
143 Clayton Valley	Alluvial valley fill, carbonate and clastic rocks, volcanic rocks	Less than 27 to 61	Upper 30.5 meters of alluvium: 1.3 million[f]	Total dissolved solids: Up to 1,700 mg/L[g] (more than 10,000 mg/L lower parts of the basin)[g]
144 Lida Valley	Alluvial valley fill, rhyolite volcanic sediments (including tuffs of the Stonewall Flat and tuffs of the Thirty Canyon Group), older rock units including claystone, siltstone, and limestone	90 to 85	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 51, 44, 45, 39, and 32; DIRS 173842-Shannon and Wilson, 2005, pp. 23-24, 29, 30, and 33 to 35.
b. The listed depth to groundwater ranges generally apply to areas underlying the alignment obtained from DIRS 180887-Converse Consultants 2007, Plates 4-1 through 4-4; groundwater can vary over a wide range of depth depending on location in each hydrographic area (DIRS 180887-Converse Consultants 2007, pp. 32, 39, 45, 51, and 52); DIRS 176600-Converse Consultants, 2005, Plate 4-5.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, pp. 34, 40, 46, and 52.

Clayton Valley (hydrographic area 143), which a portion of Montezuma alternative segment 3 would cross, is a designated groundwater basin, and the total active annual duties for this basin exceed the perennial yield of 24.7 million cubic meters (20,000 acre-feet) (see Table 3-113). There are no pending underground annual duties for hydrographic area 143 (see Table 3-113).

Alluvial valley deposits consisting of silts and clays comprise the center of the valley and are hundreds of feet thick. Alluvial valley-fill materials, volcanic rocks, and carbonate and clastic rocks are the major geologic units encountered (see Table 3-121).

Depth to groundwater in hydrographic area 143 ranges from about 3 to 72 meters (10 to 237 feet) below ground surface (see Table 3-121). Depth to groundwater underlying the rail alignment in Clayton Valley ranges from less than 3 to 61 meters (90 to 200 feet). Groundwater in Clayton Valley is highly mineralized with elevated sodium and chloride concentrations, with total dissolved solids as high as 10,000 mg/L in the lower parts of the basin (see Table 3-121) (DIRS 180760-Albers and Stewart 1981, p. 2.

Lida Valley (hydrographic area 144), which a portion of Montezuma alternative segment 3 would cross, is not a designated groundwater basin, and the committed groundwater resources are less than the perennial yield of 430,000 cubic meters (350 acre-feet) (Tables 3.3.6-1 and 3.3.6-9). As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. Geologic units in hydrographic area 144 include primarily alluvial valley fill, volcanic rocks, limestone and dolomite, hornfels, phyllite, and quartzite (see Table 3-121). Groundwater is mostly found in unconfined aquifers of the alluvial valley-fill materials.

Depth to groundwater in hydrographic area 144 varies from approximately 50 to 85 meters (160 to 280 feet) below ground surface (see Table 3-121). Depth to groundwater underlying the rail alignment varies from 73 to 85 meters (240 to 280 feet). Groundwater quality is reflected in the total dissolved solids, which are listed in Table 3-121.

As described in Section 3.3.6.3.6, up to two wells each that would be required if Montezuma alternative segment 2 is selected at either proposed well site ASV6, or at proposed alternate well site ASV7, west and northwest of Goldfield, respectively (Figure 3-194), would not be required if Montezuma alternative segment 3 is selected.

There are no proposed groundwater supply-well locations for the portion of Montezuma alternative segment 3 that is different from Montezuma alternative segments 1 and 2 that would lie outside the construction right-of-way (DIRS 180888-Converse Consultants 2007, Appendix A).

3.3.6.3.8 Mina Common Segment 2

Mina common segment 2 would begin at a point southeast of the Cuprite Hills in hydrographic area 144 (Lida Valley), and then proceed southeastward through that hydrographic area to the beginning of Bonnie Claire alternative segments 2 and 3 (Figures 3-194 and 3-195). Aquifer characteristics, such as groundwater quality and depth to groundwater underlying Mina common segment 2, would vary depending on the location within hydrographic area 144. Table 3-122 summarizes the groundwater-quality and aquifer characteristics for the Lida Valley hydrographic area.

Aquifer characteristics for hydrographic area 144, Lida Valley, have previously been described. Section 3.3.6.3.5 (Montezuma alternative segment 1) provides information regarding geology, groundwater quality, aquifer characteristics, and groundwater uses for this hydrographic area, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segment. As described previously in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. There are no proposed groundwater supply wells for Mina common segment 2 (DIRS 180888-Converse Consultants 2007, Appendix A). Also, there are no existing USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, or springs in Lida Valley that are within 1.6 kilometers (1 mile) of Mina common segment 2.

3.3.6.3.9 Bonnie Claire Alternative Segments

From north to south, Bonnie Claire alternative segments 2 and 3 would cross hydrographic areas 144 (Lida Valley) and 146 (Sarcobatus Flat) (Figure 3-196). Section 3.3.6.3.5 provides information regarding geology, groundwater quality, aquifer characteristics, and groundwater uses for hydrographic area 144, as well as information regarding existing wells and springs in the vicinity of the proposed rail alignment segments. As described in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 144. There is one existing NDWR well with water rights, no NDWR domestic wells, no existing USGS NWIS wells, and no existing springs in hydrographic area 144 within 1.6 kilometers (1 mile) of the proposed Bonnie Claire alternative segments. There are four NDWR wells with water rights, no NDWR

Table 3-122. General groundwater-quality and aquifer characteristics – Mina common segment 2.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
144 Lida Valley	Alluvial valley fill, rhyolite volcanic sediments, (including tuffs of the Stonewall Flat and tuffs of the Thirty Canyon Group) and older rock units including claystone, siltstone, and, limestone	70 to 85	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 31 and 32; DIRS 176600-Converse Consultants 2005, Plate 4-5.
b. Estimated depth to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plate 4-1 and p. 32.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 180887-Converse Consultants 2007, p. 34.

domestic wells, no USGS NWIS wells, and no existing springs in area 146 within 1.6 kilometers of the centerlines of the proposed Bonnie Claire alternative segments.

The Bonnie Claire alternative segments would predominantly overlie alluvial valley fill (see Table 3-123). Geologic units Bonnie Claire alternative segments 2 and 3 would cross primarily include alluvial valley-fill deposits and some volcanic rocks (DIRS 173842-Shannon & Wilson 2005, p. 28). The primary volcanic unit encountered along Bonnie Claire alternative segments 2 and 3 is tuff of the Timber Mountain Group (DIRS 173842-Shannon & Wilson 2005, p. 30 and Plate 2).

Hydrographic area 146, Sarcobatus Flat, is a designated groundwater basin, and has a perennial yield of 3.7 million cubic meters (3,000 acre-feet) (see Table 3-113). Committed groundwater resources in hydrographic area 146 exceed the estimated perennial yield, but as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 2.96 billion cubic meters (2.4 million acre-feet) of recoverable groundwater in the upper 30 meters (100 feet) of saturated aquifer materials within area 146. NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 146 (see Table 3-113).

There are no existing water-supply wells or springs in hydrographic area 146 within 1.6 kilometers (1 mile) of the centerlines of Bonnie Claire alternative segments.

Table 3-123 summarizes general groundwater characteristics in hydrographic areas 144 and 146. Groundwater in hydrographic area 146 contains elevated levels of sodium bicarbonate.

Most of the existing groundwater wells in hydrographic area 146 are ***screened*** in the alluvial valley fill; a few wells in the western portion of the basin are screened in volcanic rocks. The total volume of alluvial valley fill comprising the primary aquifer reservoir in hydrographic area 146 is not known because of variations in the thickness of valley fill that result in variations in the surface of the underlying bedrock. However, Malmberg and Eakin (DIRS 106695-Malmberg and Eakin 1962, pp. 13 and 19) suggested the maximum thickness of valley fill in hydrographic area 146 could be as much as thousands of meters (several thousand feet).

Table 3-123. General groundwater-quality and aquifer characteristics – Bonnie Claire alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics[a]	Depth to groundwater (meters)[b,c]	Estimated recoverable groundwater (acre-feet)[d]	Groundwater quality[e]
144 Lida Valley	Alluvial valley fill, rhyolite, volcanic sediments, (including tuffs of Stonewall Flat and tuffs of the Thirsty Canyon Group) and older rock units including claystone, siltstone, and, limestone	50 to 25	Upper 30.5 meters of alluvium: 1.5 million[f]	Total dissolved solids: 400 to 1,100 mg/L[g] Sulfate: 61 to 284 mg/L[g]
146 Sarcobatus Flat	Alluvial valley-fill deposits and some volcanic rocks[h] (Volcanic units are tuff of the Timber Mountain Group) [i]	24 to 40	Upper 30.5 meters of alluvium: 24,000[f]	Total dissolved solids: 540 mg/L[j]

a. Sources: DIRS 180887-Converse Consultants 2007, pp. 31 and 32.
b. Estimated depths to groundwater obtained from DIRS 180887-Converse Consultants 2007, Plate 4-1 and p. 32; DIRS 176600-Converse Consultants 2005, p. 41 and Plate 4-5. The listed range of depths generally applies to the area underlying the proposed Bonnie Claire alternative segments.
c. To convert meters to feet, multiply by 3.2808.
d. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
e. mg/L = milligrams per liter.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 182759-Converse Consultants 2007, p. 34.
h. Source: DIRS 176600-Converse Consultants 2006, p. 40.
i. Sources: DIRS 173842-Shannon & Wilson 2005, pp. 23 and 24, 29, 30, and 33 to 35 and Plate 2; DIRS 173179-Belcher 2004, Figure B-1.
j. Source: DIRS 176600-Converse Consultants 2006, p. 42.

Figure 3-195 shows DOE-proposed wells for supplying water to support construction of Bonnie Claire alternative segments. All proposed water wells would be within the nominal width of the construction right-of-way of the selected alternative segment. There are no potential quarry sites along Bonnie Claire alternative segments.

3.3.6.3.10 Common Segment 5 (Sarcobatus Flat Area)

Crossing from north to south, common segment 5 would overlie hydrographic area 146 (Sarcobatus Flat) and a small portion of hydrographic area 228 (Oasis Valley) (Figures 3-195and 3-196). Section 3.3.6.3.9 describes the groundwater-quality and aquifer characteristics of hydrographic area 146, which are summarized in Table 3-123. As described in Section 3.3.6.3.5, there are no documented pending underground annual duties in area 146. There are four NDWR wells with water rights, one NDWR domestic well, eight USGS NWIS wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5 within area 146.

The categories for the NDWR wells with water rights are irrigation, quasi-municipal, and stock-watering (see Table 3-114). Most wells in hydrographic area 146 are screened in alluvial valley fill; a few wells are screened in volcanic rocks on the west side of the basin (DIRS 176600-Converse Consultants 2005, pp. 41 and 42).

Section 3.3.6.3.11 describes the hydrogeologic characteristics of hydrographic area 228, including groundwater-quality and aquifer characteristics; Table 3-124 summarizes those characteristics. Committed groundwater resources in these areas exceed estimated perennial yields (see Table 3-113). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There are no NDWR wells with water rights, no USGS NWIS wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 5, as shown on Figures 3-195and 3-196 (DIRS 176600-Converse Consultants 2005, all; DIRS 176325-USGS 2006, all).

Table 3-124. General groundwater-quality characteristics – Oasis Valley alternative segments.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks, clastic rocks, older carbonate rocks, and alluvial valley fill[e]	10 to 30	Upper 30.5 meters of alluvium: 400,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g] Fluoride: 1 to more than 4 mg/L[h]

a. Estimated depth to groundwater obtained from DIRS 176600-Converse Consultants 2005, p. 38. The listed depth range generally applies to the area underlying the proposed Oasis Valley alternative rail alignments; depth to groundwater is much greater in the central and northern parts of hydrographic area 228 (DIRS 176600-Converse Consultants 2005, Plate 4-3).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the groundwater quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Sources: DIRS 176600-Converse Consultants 2005, p. 36; DIRS 181909-Fridrich et al. 2007.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Source: DIRS 172905-USGS 1995, Figure 70, with overlay of hydrographic area boundaries.
h. Source: DIRS 176600-Converse Consultants 2005, p. 38.

Common segment 5 would predominantly overlie alluvial valley fill, with depth to groundwater generally approximately 3 to 55 meters (10 to 180 feet) in those portions of hydrographic areas 146 and 228 the rail line would cross. Volcanic rocks are the predominant rock type comprising the hills surrounding the basin.

Figures 3-195 and 3-196 show DOE-proposed wells (see Section 4.3.6) for supplying water to support construction of common segment 5. All proposed water wells would be within the rail line construction right-of-way. There are no potential quarry sites along common segment 5.

3.3.6.3.11 Oasis Valley Alternative Segments

Oasis Valley alternative segments 1 and 3 would cross hydrographic area 228 (Oasis Valley) (Figure 3-196). This area is a designated groundwater basin with an estimated perennial yield in the range of 1.23 to 2.46 million cubic meters (1,000 to 2,000 acre-feet) (DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12) (see Table 3-113). Committed groundwater resources in hydrographic area 228 total 1.6 million cubic meters (1,300 acre-feet) per year (see Table 3-113). However, as previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 493 million cubic meters (400,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 228 (DIRS 180754-Rush et al. 1971, all). NDWR data indicate that there are no documented pending underground annual duties in area 228A (see Table 3-113).

Geologic units Oasis Valley alternative segments 1 and 3 would cross include sedimentary rocks, small areas underlain by volcanic rocks, and some alluvial valley fill (see Table 3-124). Depth to groundwater is generally 3 to 46 meters (10 to 150 feet), with the shallowest groundwater occurring along Oasis Valley alternative segment 1, northeast of Springdale (see Table 3-124).

Oasis Valley has several springs and seeps. The locations of these springs and seeps are dictated by structurally controlled changes in rock unit ***lithology*** and thickness and conduits. The springs, seeps, and shallow groundwater in the valley are maintained primarily by groundwater flow moving into the area through a regional volcanic rock aquifer system (DIRS 169384-Reiner et al. 2002, p. 8). Most groundwater flowing south-southeastward into Oasis Valley through the welded tuff aquifer is diverted upward along faults where it either forms springs or flows laterally out of Oasis Valley as underflow, indicating a regional groundwater inflow component to the flow at the springs. Springs and seeps occur where upward diversion coincides with areas where the potentiometric surface is above the ground surface (DIRS 169384-Reiner et al. 2002, pp. 9 and 10). Most historical groundwater resource development in this area has been from springs.

Available information indicates a non-welded confining tuff unit separates the alluvial aquifer from a regional welded tuff volcanic rock aquifer throughout much of Oasis Valley, and indicates the regional welded tuff aquifer has moderate fracture ***permeability***. Most groundwater flowing south-southeastward into Oasis Valley through the welded tuff aquifer is also diverted upward along faults where it either forms springs or flows laterally out of Oasis Valley as underflow, indicating a regional groundwater inflow component to the flow at the springs (DIRS 169384-Reiner et al. 2002, pp. 9 and 10).

Based on a review of the NDWR and USGS NWIS databases and other published information, Figure 3-196 identifies seven USGS NWIS wells, four springs, and one surface-water body within approximately 1.6 kilometers (1 mile) of the centerlines of the Oasis Valley alternative segments. As shown on the figure, there is a series of three springs (Upper Oasis Valley Ranch Springs) southwest of Oasis Valley alternative segment 1 (DIRS 177712-MO0607NHDPOINT.000). Colson Pond and Colson Pond Spring are also near Oasis Valley alternative segment 3 (Figure 3-196) (DIRS 177712-MO0607NHDPOINT.000; DIRS 177710-MO0607NHDWBDYD.000).

There are no existing NDWR wells with water rights and no NDWR domestic wells within 1.6 kilometers (1 mile) of the centerline of the Oasis Valley alternative segments. There is one cluster of three USGS-installed wells within approximately 0.64 kilometer (0.40 mile) of the centerline of Oasis Valley alternative segment 3 (wells ER-OV-01, ER-OV-06a, and ER-OV-06a2), and one USGS-installed well (ER-OV-02) within approximately 0.4 kilometer (0.25 mile) of Oasis Valley alternative segment 1 (DIRS 176600-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 169384-Reiner et al. 2002, Plate 2). The use category for these wells is monitoring. There are three additional shallow USGS-installed wells (the OVU-Dune Well, OVU-Middle ET Well, and the OVU-Lower ET Well), used for monitoring groundwater levels, within approximately 0.32 to 0.48 kilometer (0.2 to 0.3 mile) of Oasis Valley alternative segment 1 (DIRS 176600-Converse Consultants 2005, Plate 4-3 and Appendix A; DIRS 169384-Reiner et al. 2002, Plate 2). Figure 3-196 does not show all existing wells in hydrographic area 228 that lie within 1.6 kilometers of the centerlines of Oasis Valley alternative segments because some wells are at very nearly the same locations and cannot be shown at the scale used in the figure.

Groundwater in much of Oasis Valley exhibits elevated levels of fluoride, in excess of the 4 milligrams per liter Nevada drinking water standard level (see Table 3-124). Dissolved-solids concentrations in the alluvial valley fill are expected to be less than 500 milligrams per liter (approximately 500 parts per million) in the vicinity of the Oasis Valley alternative segments.

Figure 3-196 shows DOE-proposed wells for supplying water to support construction of the Oasis Valley alternative segments. In addition to a series of new wells proposed for installation within the construction right-of-way, DOE might install other wells at other locations outside the construction right-of-way, and use them either as principal water wells or in combination with other water wells installed within the construction right-of-way. These wells would be drilled in cases where either (1) groundwater resources within the construction right-of-way would not be adequate for meeting construction or operations needs, or (2) groundwater withdrawals would need to be spread out to reduce potential impacts on existing groundwater resources (see Section 4.3.6). Possible locations for wells in this category that could be used to obtain water for constructing the Oasis Valley alternative segments include the following (Figure 3-196):

- Up to two locations in the Oasis Valley groundwater basin, approximately 5.6 to 5.8 kilometers (3.5 to 3.6 miles) southwest of the centerline of common segment 6 (locations OV6 and OV8, or OV14 and OV16, depending on alternative segment). The target water source at this location would be alluvial valley fill (DIRS 176189-Converse Consultants 2006, Appendixes A and B, and Maps 14a and 14b).

- Locations in the southeastern part of Oasis Valley, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B, and Maps 14a and 14b).

Review of NDWR and USGS database data and other published information (DIRS 169384-Reiner et al. 2002, Plate 2) on existing wells and springs indicates the following:

- There are two existing NDWR wells with water rights, no NDWR domestic wells, and no USGS NWIS wells within 1.6 kilometers (1 mile) of locations OV6 and OV8, or OV14 and OV16; however, two springs (Ute Springs and Manley Springs) lie within approximately 1.3 to 1.4 kilometers (0.8 to 0.9 mile) east of locations OV6 and OV8, or OV14 and OV16.

- There are no known existing wells or springs within 1.6 kilometers of the proposed alternative well location at OV22/OV23.

3.3.6.3.12 Common Segment 6 (Yucca Mountain Approach)

From north to south, common segment 6 would cross a portion of hydrographic area 228 (Oasis Valley), all of hydrographic area 229 (Crater Flat), and a portion of hydrographic area 227A (Jackass Flats), as shown in Figure 3-196. Section 3.3.6.3.11 describes, and Table 3-125 summarizes groundwater-quality and aquifer characteristics of hydrographic area 228.

There are 14 USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-196 (DIRS 176600-Converse Consultants 2005, all; DIRS 176325-USGS 2006, all; DIRS 177294-MO0607USGSWNVD.000, all; DIRS 182898-NDWR Water Rights Data 2007, all; DIRS 176979-MO0605GISGNISN.000, all; DIRS 182759-Converse Consultants 2007, all; DIRS 177712-MO0607NHDPOINT.000, all). Figure 3-196 does not show all existing wells in hydrographic area 227A that lie within 1.6 kilometers of the centerline of common segment 6 because some wells, particularly in hydrographic area 227A, are at very nearly the same locations and cannot be shown at the scale used in this figure.

Geologic units that common segment 6 would cross include volcanic rocks and basin-fill alluvium (DIRS 173179-Belcher 2004, p. 28). Specific volcanic rock units the segment would cross include volcanic rocks of the Crater Flat and Paintbrush Groups (DIRS 173842-Shannon & Wilson 2005, Plate 2).

Table 3-125. General groundwater-quality and aquifer characteristics – common segment 6.

Hydrographic area number and name	Aquifer geologic characteristics	Depth to groundwater (meters)[a,b]	Estimated recoverable groundwater (acre-feet)[c]	Groundwater quality[d]
228 Oasis Valley	Volcanic rocks, clastic rocks, older carbonate rocks, and alluvial valley-fill deposits[e]	10 to 30	Upper 30.5 meters of alluvium: 400,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g] Fluoride: 1 to more than 4 mg/L[h]
229 Crater Flat	Volcanic rocks and alluvial valley fill[e]	180 to 370	Upper 30.5 meters of alluvium: 350,000[f]	Total dissolved solids: 270 mg/L[h]
227A Fortymile Canyon, Jackass Flats	Volcanic rocks and alluvial valley fill[e]	210 to 370	Upper 30.5 meters of alluvium: 740,000[f]	Total dissolved solids: Less than 500 to 1,000 mg/L[g]

a. Estimated depth to groundwater obtained from DIRS 176600-Converse Consultants 2005, p. 30, 31, 34, and 38. The listed depth range for hydrographic area 228 generally applies to the area underlying the rail alignment; depth to groundwater is much greater in the central and northern parts of hydrographic area 228 (DIRS 176600-Converse Consultants 2005, Plate 4-3). The listed depth range for hydrographic area 229 generally applies to the area underlying the rail alignment; depth to groundwater is less in the northwestern and southern parts of hydrographic area 229 (DIRS 176600-Converse Consultants 2005, Plate 4-2).
b. To convert meters to feet, multiply by 3.2808.
c. To convert acre-feet to cubic meters, multiply by 1233.49; unless otherwise specified, the ground water quality refers to the upper 30 meters of the saturated alluvial valley-fill material in the hydrographic area.
d. mg/L = milligrams per liter.
e. Sources: DIRS 176600-Converse Consultants 2005, p. 36; DIRS 181909-Fridrich et al. 2007.
f. Source: DIRS 180754-Rush et al. 1971, all.
g. Sources: DIRS 172905-USGS 1995, Figure 70; DIRS 177741-State of Nevada 2005, all, with overlay of hydrographic area boundaries.
h. Source: DIRS 176600-Converse Consultants 2005, pp. 35 and 38.

Hydrographic area 229, Crater Flat, is not a designated groundwater basin. Committed groundwater resources exceed the estimated perennial yield of about 271,000 cubic meters (220 acre-feet) (see Table 3-113). As previously noted, all committed resources within a hydrographic area might not be in use at the same time. There could be approximately 431 million cubic meters (350,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 229. In addition to existing groundwater wells in hydrographic area 229 that have water-rights appropriations, NDWR data indicate that approximately 101,000 cubic meters (82 acre-feet) of pending annual duties (see Table 3-113) exist in hydrographic area 229. The pending water-rights locations are not within
1.6 kilometers (1 mile) of the centerline of common segment 6.

Table 3-125 summarizes groundwater-quality and aquifer characteristics of hydrographic area 229. Groundwater is typically very deep in hydrographic area 229 beneath the rail alignment, generally 180 to 370 meters (600 to 1,200 feet) below ground. In the northwestern portion of hydrographic area 229 and west of the rail alignment, groundwater occurs within two aquifers and the estimated depth to groundwater varies from 55 to 200 meters (180 to 650 feet). There are three USGS NWIS wells, no NDWR wells with water rights, no domestic wells, and no springs in hydrographic area 229 within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6, as shown on Figure 3-196 (DIRS 176600-Converse Consultants 2005, all; DIRS 176325-USGS 2006, all; DIRS 177292-MO0607NDWRWELD.000; DIRS 177294-MO0607USGSWNVD.000; DIRS 182898-NDWR 2007, all; DIRS 176979-MO0605GISGNISN.000, all).

Hydrographic area 227A, Fortymile Canyon (Jackass Flats), is not a designated groundwater basin. Committed groundwater resources do not exceed the total perennial yield value of 1.09 million cubic meters (880 acre-feet) per year estimated for the entire hydrographic area (see Table 3-113). NDWR data indicate that there are no documented pending underground annual duties in hydrographic area 227A (see

Table 3-113) (DIRS 178726-State of Nevada 2006, all). The perennial yield estimate for the western two-thirds of hydrographic area 227A is assumed to be approximately 720,000 cubic meters (580 acre-feet) per year, while the perennial yield estimate for the eastern one-third of this hydrographic area has been estimated at approximately 370,000 cubic meters (300 acre-feet) per year. There could be approximately 910 million cubic meters (740,000 acre-feet) of recoverable groundwater in the upper 30.5 meters (100 feet) of saturated aquifer materials within area 227A.

Table 3-125 summarizes groundwater-quality and aquifer characteristics of hydrographic area 227A. In hydrographic area 227A, groundwater occurs in alluvial valley-fill deposits in the southern portion of the area and deeper in volcanic rocks in the central part of the basin. The depths to groundwater in wells throughout the area vary from approximately 12 to 650 meters (38 to 2,150 feet) (DIRS 176600-Converse Consultants 2006, p.31). Most groundwater storage in hydrographic area 227A occurs toward the southern end of the basin, south of the rail alignment. Groundwater is typically very deep near the rail alignment, generally 210 to 370 meters (700 to 1,200 feet) below ground.

Most wells penetrating the volcanic rocks are monitoring wells used for monitoring groundwater conditions southwest, southeast, and south of the Yucca Mountain Site. There are 8 USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs in area 227A within 1.6 kilometers (1 mile) of the centerline of common segment 6 (Figure 3-196). The volcanic rocks in this area generally have low porosity, and are not considered suitable for groundwater production except in major fractured areas.

Figure 3-196 shows DOE-proposed wells for supplying water to support construction of common segment 6. All proposed water wells would be within the rail alignment construction right-of-way. There are no potential quarry sites along common segment 6.

3.3.7 BIOLOGICAL RESOURCES

This section describes the biological resources that could be affected by construction and operation of the proposed railroad along the Mina rail alignment.

Biological resources include vegetation, wildlife, special status species, game species, and wild horses and burros within or near the construction right-of-way described in Section 3.3.7.1. This discussion of biological resources is based on the results of a review of available data from federal, State of Nevada, local agencies, and data gathered during field investigations.

Special Status Species

Endangered species are classified under the Endangered Species Act as being in danger of extinction throughout all or a significant part of their range.

Threatened species are classified under the Endangered Species Act as likely to become endangered species in the foreseeable future.

Proposed species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats and that are the subject of a Fish and Wildlife Service *Federal Register* rulemaking notice to list them as endangered or threatened.

Candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information to support a proposal to list as endangered or threatened, but development of a listing regulation is precluded by other higher priority listing activities.

Endangered Species Act candidate species are plants and animals for which the U.S. Fish and Wildlife Service has sufficient information on their biological status and threats to propose them as endangered or threatened under the Endangered Species Act.

State protected plant and animal species. Wildlife species or subspecies are classified as protected under Nevada Administrative Code (NAC) Chapter 503 if one or more of the following criteria exists:

1. The wildlife is found only in the State of Nevada and its population, distribution, or habitat is limited.
2. The limited population or distribution within Nevada is likely to decline.
3. The population is threatened as a result of the deterioration or loss of its habitat.
4. The wildlife has ecological, scientific, educational, or other value that justifies its classification as protected.
5. The available data is not adequate to determine the exact status of the wildlife population, but does indicate a limited population, distribution, or habitat.
6. The wildlife is listed by the U.S. Fish and Wildlife Service as a candidate species, or it is classified as threatened or endangered in the federal Endangered Species Act.
7. Other evidence exists to justify classifying the wildlife as protected.

Under NAC Chapter 527, plants are classified as being in danger of extinction if their survival requires assistance because of overexploitation, disease, or other factors or because its habitat is threatened with destruction, drastic modification, or severe curtailment. There are no State of Nevada-listed endangered plants present in the areas of assessment.

BLM-designated sensitive species are species other than federally listed, proposed, or candidate species, and may include such native species as those that:

1. Could become endangered in or extirpated from a state or within a significant portion of their distribution in the foreseeable future;
2. Are undergoing a status review by the U.S. Fish and Wildlife Service to determine whether to list the species as a threatened or endangered species across all or a significant portion of its range under the Endangered Species Act;
3. Are undergoing significant current or predicted downward trends in habitat capability that would reduce their existing distribution;
4. Are undergoing significant current or predicted downward trends in population or density such that federally listed, proposed, candidate, or state listed status might become necessary;
5. Have typically small and widely dispersed populations;
6. Are inhabiting ecological refugia or specialized or unique habitats; or
7. Are state listed but might be better conserved through application of BLM sensitive species status. Such species should be managed to the level of protection required by State laws or under the BLM policy for candidate species, whichever would provide better opportunity for their conservation.

Section 3.3.7.2 provides a general overview of biological resources, including vegetation, wildlife, special status species, game species, and wild horses and burros along the Mina rail alignment. Section 3.3.7.3 describes biological resources unique to each Mina rail alignment alternative segment and common segment. Appendix H, Biological Resources, provides additional information regarding biological resources along the Mina rail alignment.

3.3.7.1 Areas of Assessment

DOE used two areas of assessment to describe the affected environment for biological resources: the greater study area and the construction right-of-way area.

3.3.7.1.1 Construction Right-of-Way

The rail line construction right-of-way would be a nominal width of 300 meters (1,000 feet), which is 150 meters (500 feet) on either side of the rail alignment centerline. The footprint, which would be within the construction right-of-way, is the area that would involve clearing of vegetation, excavation, and filling for subgrade to support the rail line. This area would be directly affected, long term, by rail line construction activities. The footprint would fluctuate throughout the alignment due to topography, cut and fill requirements, land use, and the selected alternative segment. The footprint could also vary based on land use and avoidance or minimization of impacts to other resources (for example, water and structures) but generally would be 300 meters or less. The area between the footprint and the outer edge of the construction right-of-way would be directly affected, short term, by construction-related activities such as construction staging and temporary access roads construction. DOE analyzed the area between the footprint and the outer edge of the construction right-of-way for ***short-term impacts*** even though the use of this area would be minimized and the area might not be disturbed. For purposes of this analysis, DOE has taken a conservative approach of potentially overstating the environmental impacts to biological resources. For facilities that would be outside the nominal width of the rail line construction right-of-way (such as quarries and other ***infrastructure***), the area DOE assessed as the affected environment is the maximum area or the footprint of the proposed facility.

3.3.7.1.2 Study Area

DOE identified a study area (16 kilometers [10 miles] wide, extending 8 kilometers [5 miles] on either side of the centerline of the rail alignment) for use in database and literature searches to ensure the identification of sensitive habitat areas near the Mina rail alignment and transient or migratory wildlife, particularly special status species, that could pass through the construction right-of-way. Using the larger study area also increased the chance of identifying special status species and/or habitat that could be present near the rail alignment, to better describe the habitat value and species use within the construction right-of-way.

3.3.7.2 General Environmental Setting and Characteristics

This section describes the affected environment for biological resources that could be present or have the potential to occur within the construction right-of-way or the study area. DOE used the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), which the BLM currently uses in its conservation and management actions, to characterize the land-cover types for the affected environment for the Mina rail alignment.

As a starting point for classification, the 2004 Southwest Regional Gap Analysis Project divided the southwestern United States into general ***ecoregions*** (relatively discrete sets of ecosystems characterized by certain plant communities or assemblages) based on physical and biological similarities. Using satellite imagery and field data, the Project classified geographic areas or "mapping zones" within each ecoregion based on their land-cover types, and generated maps of these land-cover types. The Project classified naturally vegetated types using the "ecological systems" and developed and described types based on dominant vegetation, physical characteristics of the land, hydrology, and climate in the area (DIRS 176369-Lowry et al. 2005, all; DIRS 173051-Comer et al. 2003, all). These mapping zones represent recurring groups of biological communities that are found in similar physical environments and are influenced by similar dynamic ecological processes, such as fire or flooding. As shown in Figure 3-197, the Mina rail alignment would cross three mapping zones: the Humboldt, the Nellis, and the Mojave. However, only the Nellis and Mojave mapping zones are considered in the analysis because the segment that crosses the Humboldt is an existing Union Pacific Railroad rail line and there would be no construction-related impacts. The land-cover types are grouped into land-cover classes. Eleven land-cover classes occur in this part of Nevada. To identify the land-cover types and classes within the construction right-of-way and the study area, digital maps of the land-cover types within the affected map zones were overlain (spatial analysis using a Geographic Information System) with the Mina rail alignment construction right-of-way and operations facilities. The Mina rail alignment construction right-of-way would cross 9 of the 11 classes (DIRS 174324-NatureServe 2004, all). Table 3-126 lists classes and types, and Figures 3-198 through 3-204 show the classes the rail alignment would cross.

To document additional site-specific information regarding vegetation and habitat, DOE performed literature and database searches, and consulted with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, the Nevada Department of Wildlife, the University of Nevada–Reno, and the Nevada Division of Forestry.

In addition to the review of existing information, DOE conducted field surveys and gathered data to further characterize the mapping zones and associated vegetation communities, and to further characterize the habitats in the study area that might support special status species. DOE chose field survey locations to provide representative survey coverage of the different types of vegetation along the Mina rail alignment, specifically in the construction right-of-way, but also in the larger study area. The field survey data that was collected helped further characterize the types of habitats in the construction right-of-way and identified by the Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Appendix H describes the field survey methodology. The additional surveys and data searches are outlined in each specific resource area below.

3.3.7.2.1 Vegetation

The Mina rail alignment is situated within two large deserts: the Great Basin and the Mojave. The Great Basin Desert is considered a cold desert and has been referred to as the Basin and Range region due to its parallel north-south trending ranges, or mountains, and intervening basins, or valleys. This region covers most of central and northern Nevada, with its southern extent ending roughly in southern Lincoln, Esmeralda, and Nye Counties. The Mojave Desert is considered a hot desert and covers most of southern Nevada and much of southeastern California (DIRS 174412-Ryser 1985, p. 4). Although the two deserts are distinguished from one another climatically, the predominant vegetation and vegetation communities also distinguish each desert.

The Great Basin Desert is generally characterized by big sagebrush (*Artemisia tridentata*), which is mostly absent from the Mojave Desert except at moderate to high elevations in the mountains. Alternatively, the Mojave Desert is dominated by creosote bush (*Larrea tridentata* var. *arenaria*), which is mostly absent from the Great Basin Desert. There is a broad transitional zone where these two deserts meet, which exhibits characteristics of both regions.

Based on the spatial analysis described above, the Mina rail alignment would intersect 25 land-cover types, which are listed in Table 3-126 and shown in Figures 3-203 through 3-204. The most common

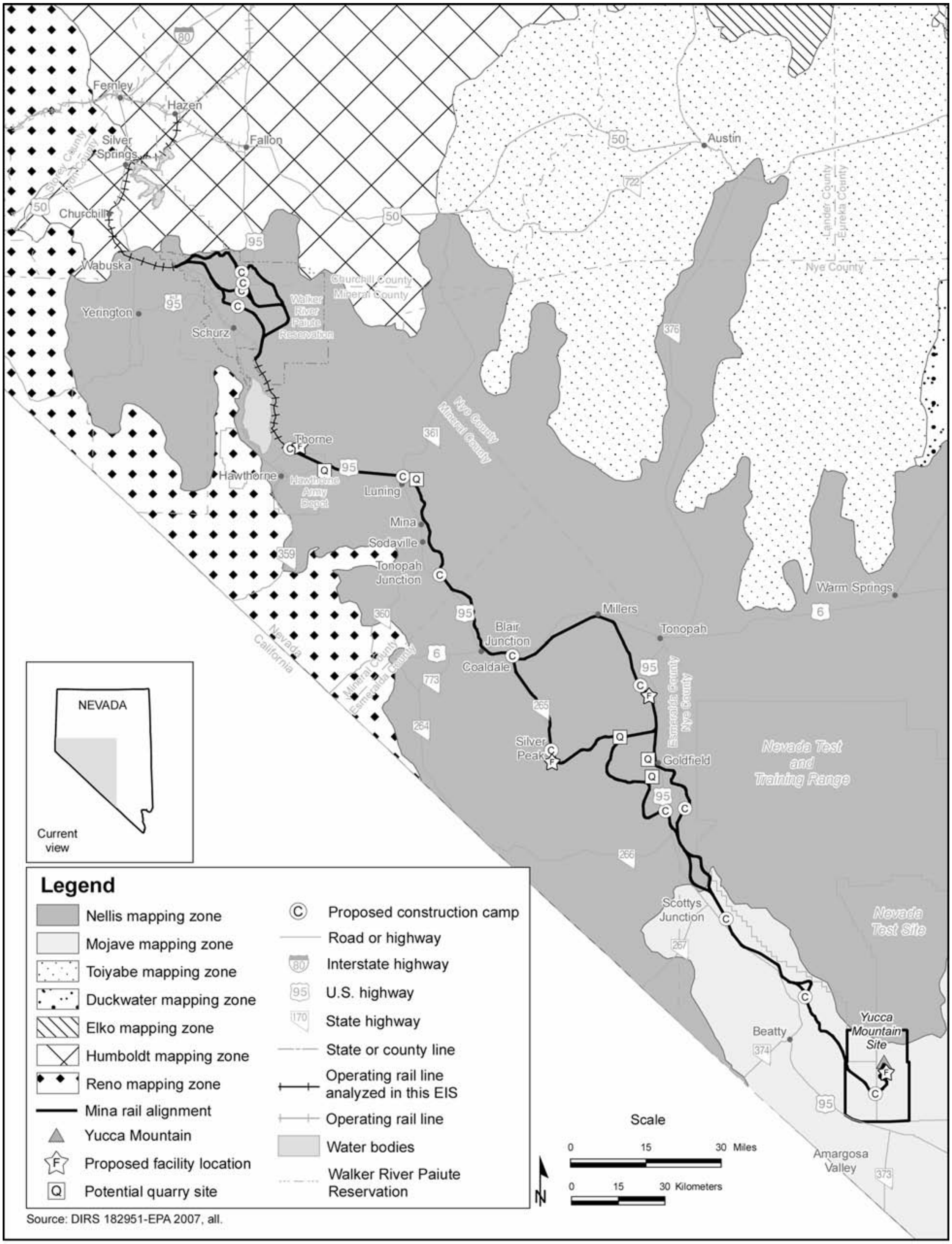


Figure 3-197. Mapping zones along the Mina rail alignment.

Table 3-126. Land-cover classes and types in the mapping zones.[a]

Class and type[b]	Total amount of classes and land-cover types within the Mojave and Nellis mapping zones (square kilometers)[c]
Barren Lands	
Inter-Mountain Basins Playa	1,115
Inter-Mountain Basins Cliff and Canyon	394
North American Warm Desert Playa	524
North American Warm Desert Bedrock Cliff and Outcrop	525
Inter-Mountain Basins Active and Stabilized Dune	29
Evergreen Forest	
Great Basin Pinyon-Juniper Woodland	4,966
Scrub/Shrub	
Inter-Mountain Basins Mixed Salt Desert Scrub	25,547
Inter-Mountain Basins Big Sagebrush Shrubland	8,013
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	19,415
Great Basin Xeric Mixed Sagebrush Shrubland	6,328
Mojave Mid-Elevation Mixed Desert Scrub	10,030
Sonora-Mojave Mixed Salt Desert Scrub	2,976
Grassland/Herbaceous	
Inter-Mountain Basins Semi-Desert Shrub Steppe	4,768
Inter-Mountain Basins Semi-Desert Grassland	75
Woody Wetland	
Inter-Mountain Basins Greasewood Flat	1,409
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	77
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	28
Emergent Herbaceous Wetland	
North American Arid West Emergent Marsh	32
Altered or Disturbed	
Invasive Annual Grassland	48
Invasive Annual and Biennial Forbland	29
Developed and Agriculture	
Developed, Open Space - Low Intensity	430
Developed, Medium - High Intensity	84
Other	
Barren Lands, Non-specific	30

a. Source: DIRS 174324-NatureServe, all.
b. Mojave and Nellis ecoregions are included in totals. Humboldt ecoregion was excluded because construction-related impacts would not occur there.
c. To convert square kilometers to acres, multiply by 247.10.

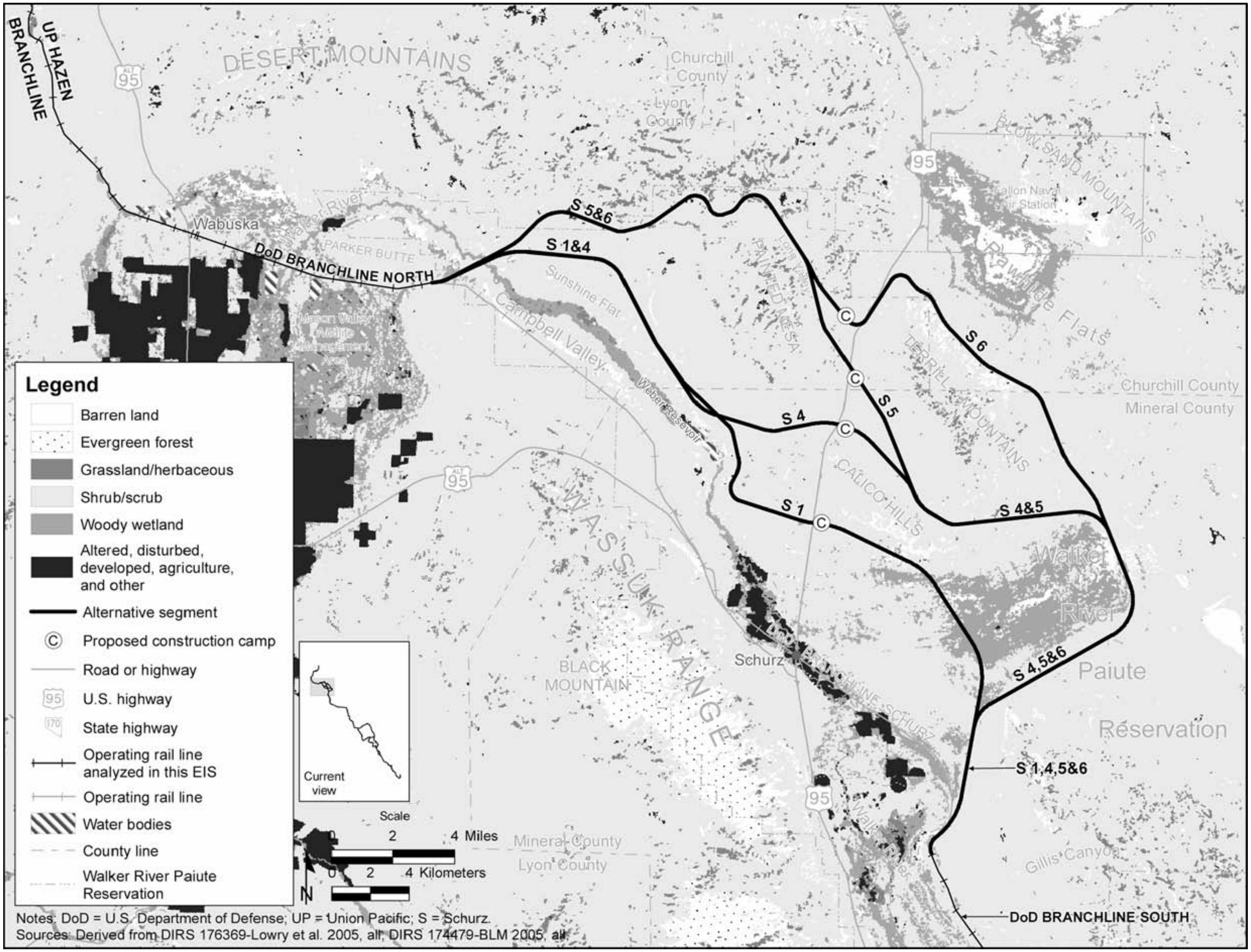


Figure 3-198. Land-cover classes the Mina rail alignment would cross within map area 1.

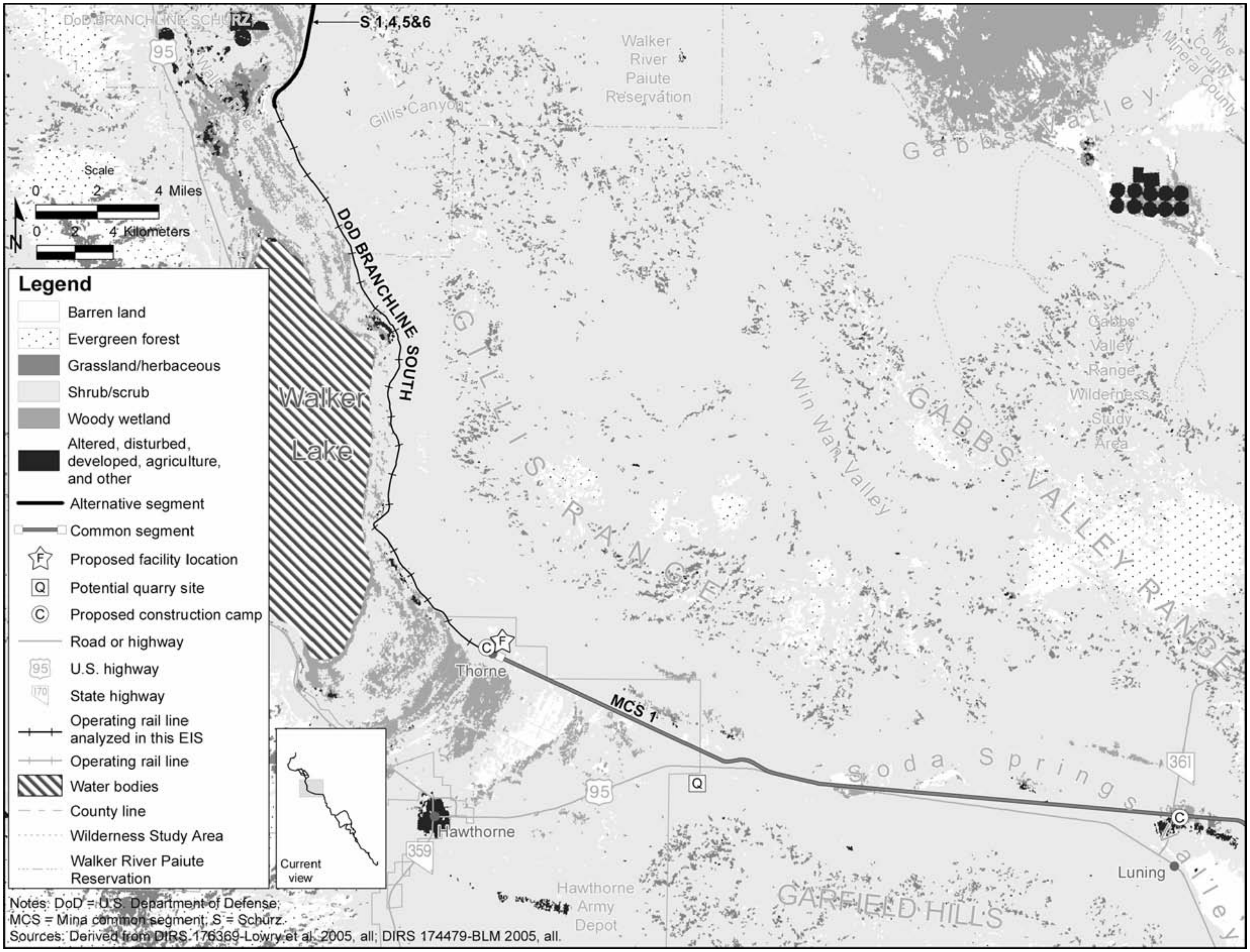


Figure 3-199. Land-cover classes the Mina rail alignment would cross within map area 2.

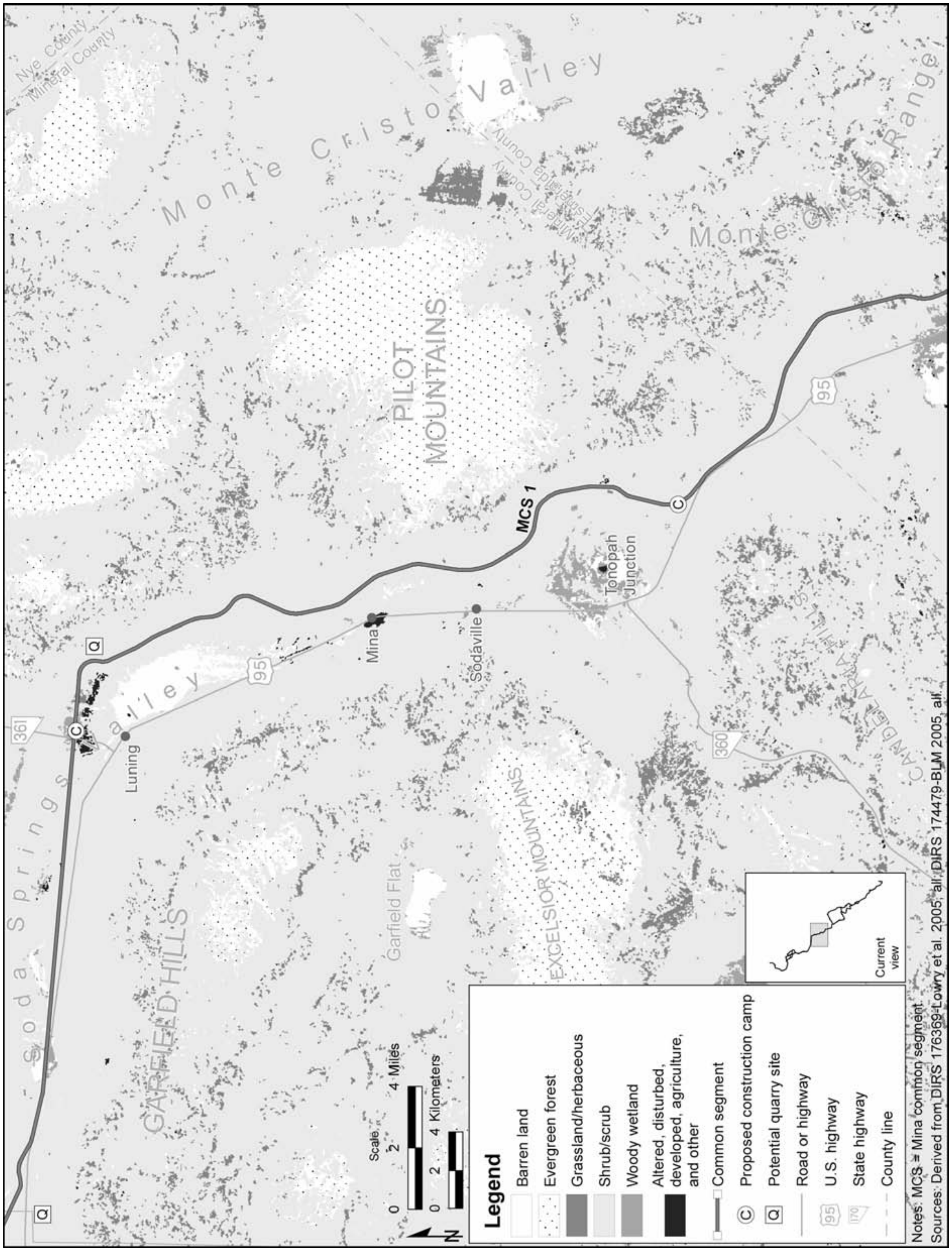


Figure 3-200. Land-cover classes the Mina rail alignment would cross within map area 3.

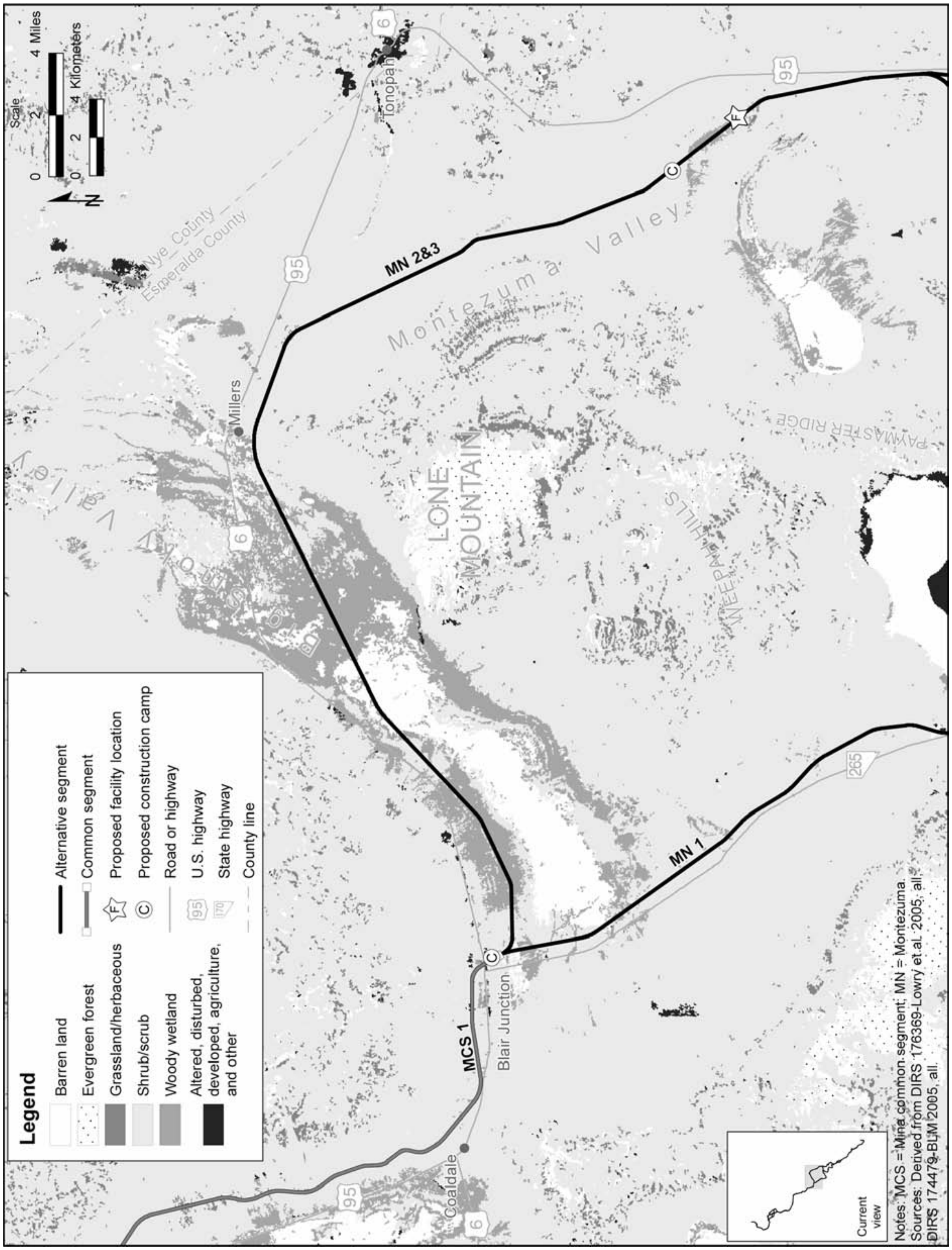


Figure 3-201. Land-cover classes the Mina rail alignment would cross within map area 4.

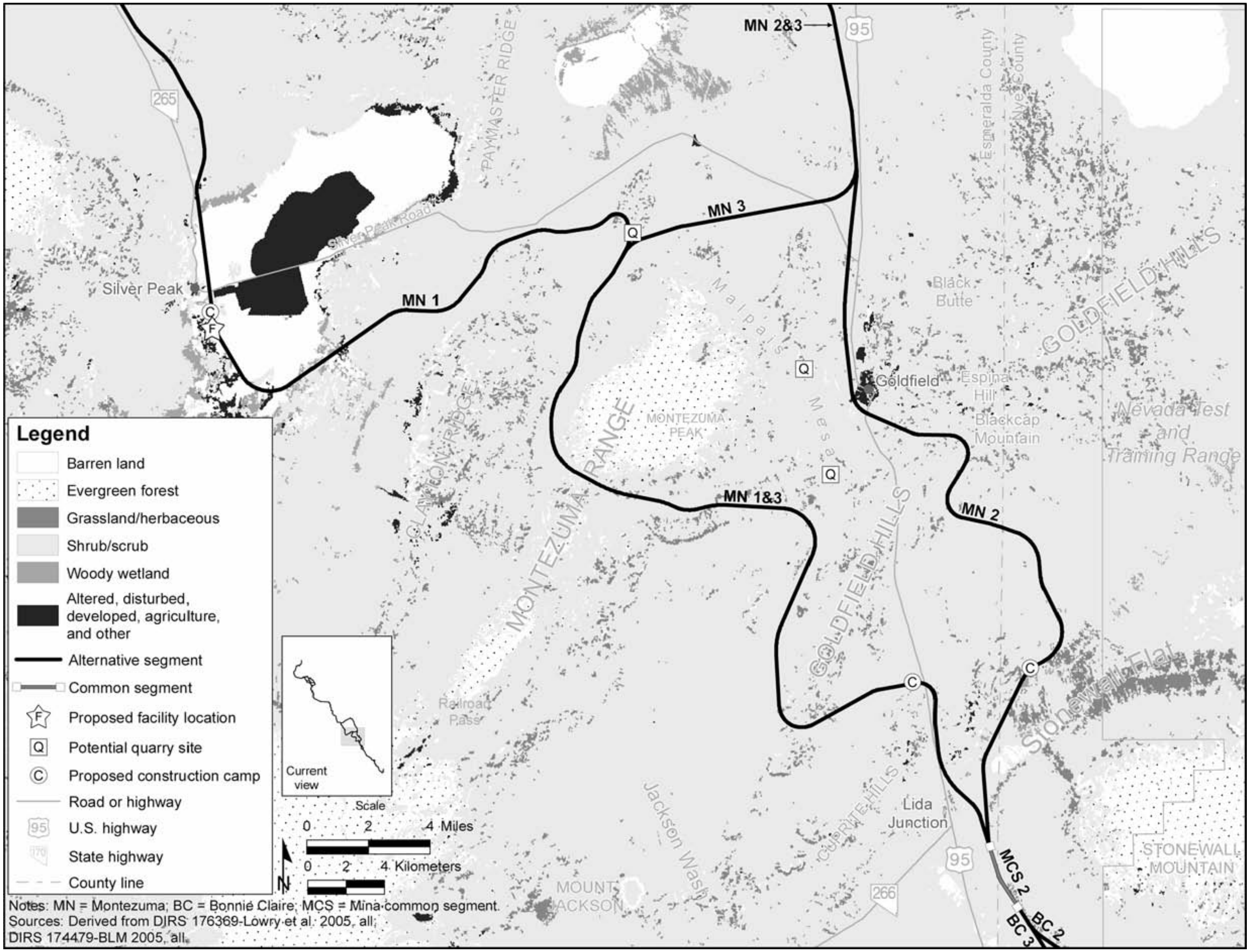


Figure 3-202. Land-cover classes the Mina rail alignment would cross within map area 5.

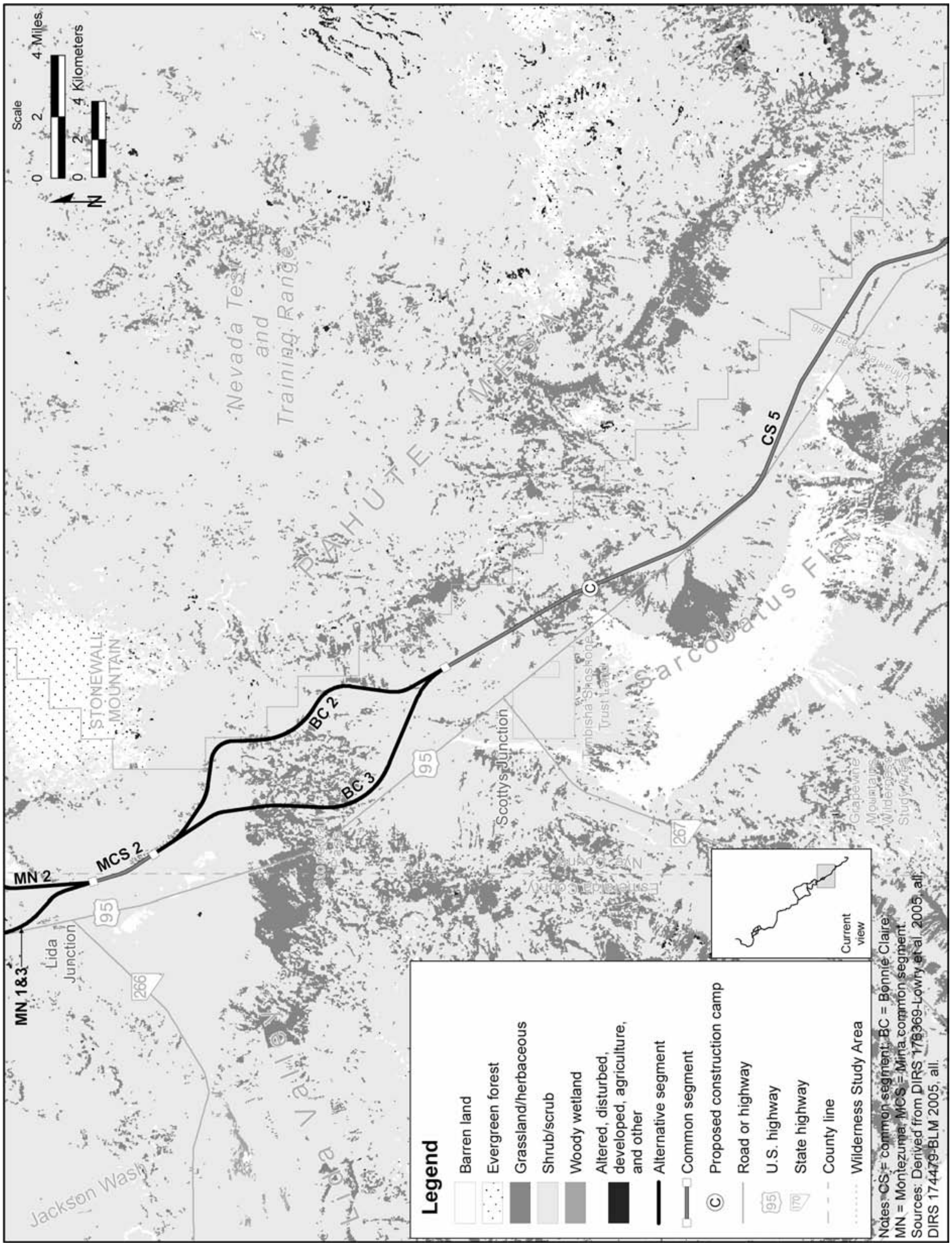


Figure 3-203. Land-cover classes the Mina rail alignment would cross within map area 6.

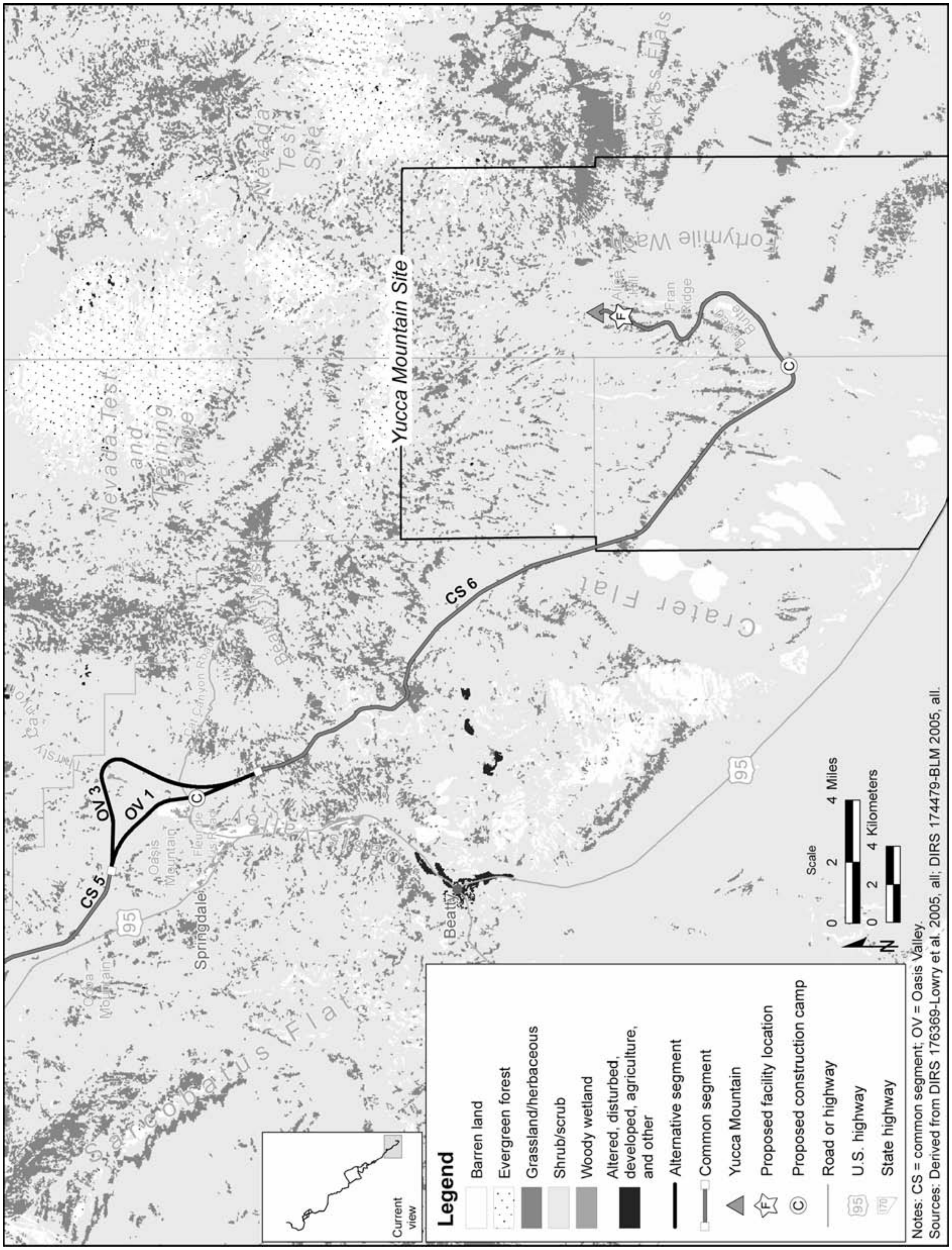


Figure 3-204. Land-cover classes the Mina rail alignment would cross within map area 7.

land-cover types within the construction right-of-way and study area are the Inter-Mountain Basins Mixed Salt Desert Scrub and the Inter-Mountain Basins Big Sagebrush Shrubland.

Appendix H, Table H-1, describes land-cover types.

Undisturbed areas of winterfat, or whitesage (*Krascheninnikovia lanata*), are present, but uncommon, within the construction right-of-way. While they have no official protected status with any federal or state agency, the BLM has identified these vegetation communities as important and their conservation or protection should be considered during development of any projects.

In addition to shrubs and grasses, biological soil crusts are an important component to both the Mojave and Great Basin ecosystems. Biological crusts are comprised of multiple species of lichen, moss, cyanobacteria and algae which live on top of the soil surface, binding with soil particles and forming a cohesive mat or crust on the surface of arid landscapes (DIRS 181866-Belnap 2006, p. 1). Biological crusts (if present) could play an important role in maintaining the health of some of the desert vegetation communities listed in Table 3-6, including but not limited to facilitating water infiltration, retaining soil moisture, and reducing soil loss from wind and water erosion (DIRS 181957-Kaltenecker and Wicklow-Howard 1994, p. 1-8). Crusts are highly sensitive to surface disturbance and are easily destroyed. Biological crusts likely occur within the region of influence in some areas where there has been no surface disturbance. Biological crusts are potentially present in areas where construction would occur, but because of insufficient data regarding the location and extent of biological crusts in the region of influence, Section 4.3.7 does not discuss impacts to biological crusts.

Nonnative plant species: A species found in an area where it has not historically been found.

Native plant species: With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13112, *Invasive Species*).

Invasive plant species: An alien species whose introduction does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112, *Invasive Species*).

Noxious weeds: The BLM defines noxious weeds as: "A plant that interferes with management objectives for a given area of land at a given point in time." (DIRS 177037-BLM 1996, p. 3) The State of Nevada defines noxious weeds as: "Any species of plant which is, or liable to be, detrimental or destructive and difficult to control or eradicate..." (Nevada Revised Statute 555.005).

Weeds can be native or nonnative, invasive or non-invasive, and noxious or not noxious. Invasive species include not only noxious weeds, but also other non-native plants. The BLM considers plants invasive if they have been introduced into an environment where they did not evolve. As a result, invasive species usually have no natural enemies to limit their spread and can produce significant detrimental changes.

3.3.7.2.1.1 Noxious Weeds and Invasive Species. The Great Basin-Mojave Desert region is threatened by a number of ***nonnative,*** invasive plant species that have displaced ***native plant species***. Invasive plant species, such as red brome *(Bromus rubens)*, tamarisk *(Tamarix ramosissima)*, and cheatgrass *(Bromus tectorum)*, have the ability to out-compete individual species of native range plants, which results in extensive monocultures of the introduced species. ***Invasive species*** usually have little to no nutritional value for livestock and wildlife; some invasive species are toxic or physically injurious to animals, can increase the frequency of wildfires, and degrade wildlife habitat by reducing the diversity of native vegetation (DIRS 155925-Nevada Weed Action Committee 2000, p. 5).

Some plant species are considered ***noxious weeds***, an official designation used by federal and state authorities to identify species with a high likelihood of being very destructive or difficult to control or eradicate. Chapter 555.010 of the Nevada Administrative Code lists species designated as noxious. Chapter 555 of the Nevada Revised Statutes directs that designated noxious weeds are to be controlled on both public and private land, and provides for enforcement measures should the landowner or occupier fail to take corrective action. While many noxious species are invasive, invasiveness is not required for a species to be designated noxious. Some species managed as noxious weeds are not considered truly invasive because they cannot effectively out-compete healthy communities of native vegetation.

3.3.7.2.1.2 Wetlands and Riparian Habitats. Riparian habitats are transition areas from wetland or stream habitat to upland habitat. Wetlands are areas that are saturated by water for a sufficient amount of time to support vegetation that is adapted to saturated soil conditions. While wetland and riparian habitats in Nevada cover a very small percentage of the total area of the state, they support a comparatively high number and large diversity of species, many of which are locally ***endemic***. Wetland and riparian habitats have been reduced in the region over the years due in part to water removal, drought, and the presence of invasive species, such as tamarisk (DIRS 174518-BLM 2005, p. 3.5-9). Appendix F contains information on wetlands within the project area and Sections 3.3.5 and 4.3.5 discuss impacts in relation to Section 404 of the Clean Water Act and wetland fill permitting. This section discusses wetlands and riparian habitats that support terrestrial and aquatic species.

To maintain consistency within this section, DOE assessed the amount and type of wetland and riparian habitat utilizing the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all). Section 3.3.5, Surface Water Resources, utilizes National Wetlands Inventory maps (DIRS 176976-NWI 2006, all) and the results of the wetland delineations conducted during the field surveys in 2007 (DIRS 180889-PBS&J 2007, all) and 2006 (DIRS 180889 PBS&J 2007, pp. 11 and 12) to calculate the area of the wetlands. Therefore, the area totals differ between Sections 3.3.5 and 3.3.7 because Section 3.3.7 analyzes wetland and riparian habitat and Section 3.3.5 analyzes only the wetland areas.

According to the Southwest Regional Gap Analysis Project, there are three types of wetland or riparian land-cover types along the Mina rail alignment and at locations of the proposed rail line construction and operations support facilities: North American Warm Desert Lower Montane Riparian Woodland and Shrubland; Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland; and North American Arid West Emergent Marsh (Figures 3-205 to 3-211) and (see Table 3-126).

The North American Warm Desert Lower Montane Riparian Woodland and Shrubland is found along perennial and seasonally intermittent streams. Generally located in middle to low elevations and found in canyons and valleys, vegetation in this land-cover type depends on seasonal flooding and removal of sediment that occurs during these flood events. The vegetation is a mix of tree and shrub species including Fremont cottonwood (*Populus fremontii*) and willows, including sandbar willow (*Salix exigua*) and seep willows (*Baccharis salicifolia*) (DIRS 174324-NatureServe 2004 pp. 140 to 142).

The Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland land cover occurs in the mountains of the Great Basin from middle to high elevations. This habitat requires flooding, and the scouring and subsequent deposition of soils that occurs during flood events, for maintenance and germination of vegetation. Vegetation typically associated with this type of riparian habitat includes Fremont cottonwood, willows, rushes (*Juncus* spp.), and sedges (*Carex* spp.) (DIRS 174324-NatureServe 2004, pp. 149 and 150).

The North American Arid West Emergent Marsh land-cover type occurs throughout the arid regions of the western United States. This land cover occurs along slow-moving streams, has soils that are able to accumulate organic material, and contains vegetation that is adapted to frequently or continually saturated soil conditions. Vegetation commonly found in marsh areas includes bulrushes (*Scirpus* spp.), cattails (*Typha* spp.), and rushes (DIRS 174324-NatureServe 2004, pp. 154 to 156).

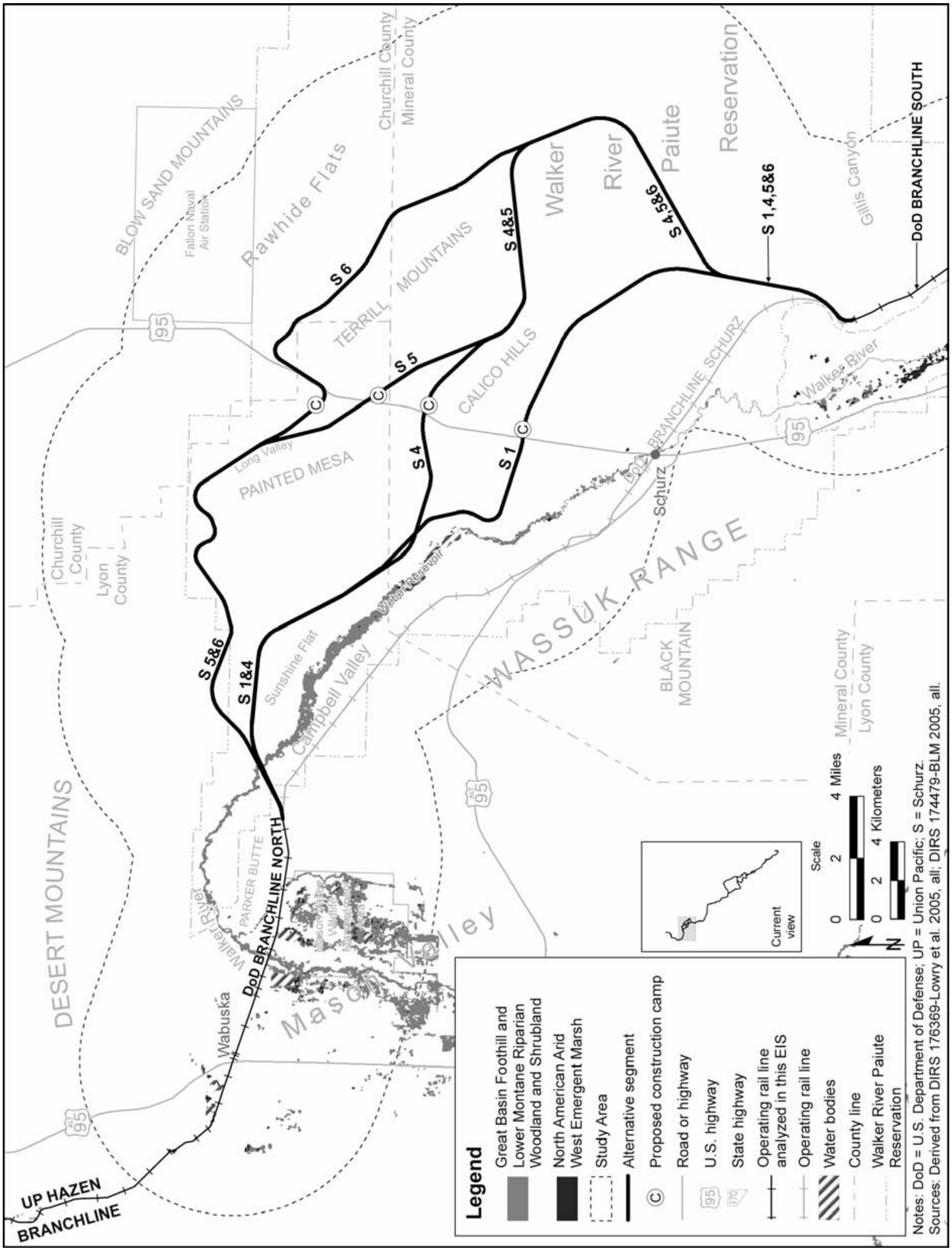


Figure 3-205. Wetland/riparian habitat the Mina rail alignment would cross in map area 1.

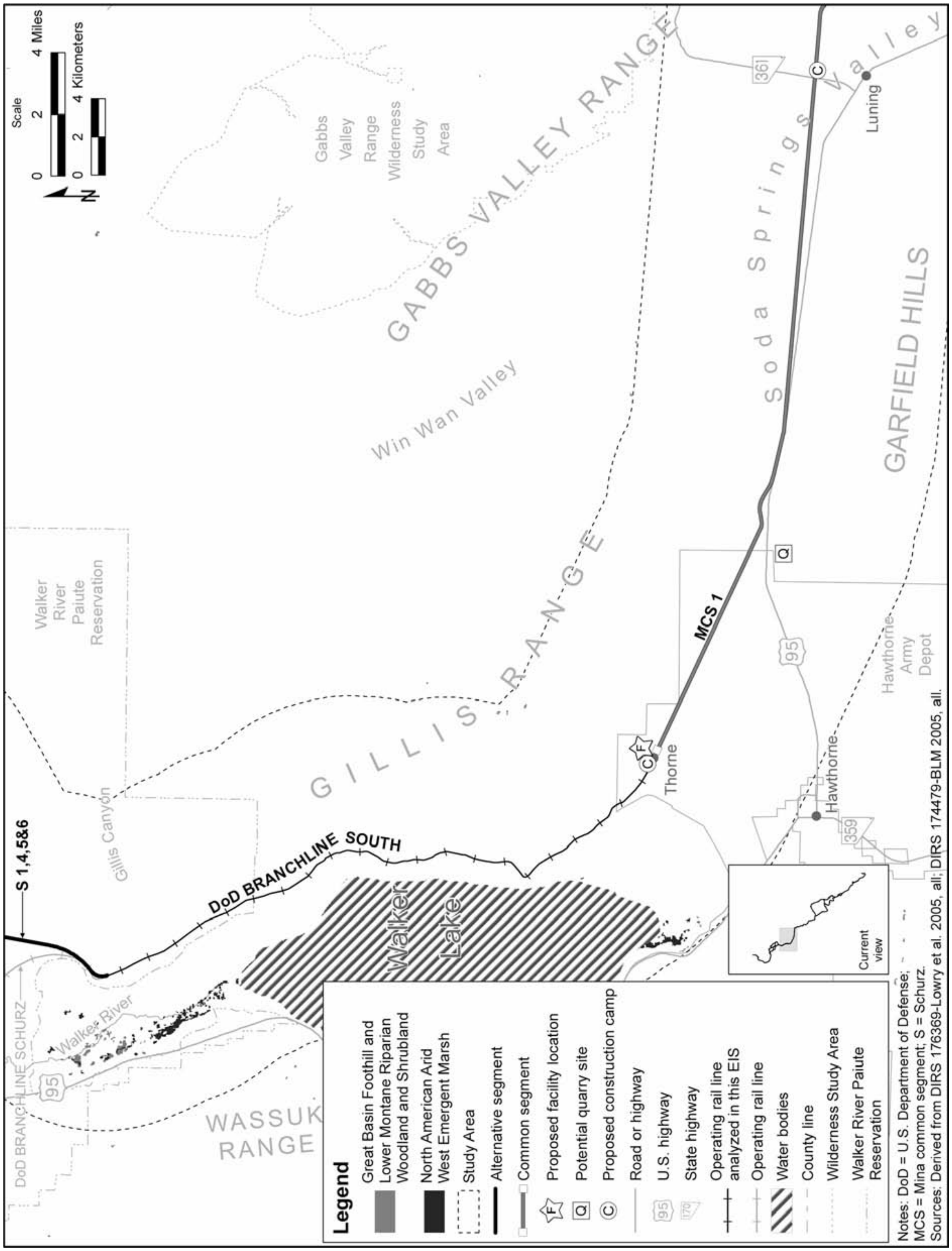


Figure 3-206. Wetland/riparian habitat the Mina rail alignment would cross in map area 2.

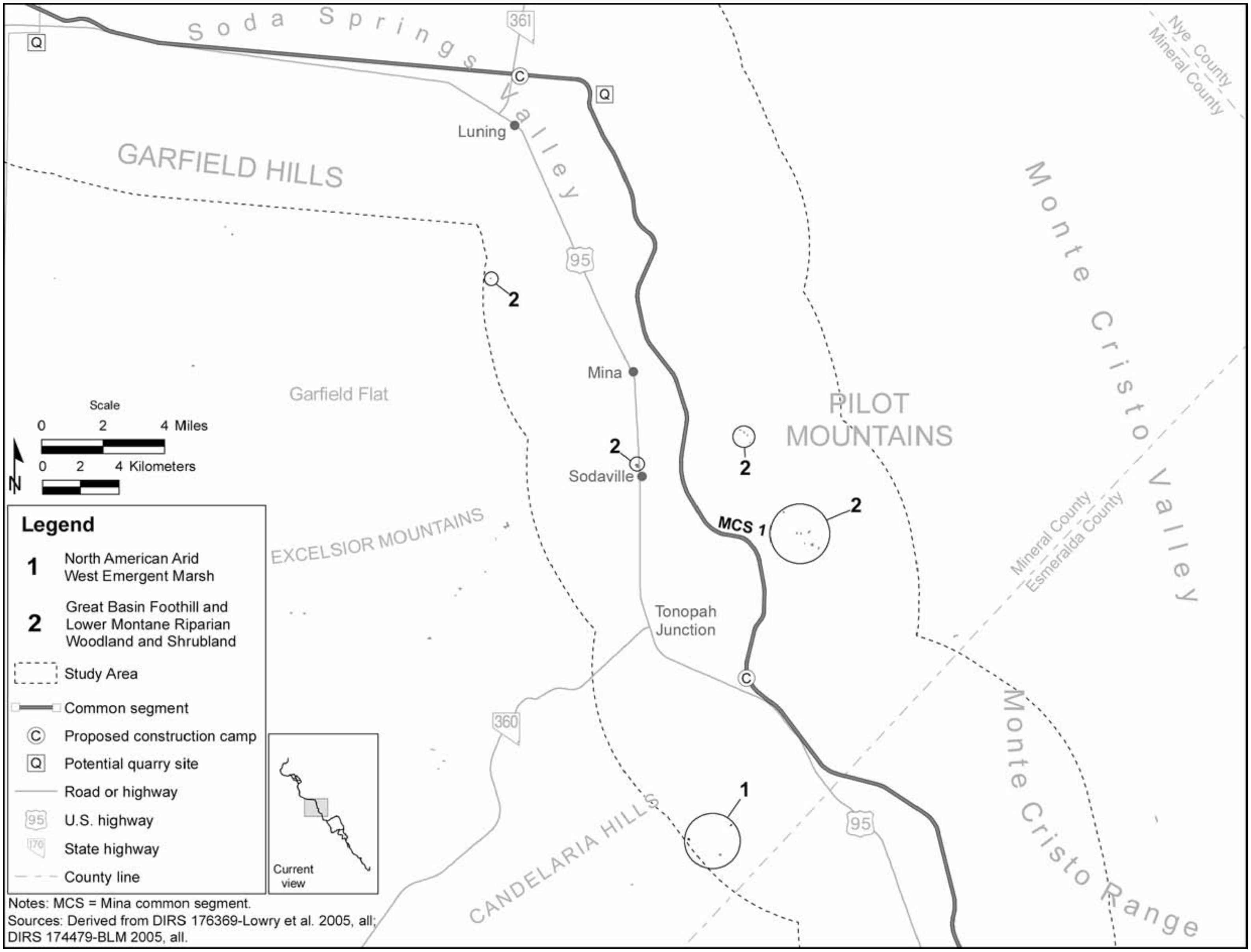


Figure 3-207. Wetland/riparian habitat the Mina rail alignment would cross in map area 3.

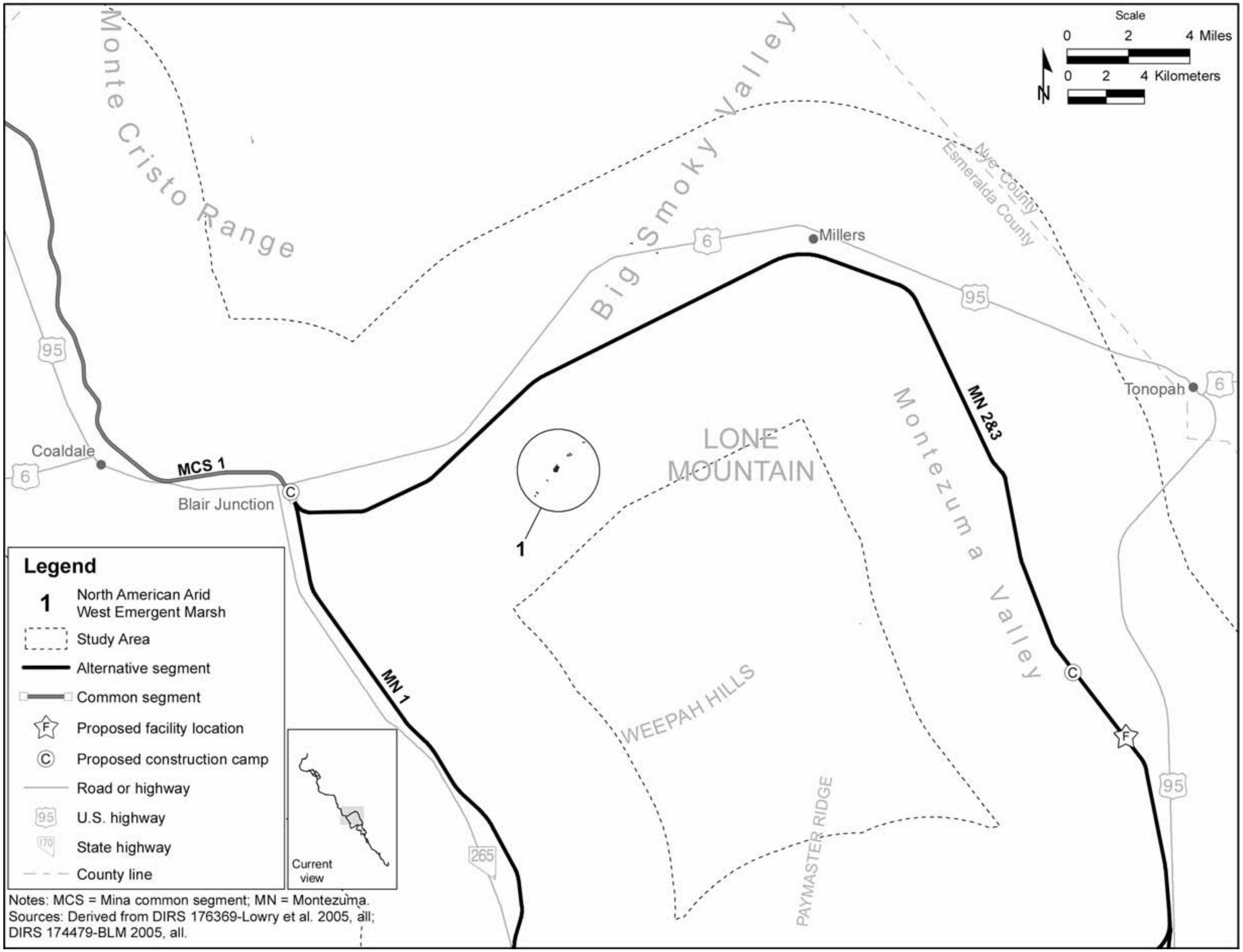


Figure 3-208. Wetland/riparian habitat the Mina rail alignment would cross in map area 4.

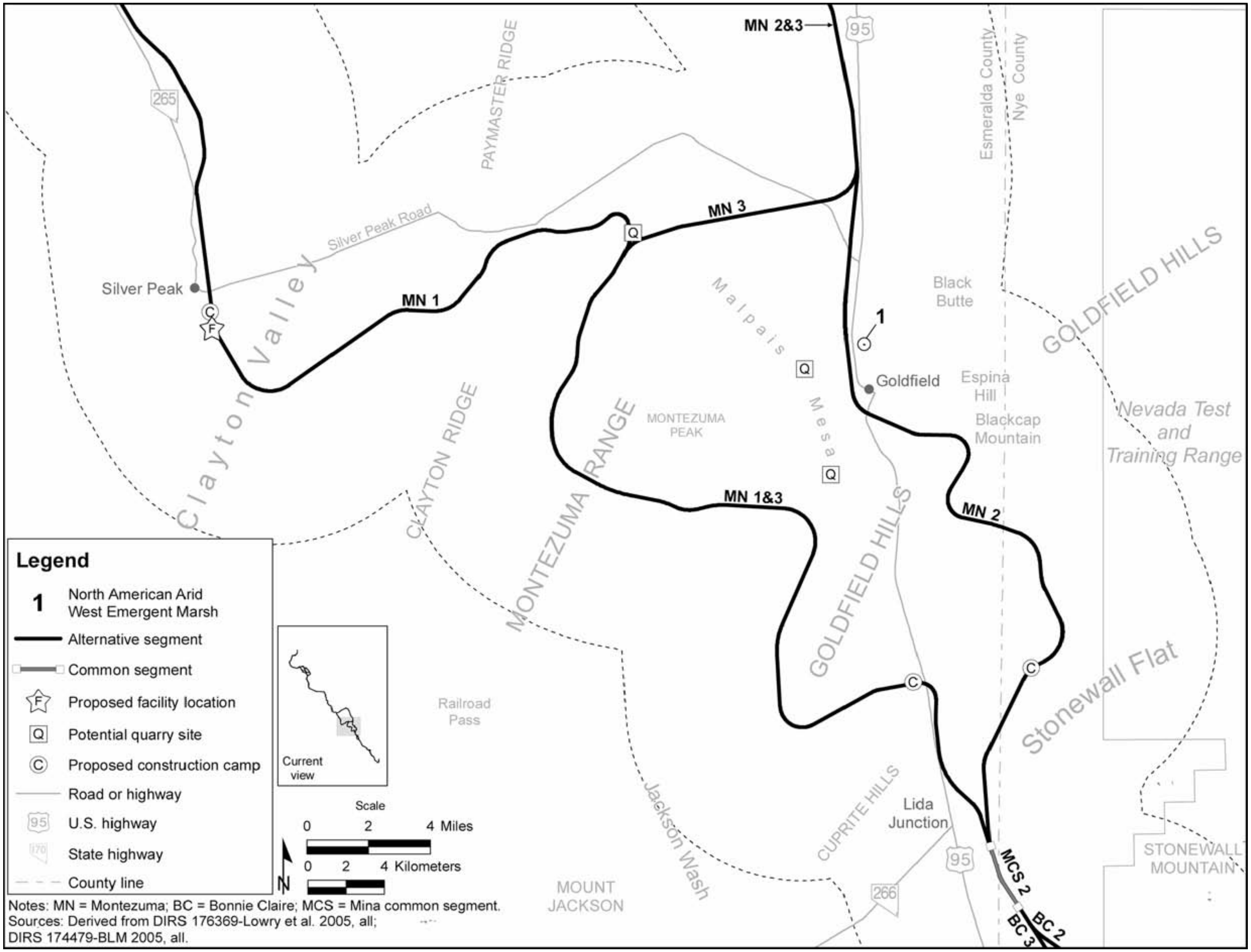


Figure 3-209. Wetland/riparian habitat the Mina rail alignment would cross in map area 5.

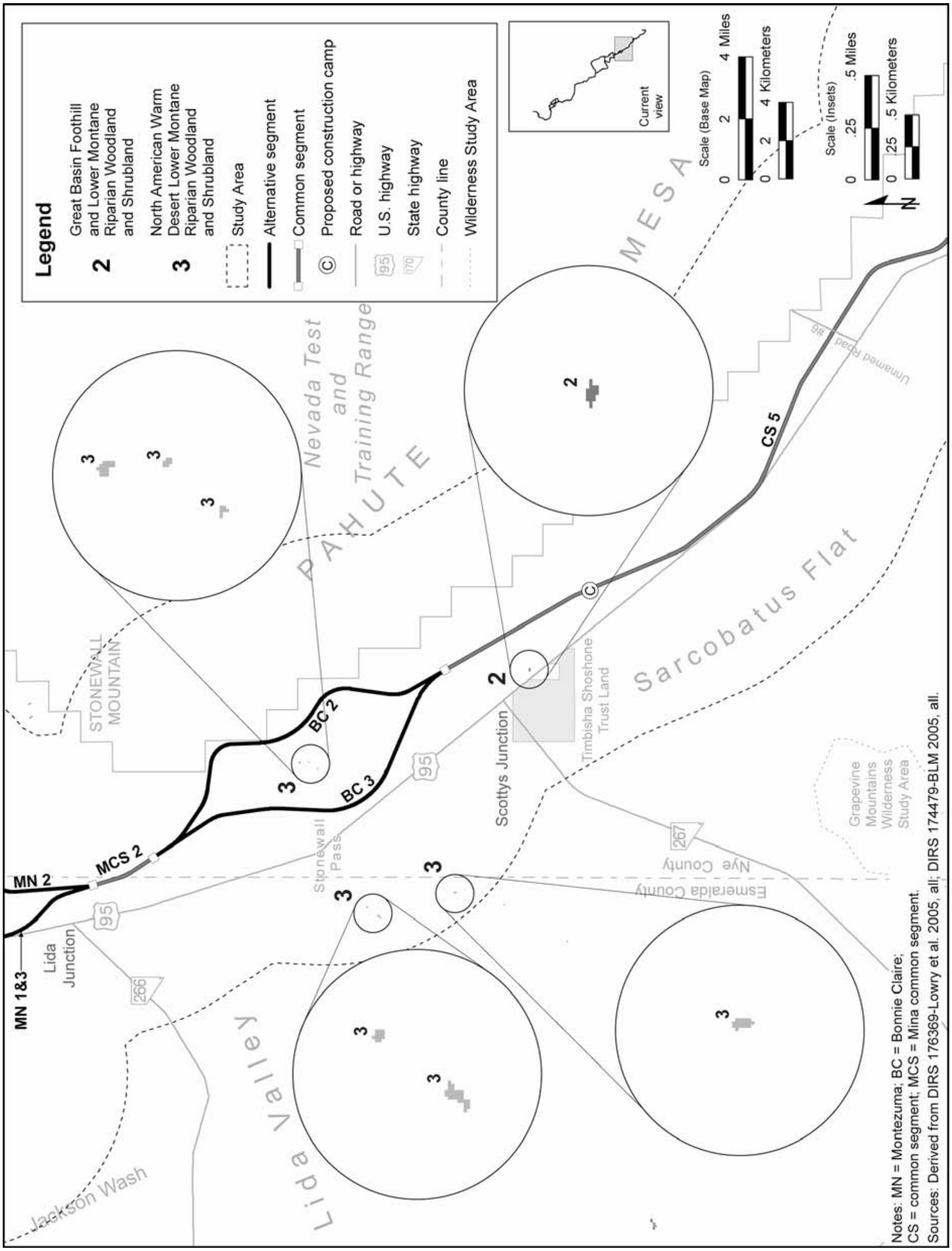


Figure 3-210. Wetland/riparian habitat the Mina rail alignment would cross in map area 6.

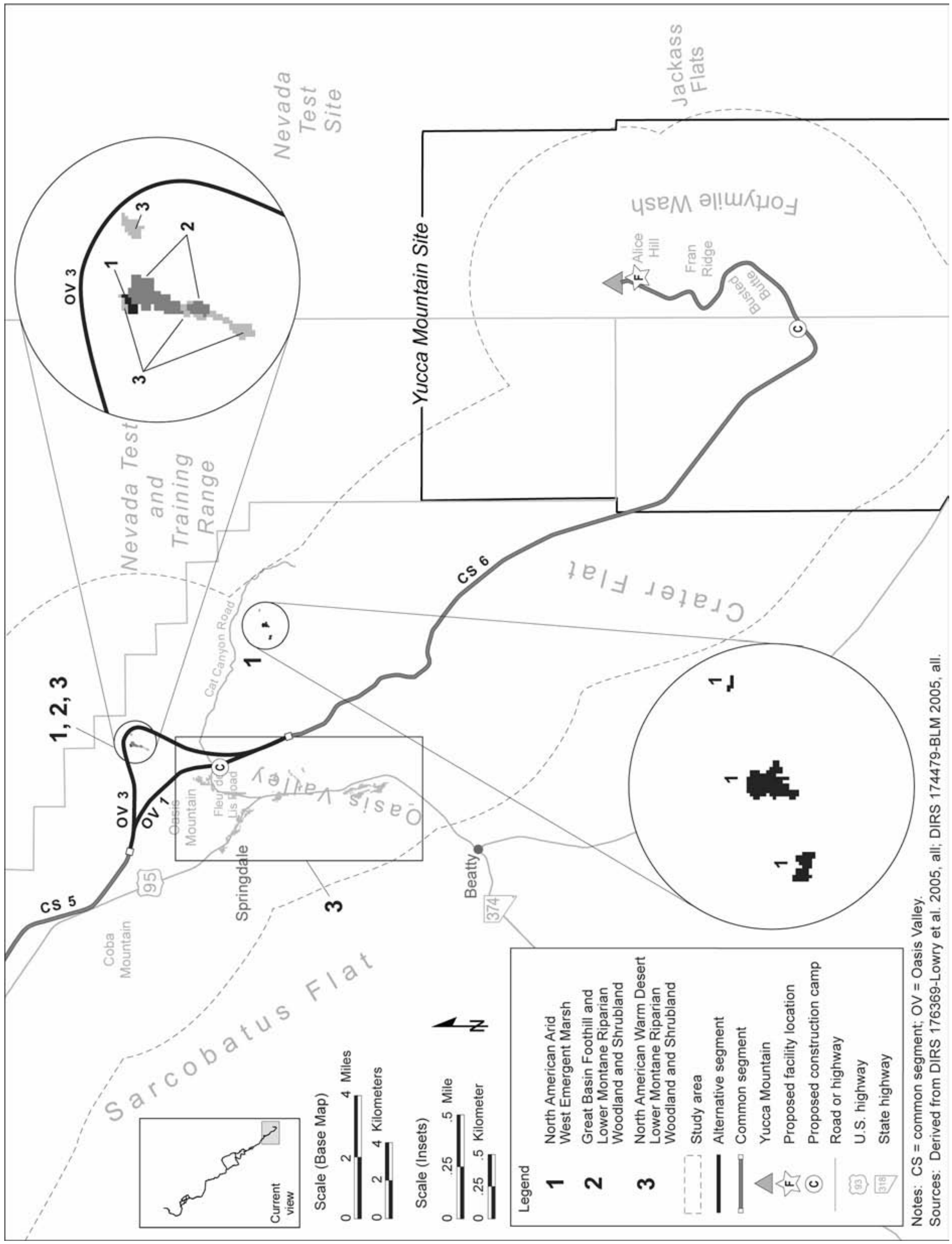


Figure 3-211. Wetland/riparian habitat the Mina rail alignment would cross in map area 7.

3.3.7.2.2 Wildlife

As with the vegetation communities and wetland habitats, DOE gathered data on wildlife communities to identify existing information regarding the occurrence and distribution of wildlife, including mammals, birds, reptiles, and aquatic species, within the construction right-of-way. These investigations incorporated literature and database searches and consultations with land and resource management agencies and authorities, including the BLM, the U.S. Fish and Wildlife Service, the Nevada Natural Heritage Program, and the Nevada Department of Wildlife. DOE also obtained information regarding Nevada game species from these agencies. Concurrent with other field surveys, the Department gathered information during field observations to identify the presence of wildlife within the construction right-of-way. DOE used habitat-related information from the Southwest Regional Gap Data to identify areas where a high probability of species existence occurred in relation to the construction right-of-way. Appendix H contains a map detailing field survey locations.

3.3.7.2.3 Special Status Species

Special status species are plants, fish, and wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. DOE contacted the U.S. Fish and Wildlife Service to obtain a list of species protected under the federal Endangered Species Act that are known to exist or could exist within the construction right-of-way or within the study area (DIRS 181055-Williams 2007). The Department assessed the potential for federally listed species to occur within the construction right-of-way by reviewing agency listings of known, or potentially occurring, listed species, and through a review of potential habitat for those species along the Mina rail alignment. The Department also obtained location records for special status species from a statewide database managed by the Nevada Natural Heritage Program that contains records of incidental observations of rare or protected plants, fish, and wildlife species (DIRS 182061-Hopkins 2006, all). The special status species DOE selected for further consideration are one or a combination of the following:

- Special status species documented as occurring within the study area (Figure 3-212 and Figure 3-213)
- Special status species identified as potentially occurring in the study area by personnel affiliated with appropriate resource management agencies, including the BLM (DIRS 172900 BLM 2003, all), the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry
- Special status species identified as potentially occurring in the study area because field personnel identified potentially suitable habitat during the field surveys

DOE used a Geographic Information System database to map the documented occurrences of special status plants and wildlife species within the study area in relation to the Southwest Regional Gap Analysis Project land-cover types. The Department then used these maps to identify areas of potential habitat and the presence of the documented special status species. Through field surveys, the Department further evaluated areas that appeared to contain viable habitat for a special status species. Appendix H provides details on the survey methodology for special status species.

3.3.7.2.4 State of Nevada Game Species

Table 3-127 lists the game species identified in the Nevada Administrative Code Sections 503.020, 503.045, and 503.060 that potentially occur in the study area and construction right-of way. Game species identified in these sections of the Nevada Administrative Code that are absent from the study area are listed in Appendix H, Table H-5, and are not considered further in this Rail Alignment EIS.

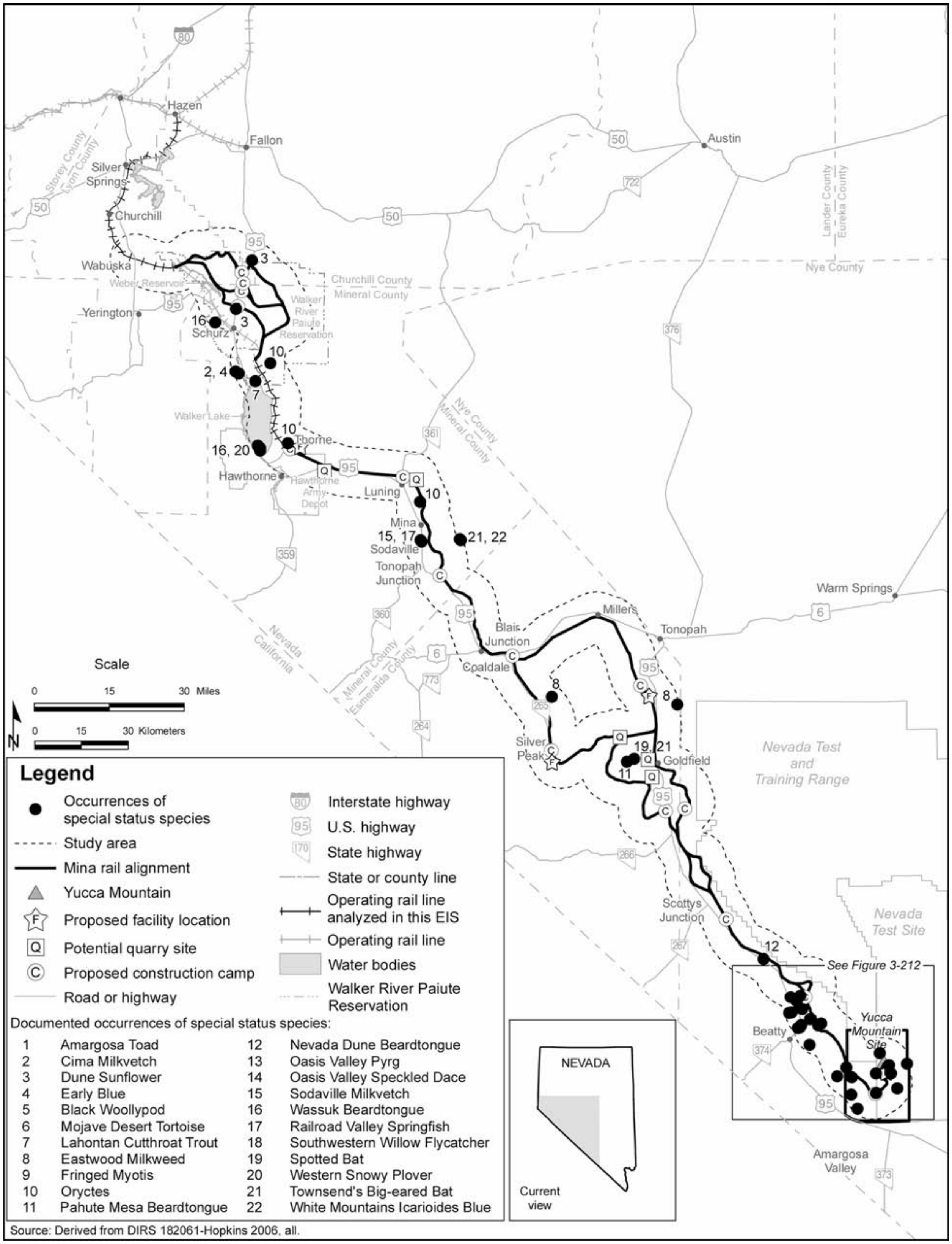


Figure 3-212. Occurrences of special status species documented in the Nevada Natural Heritage Program database along the Mina rail alignment.

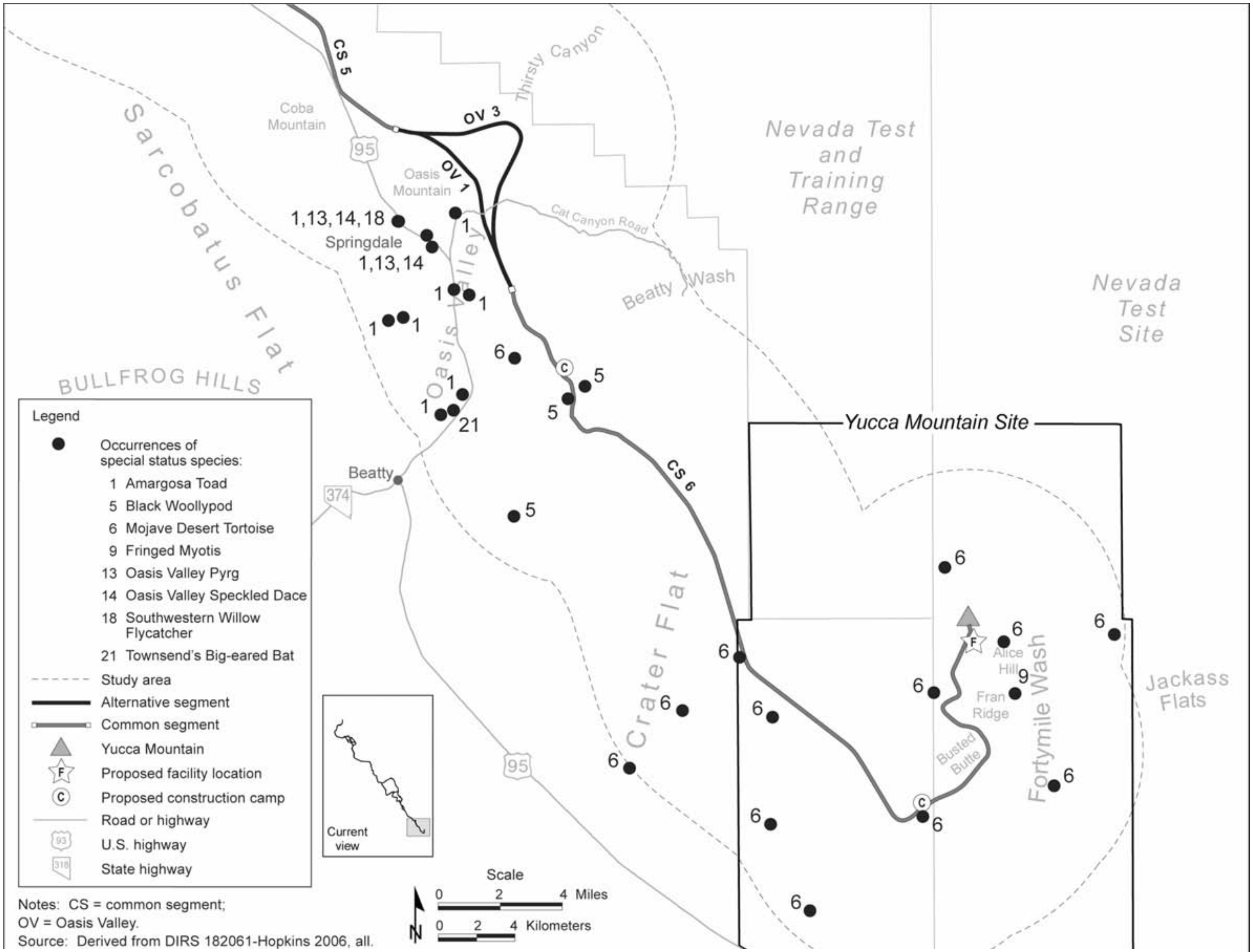


Figure 3-213. Occurrences of special status species documented in the Nevada Natural Heritage Program database adjacent to the Oasis Valley alternative segments and the Yucca Mountain Site.

The greater sage-grouse (*Centrocercus urophasianus*) and pygmy rabbit (*Sylvilagus idahoensis*) are game species that are also BLM-listed sensitive and State of Nevada protected. The bighorn sheep is a BLM-listed sensitive species that is managed by the Nevada Department of Wildlife as a big game mammal.

DOE conducted surveys along the Mina rail alignment to further characterize the presence or absence of game species. Observations included identification of tracks and fecal pellets, and direct observation of animals on or near the rail alignment. Results do not imply population level or habitat quality, only the presence or absence of game species and their approximate level of use.

3.3.7.2.5 Wild Horses and Burros

The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros that the herd management area is managed for, and it is established to avoid the ecological degradation of the herd management area. DOE reviewed the Tonopah Resource Management Plan (DIRS 173224-BLM 1997, all), Carson City Consolidated Resource Management Plan (DIRS 179560-BLM 2001, all), and herd management plans for the Battle Mountain and Carson City BLM Districts to obtain current information on herd management areas. The Department contacted the BLM to obtain Geographic Information System data on management areas and to obtain data regarding the use of the herd management areas by wild horses and burros (Figure 3-214). Concurrent with other field investigations, DOE performed observations for wild horses and burros, or signs of their presence. Section 3.3.2, Land Use and Ownership, describes the grazing allotment planning process.

3.3.7.3 Affected Environment along Alternative Segments and Common Segments

This section describes biological resources in the Mina rail alignment construction right-of-way and study area. To avoid unnecessary repetition, this section discusses biological resources by resource type (vegetation, wildlife, special status species, migratory birds, State of Nevada game species, and wild horses and burros) rather than by alternative segment or common segment.

3.3.7.3.1 Vegetation

There are 25 different land-cover types within the construction right-of-way and multiple options for the proposed Mina railroad construction and operations support facilities. Tables 3-128 through 3-130 list land-cover types along the rail alignment and the areas of proposed operations support facilities. The percentages disclosed are the percent of land-cover types that could be affected and these percentages are related to the total acreages in the Mojave and Nellis mapping zones (see Table 3-126). The land-cover types listed and the percentages that could be affected are based on the nominal width of the rail line construction right-of-way for the alternative segments and common segments and the footprint of each proposed operation support facility. Table 3-131 lists the land-cover types present in the areas of the potential quarry sites.

3.3.7.3.1.1 Noxious Weeds and Invasive Species. Cheatgrass is found along most of the Mina rail alignment where it fills open space between shrubs. Red brome is also common, although it is generally confined to areas along the rail alignment that would cross the Mojave Desert region. These observations were made during the 2005 field surveys.

Table H-2 in Appendix H of this Rail Alignment EIS lists invasive and noxious species likely to occur in the area around the Mina rail alignment. The information is based on general habitat requirements or documented occurrences.

Table 3-127. Nevada game species present or potentially present in the biological resources study area – Mina rail alignment.[a]

Common name	Scientific name	Occurrence within the study area
Game mammals		
Pronghorn antelope	*Antilocapra americana*	Present
Mule deer	*Odocoileus hemionus*	Present
Mountain lion	*Felis concolor*	Present
Cottontail rabbit	*Sylvilagus* spp	Present
Black-tailed jackrabbit	*Lepus californicus*	Present
Bighorn sheep	*Ovis canadensis*	Present
Elk	*Cervus elaphus*	Present
Upland and migratory game birds		
Greater sage-grouse	*Centrocercus urophasianus*	Potentially present
Chukar	*Alectoris chukar*	Present
Ring-necked pheasant	*Phasianus colchicus*	Present
Gambel's quail	*Callipepla gambelii*	Present
Wild turkey	*Meleagris gallopavo*	Present
American crow	*Corvus brachyrhynchos*	Present
Ducks, geese, and swans	Family*Anatidae*	Present only in wetland/marsh areas
Wild doves and pigeons	Family *Columbidae*	Present
Cranes	Family *Gruidae*	Present only in wetland/marsh areas
Rails, coots, and gallinules	Family *Rallidae*	Present only in wetland/marsh areas
Woodcocks and snipes	Family *Scolopacidae*	Present only in wetland/marsh areas
Game fish		
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Present
Brown trout	*Salmo trutta*	Present
Rainbow trout	*Oncorhynchus mykiss*	Present
Mountain whitefish	*Prosopium williamsoni*	Present
Channel catfish	*Ictalurus punctatus*	Present
White catfish	*Ameiurus catus*	Present
White bass	*Morone chrysops*	Present
Largemouth black bass	*Micropterus salmoides*	Present
Spotted bass	*Micropterus punctulatus*	Present
White crappie	*Pomoxis annularis*	Present
Yellow perch	*Perca flavescens*	Present
Bluegill sunfish	*Lepomis macrochirus*	Present
Walleye	*Stizostedion vitreum*	Present

a. Source: Nevada Administrative Code Sections 503.020, 503.045, and 503.060.

3.3.7.3.1.2 Wetlands and Riparian Habitat. Before conducting field surveys, DOE reviewed pertinent maps, the 2004 Southwest Regional Gap Analysis Project (DIRS 174324-NatureServe 2004, all), and available state wetland and land-use inventories to identify the locations of possible wetland and riparian habitat within the rail line construction right-of-way and the study area.

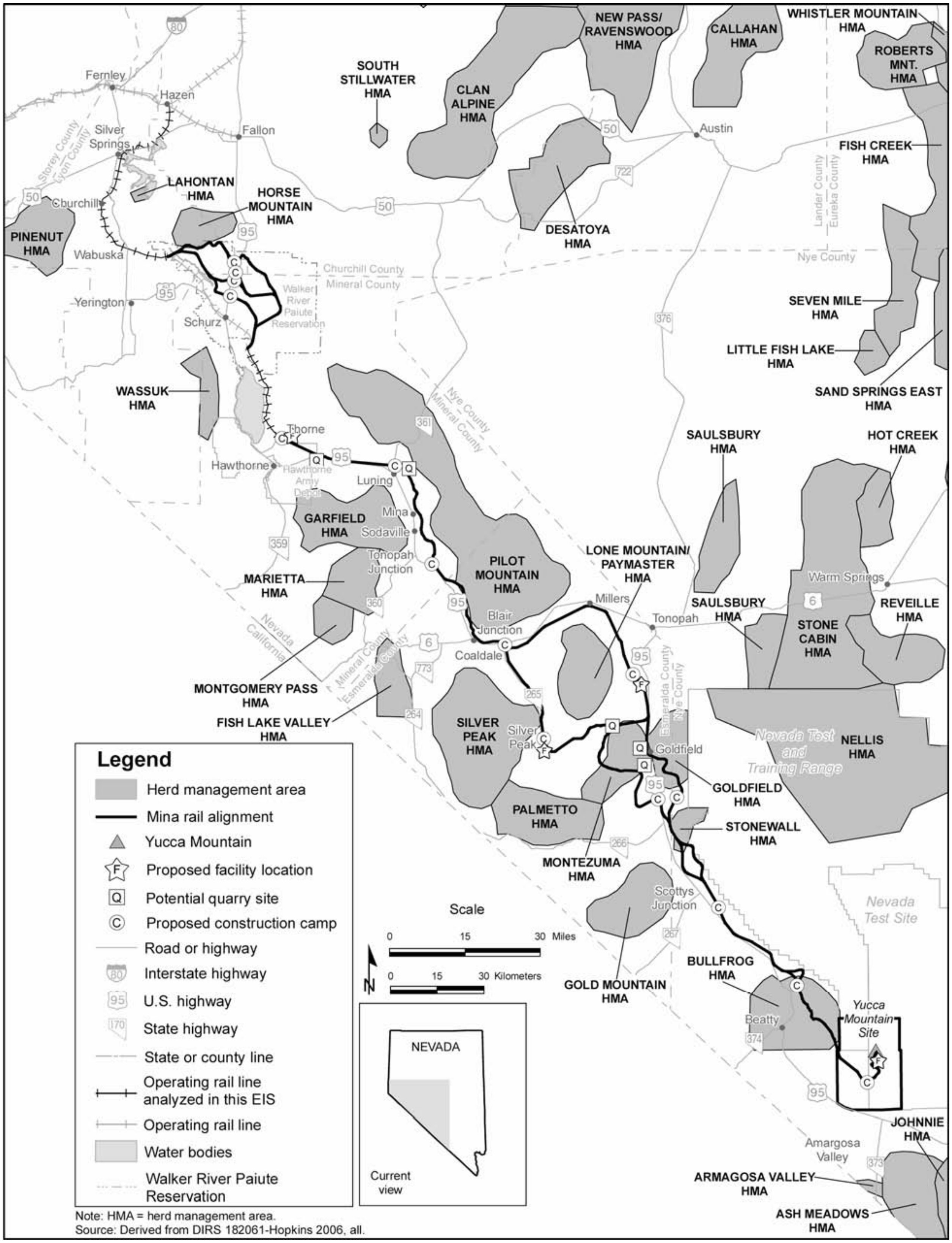


Figure 3-214. Herd management areas along the Mina rail alignment.

Table 3-128. Land-cover types and percentages within the construction right-of-way by common segment.[a]

Land-cover type	Area covered by common segment[b] (percent)			
	CS1	CS2	CS5	CS6
Barren Lands, Non-specific	0.23	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0.29	0		0
Inter-Mountain Basins Cliff and Canyon	<0.01	0		0
Great Basin Pinyon-Juniper Woodland	0	0	0.10	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0.05	0
Inter-Mountain Basins Greasewood Flat	1.87	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	93.78	93.81	0	0
Inter-Mountain Basins Playa	1.95	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	1.81	6.19	7.55	13.59
Invasive Annual and Biennial Forbland	0.06	0	0	0
Invasive Annual Grassland	0.02	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	12.46	23.92
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0.39
North American Warm Desert Playa	0	0	<0.01	0.13
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	26.47	61.38
Sonora-Mojave Mixed Salt Desert Scrub	0	0	53.37	0.59
Totals[c]	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. CS = common segment; < = less than.
c. Totals might differ from sums of values due to rounding.

DOE identified wetland and riparian habitat along the following portions of the Mina rail alignment using a combination of fieldwork and the 2004 Southwest Regional Gap Analysis Project (see Figures 3-205 to 3-211):

- Schurz alternative segments
- Mina common segment 1
- Bonnie Claire alternative segments
- Oasis Valley alternative segments

This section discusses only portions of the Mina rail alignment in which there are wetland and/or riparian habitats. Section 3.3.5, Surface-Water Resources, provides information on springs and their locations and specific information on function and value of wetlands for Section 404 compliance. Table 3-132 details the identified wetland and riparian land-cover types found in the construction right-of-way and the study area along alternative segments and common segments of the Mina rail alignment.

Table 3-129. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 1 of 2).

	Area covered by alternative segment (percent)[b]											
	Schurz				Montezuma				Bonnie Claire		Oasis Valley	
Land-cover type	S1	S4	S5	S6	MN1	MN2	MN1/MN3	MN3	BC2	BC3	OV1	OV3
Barren Lands, Non-specific	0	0	0	0	1.12	0.03	0	0	0	0	0	0
Developed, Medium-High Intensity	0	0	0	0	0	0.08	0	0	0	0	0	0
Developed, Open Space – Low Intensity	0	0	0	0	0	0.24	0	0	0	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	1.95	0.84	0.35	0.42	<0.01	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.35	0.27	0.25	0.23	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0	0	0	0	0	0	0.047	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0.84	1.60	8.05	<0.01	0.11	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0.04	0.04	0.56	11.40	17.87	7.38	5.04	0.80	0	0
Inter-Mountain Basins Cliff and Canyon	0	0	0	0.01	0	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	15.1	5.85	4.21	3.93	0	1.54	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	82.0	92.95	94.02	94.03	75.59	2.71	1.93	0	33.59	30.27	0	0
Inter-Mountain Basins Playa	0	0	0	0	16.53	0	0	0	0.51	0	0	0

Table 3-129. Land-cover types and percentages within the construction right-of-way by alternative segment[a] (page 2 of 2).

Land-cover type	Area covered by alternative segment (percent)[b]											
	Schurz				Montezuma				Bonnie Claire		Oasis Valley	
	S1	S4	S5	S6	MN1	MN2	MN1/MN3	MN3	BC2	BC3	OV1	OV3
Inter-Mountain Basins Semi-Desert Shrub-Steppe	0	0	0	0	0.32	2.71	1.93	0	0	0	0	0
Inter-Mountain Basins Playa	0.55	0	0	0.04	16.53	0	0	0	0	0.51	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0.09	0.07	0.10	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0.32	2.71	1.93	0	10.66	16.53	4.88	3.13
Inter-Mountain Basins Wash	0	0	0	0	0	0	0	0	0	0	0	0
Invasive Annual Grassland	0	0	0.41	0.39	0	0	0	0	0	0	0	0
Invasive Annual and Biennial Forbland	0	0	<0.01	<0.01	0	0	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	31.44	23.43	3.61	0.45
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0.43
North American Warm Desert Playa	0	0	0	0	0	0	0	0	0	0	5.33	1.07
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	0	13.88	27.01	77.56	72.68
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	5.29	1.84	8.63	22.24
Totals[c]	100	100	100	100	100	100	100	100	100	100	100	100

a. Source: DIRS 174324-NatureServe 2004.
b. < = less than.
c. Totals might differ from sums of values due to rounding.

Table 3-130. Land-cover types and percentages within facility footprints by facility.[a]

Land-cover type	Staging Yard at Hawthorne	Silver Peak option Maintenance-of-Way Facility	Klondike option Maintenance-of-Way Facility	Rail Equipment Maintenance Yard
	Area covered by facility (percent)			
Great Basin Xeric Mixed Sagebrush Shrubland		0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0.14	0.05	0	0
Inter-Mountain Basins Greasewood Flat	0.93	2.65	45.35	0
Inter-Mountain Basins Mixed Salt Desert Scrub	98.93	9.40	53.40	0
Inter-Mountain Basins Playa	0	87.91	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	1.26	15.04
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	8.04
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	74.94
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	1.98

a. Source: DIRS 174324-NatureServe 2004.
b. Totals might differ from sums of values due to rounding.

Table 3-131. Land-cover types and percentages within the footprints of potential quarry sites[a] (page 1 of 2).

Land-cover type	Area covered (percent)
Garfield Hills	
Great Basin Xeric Mixed Sagebrush Shrubland	99.99
Inter-Mountain Basins Big Sagebrush Shrubland	<0.01[c]
Total[b]	100
Gabbs Range	
Inter-Mountain Basins Big Sagebrush Shrubland	0.38
Inter-Mountain Basins Mixed Salt Desert Scrub	99.62
Total	100
North Clayton	
Great Basin Xeric Mixed Sagebrush Shrubland	7.37
Inter-Mountain Basins Big Sagebrush Shrubland	20.21
Inter-Mountain Basins Mixed Salt Desert Scrub	68.43
Inter-Mountain Basins Semi-Desert Shrub Steppe	3.99
Total	100

Table 3-131. Land-cover types and percentages within the footprints of potential quarry sites[a] (page 2 of 2).

Land-cover type	Area covered (percent)
Quarry ES-7	
Great Basin Xeric Mixed Sagebrush Shrubland	29.69
Inter-Mountain Basins Big Sagebrush Shrubland	48.14
Inter-Mountain Basins Mixed Salt Desert Scrub	20.68
Inter-Mountain Basins Semi-Desert Shrub Steppe	1.48
Total	100
Malpais Mesa	
Great Basin Xeric Mixed Sagebrush Shrubland	6.58
Inter-Mountain Basins Big Sagebrush Shrubland	55.48
Inter-Mountain Basins Mixed Salt Desert Scrub	34.86
Inter-Mountain Basins Semi-Desert Shrub Steppe	3.08
Total	100

a. Source: DIRS 174324-NatureServe 2004.
b. Totals might differ from sums of values due to rounding.
c. < = less than.

Wetlands within and adjacent to the Mina rail alignment were classified as Great Basin foothill and lower mountain riparian woodland and shrubland; North American arid west emergent marsh; and North American warm desert lower montane riparian woodland and shrubland (DIRS 180889-PBS&J 2007, p. 16). Plant species considered indicators of wetland conditions that were found within and adjacent to the Mina rail alignment include bulrushes, sedges, Fremont cottonwood, willows (including sandbar willow), broadleaf cattail (*Typha latifolia*), Baltic rush (*Juncus balticus*), common reed (*Phragmites australis*), tamarisk, and Russian olive (*Eleagnus angustifolia*) (DIRS 180889-PBS&J 2007, p. 17).

Oasis Valley alternative segment 3 contains a small (approximately 0.02 square kilometer [5 acres]) wetland area within the construction right-of-way (Figure 3-210). See Section 3.3.5, Surface-Water Resources, for more specific information on wetlands.

3.3.7.3.2 Wildlife

This section describes the wildlife and wildlife communities potentially present in the Mina rail alignment construction right-of-way. Figures 3-215 through Figure 3-218 detail the manmade wildlife water sources, also called ***wildlife guzzlers***, within the study area. There are 46 wildlife guzzlers within the study area. The largest concentrations of guzzlers are located along Schurz alternative segments 5 and 6 (10 guzzlers), and along Mina common segment 1 (35 guzzlers.) The wildlife guzzlers closest to the Mina rail alignment are DM#24, which is approximately 1.6 kilometers (1 mile) north of Schurz alternative segments 5 and 6; and PI#1 and PI#4, which are both approximately 1.6 kilometers east of Mina common segment 1. Section 3.3.5, Surface-Water Resources, provides information about and locations of other sources of water available to wildlife.

A **wildlife guzzler** is a water development for wildlife that relies on rainfall or snowmelt to recharge it, rather than springs or streams. Usually used where there are no other sources of water for wildlife.

The following sections describe the most common species of mammals, birds, reptiles, amphibians, and fish potentially found within the study area or construction right-of-way of the Mina rail alignment including federally listed threatened and endangered species, and federally and state-listed sensitive or protected species, migratory birds, Nevada game species, and wild horses and burros.

Table 3-132. Wetland and riparian land-cover types within the Mina rail alignment construction right-of-way and study area.[a]

Segment/land-cover type	Amount in construction right-of-way (square kilometers)[b]	Amount in study area (square kilometers)
Schurz alternative segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.01	20.75
North American Arid West Emergent Marsh	0	2.90
Schurz alternative segment 4		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.01	20.04
North American Arid West Emergent Marsh	0	2.86
Mina common segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.19
North American Arid West Emergent Marsh	0	0.04
Bonnie Claire alternative segment 2		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.03
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0.03
Bonnie Claire alternative segment 3		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.02
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0.07
Oasis Valley alternative segment 1		
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.08
North American Arid West Emergent Marsh	0	0.13
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	2.02
Oasis Valley alternative segment 3		
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0.02	2.02
North American Arid West Emergent Marsh	0	0.23
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	0.08

a. Source: DIRS 174324-NatureServe 2004, all.
b. To convert square kilometers to acres, multiply by 247.10.

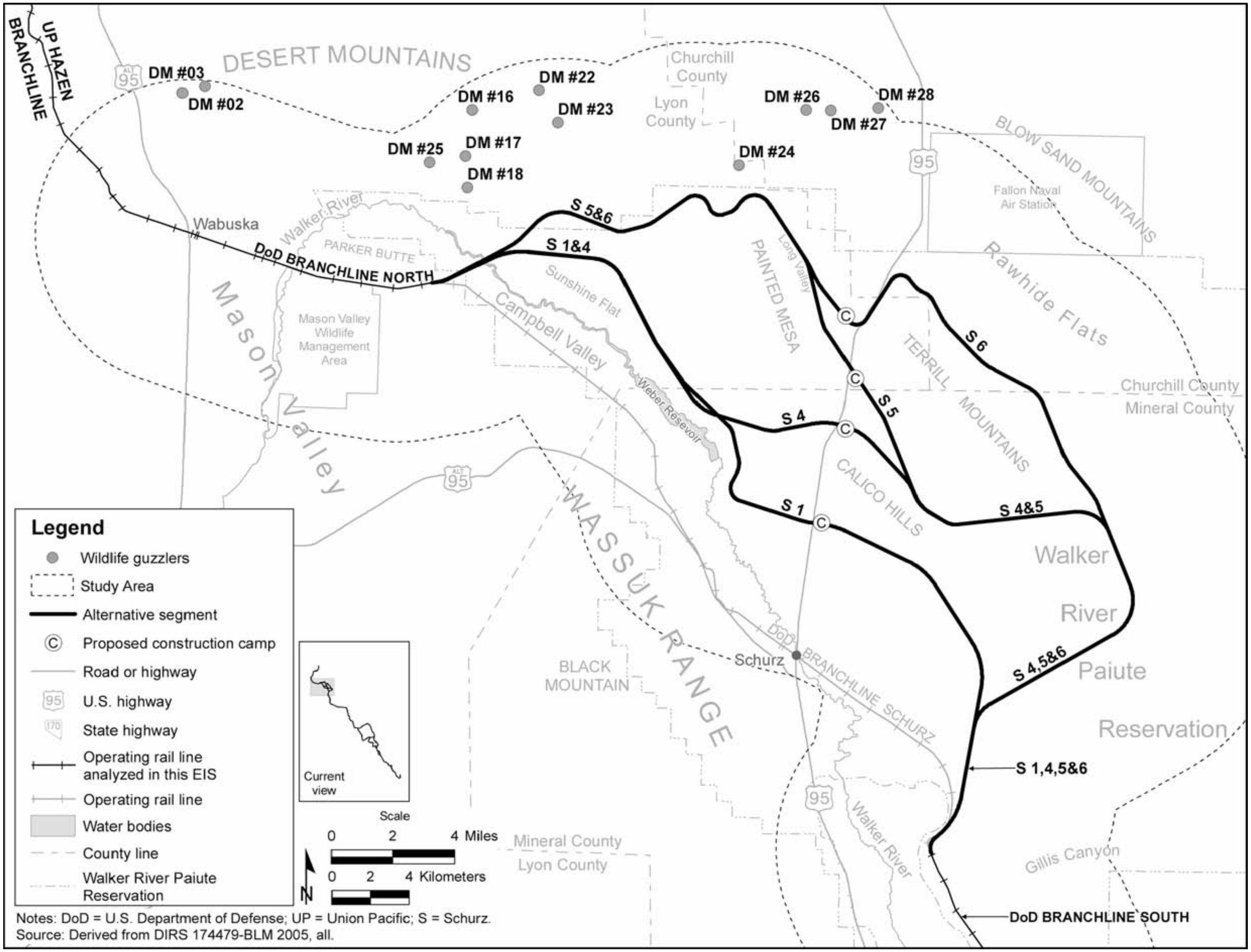


Figure 3-215. Wildlife guzzlers located along the Mina rail alignment in map area 1.

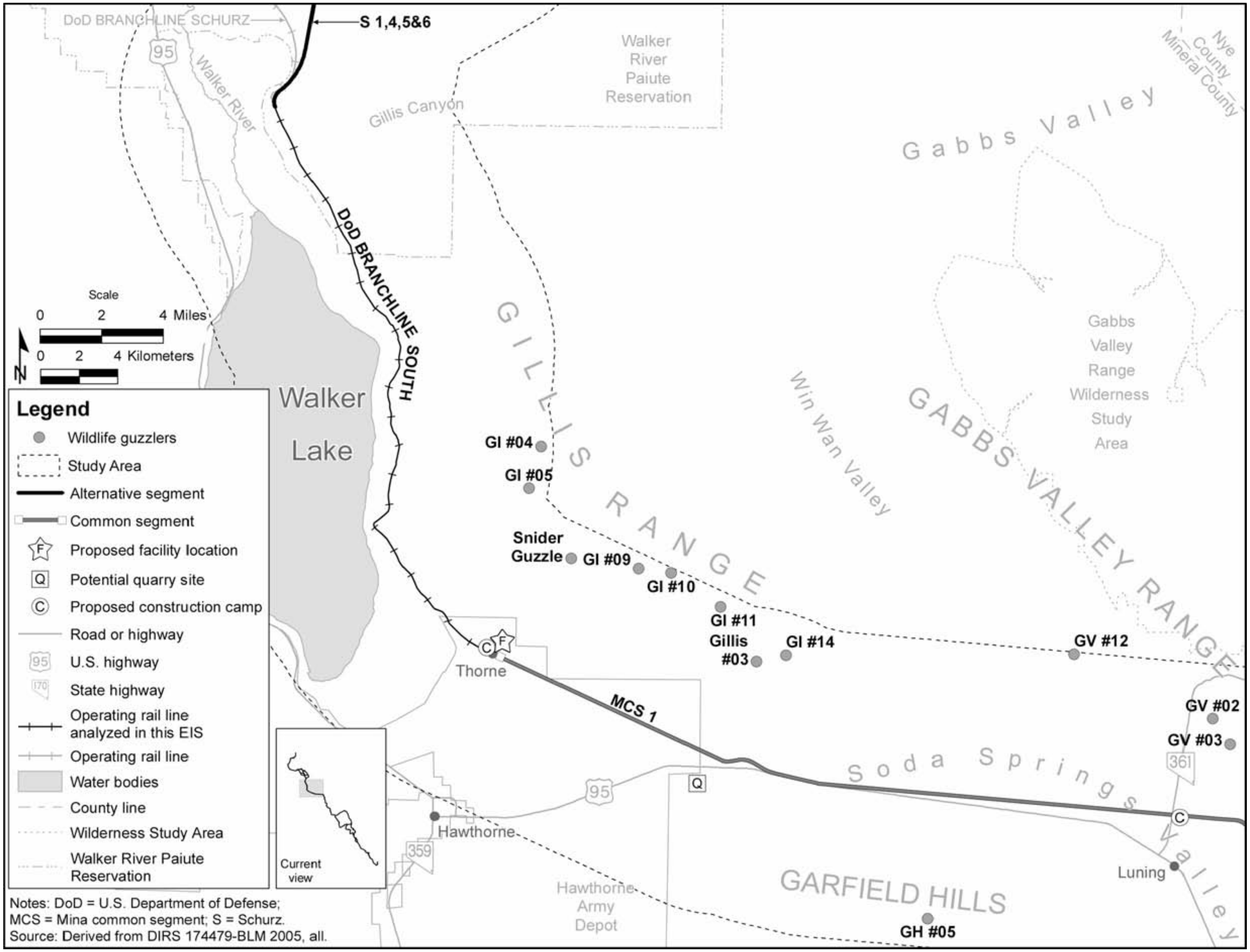


Figure 3-216. Wildlife guzzlers located along the Mina rail alignment in map area 2.

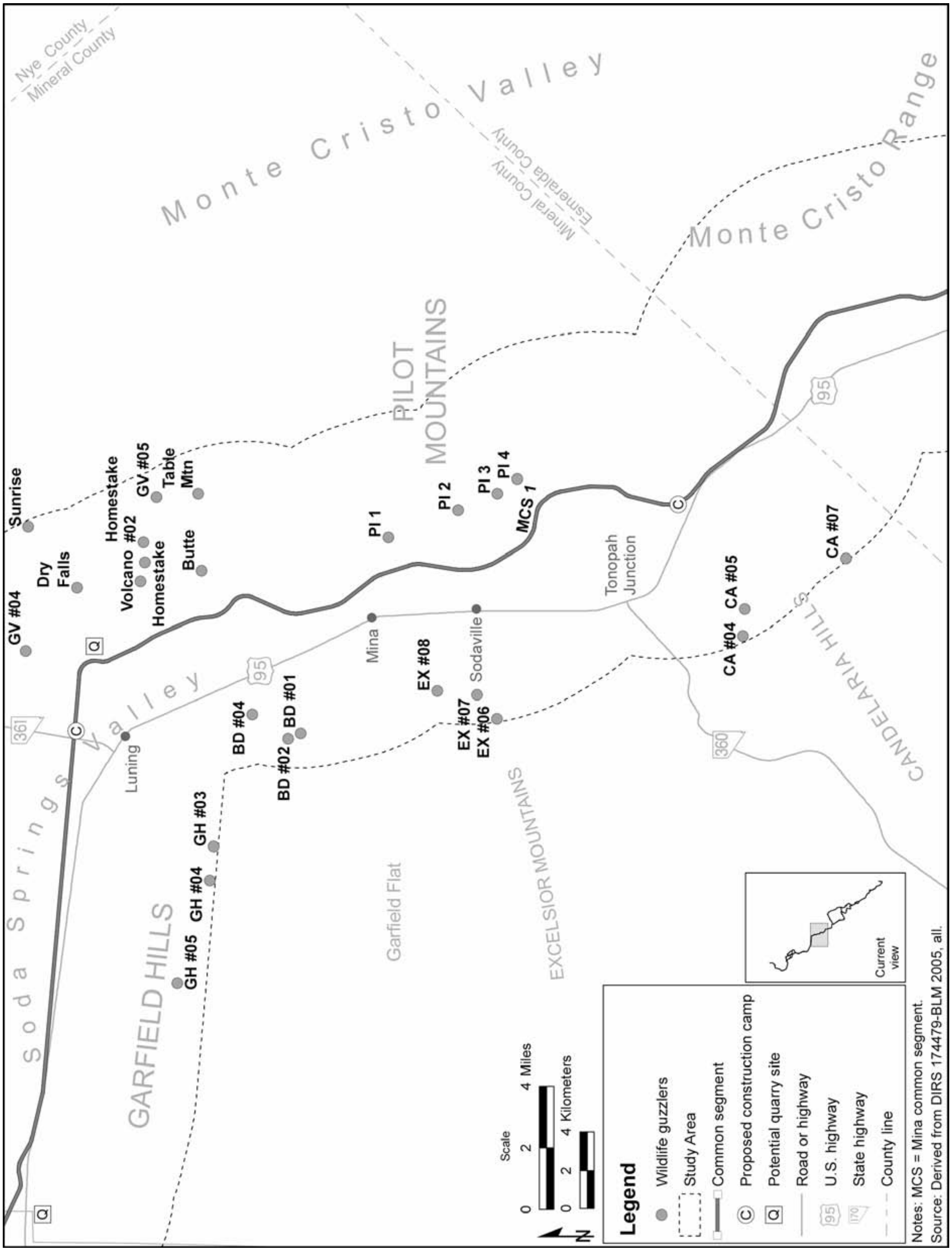


Figure 3-217. Wildlife guzzlers located along the Mina rail alignment in map area 3.

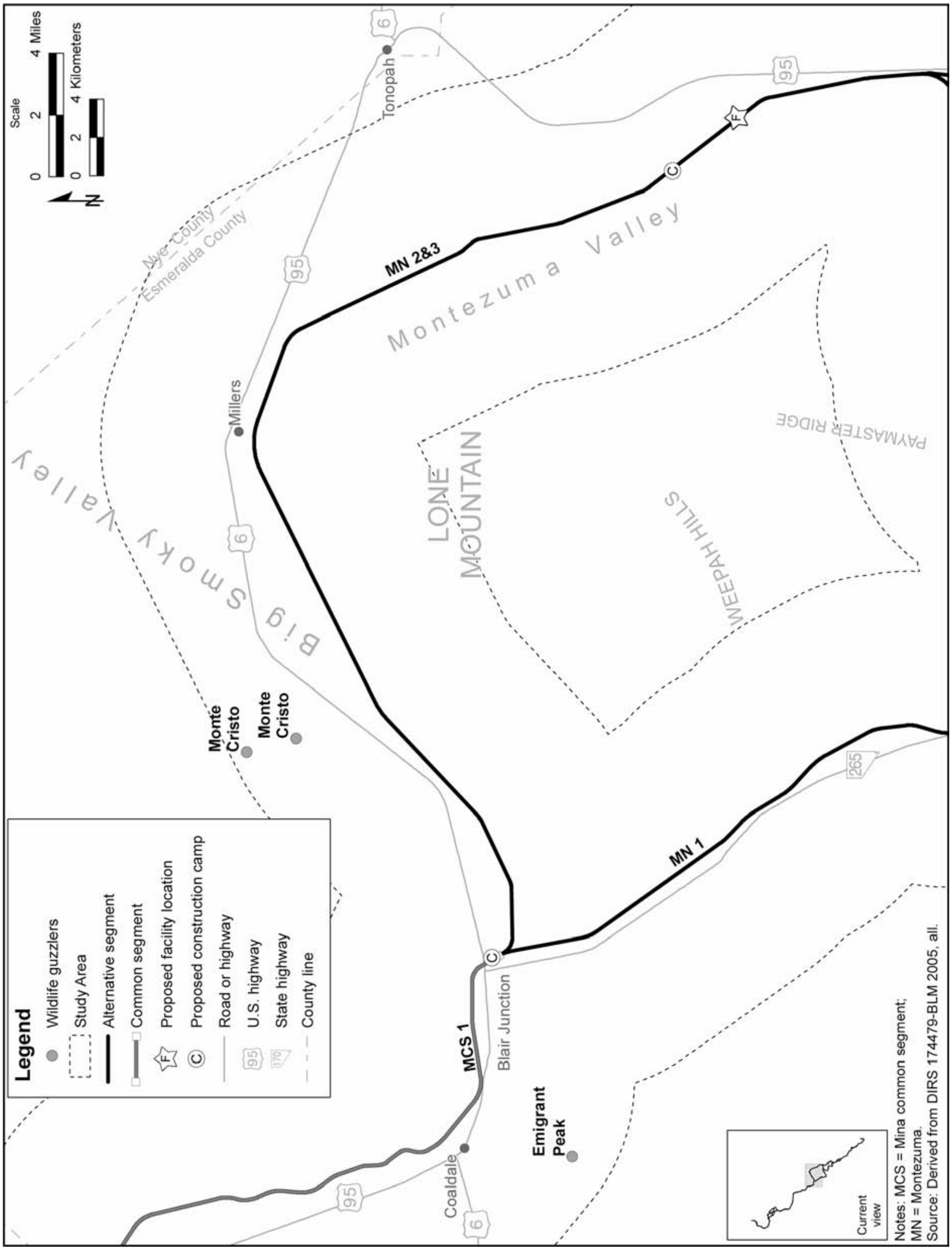


Figure 3-218. Wildlife guzzlers located along the Mina rail alignment in map area 4.

3.3.7.3.2.1 Mammals. Mammals are known to exist within the study area along the entire length of the Mina rail alignment. The types of mammals found within the study area would depend on the vegetation communities. Mammals that occur in the greater study area and the construction right-of-way of the Mina rail alignment include:

- Mountain lion *(Felis concolor)*
- Bighorn sheep *(Ovis Canadensis)*
- Kit fox *(Vulpes macrotis)*
- Coyote *(Canis latrans)*
- Bobcat *(Lynx rufus)*
- Badger *(Taxidea taxus)*
- Beaver *(Castor canadensis)*
- Raccoon *(Procyon lotor)*
- Cottontail rabbit *(Sylvilagus* spp.*)*
- Various rodents
- Pronghorn antelope *(Antilocapra americana)*
- Grey fox *(Urocyon cinereoargenteus)*
- Mule deer *(Odocoileus hemionus)*
- Black-tailed jackrabbit *(Lepus californicus)*
- Ringtail *(Bassariscus astutus)*
- Common muskrat *(Ondatra zibethicus)*
- Striped skunk *(Mephitis mephitis)*
- Various bats
- Ground squirrels (*Spermophilus* spp.)

3.3.7.3.2.2 Birds. A variety of bird species are commonly observed in central and southern Nevada, including year-round residents, summer residents, migratory species breeding in southern Nevada, winter residents that breed to the north, and seasonal migrants passing through central and southern Nevada en route to breeding ranges to the north and winter ranges to the south. Table H-4 in Appendix H lists the bird species that could occur along the Mina rail alignment. Several federal laws and state statutes protect various groups of birds. Chapter 6, Statutory, Regulatory, and Other Applicable Requirements, details these protections.

The Great Basin region of Nevada is an important migration route for waterfowl and other species of birds traveling between southern wintering areas and northern breeding territories; however, suitable habitat for waterfowl and shorebirds is limited to the Walker River, Walker Lake, and other rare open-water areas. No waterfowl or shorebirds were observed during the 2006 field surveys; however, DOE assumes that there are such birds on Walker Lake which may move through the study area and construction right-of-way. Walker Lake is approximately 1 kilometer (0.6 miles) from the Mina rail alignment.

Common species of resident and migrating birds observed along the Mina rail alignment include:

- Common raven *(Corvus corax)*
- Black-billed magpie *(Pica hudsonia)*
- Horned lark *(Eremophila alpestris)*
- Northern oriole *(Icterus galbula)*
- Red-winged blackbird *(Agelaius phoenicius)*
- American crow *(Corvus brachyrhynchos)*
- House wren *(Troglodytes aedon)*
- Killdeer *(Charadrius vociferous)*
- Loggerhead shrike *(Lanius ludovicianus)*
- Yellow warbler *(Dendroica petechia)*

Two upland game bird species are expected to occur within the Mina rail alignment construction right-of-way: chukar (*Alectoris chukar*) and Gambel's quail (*Callipepla gambelii*). Chukars were observed during surveys conducted along the rail alignment. Chukars were recorded in cliff and talus habitat in the Beatty Wash area. Mourning doves are common and were observed at multiple locations along the rail alignment. The greater sage-grouse (*Centrocercus urophasianus*) is a BLM-listed special status species and receives additional protection from the State of Nevada (see Section 3.3.7.3.3). The greater sage-grouse is an upland game bird that has historically occurred in low abundance near portions of the rail alignment, but outside of the study area (Figure 3-219).

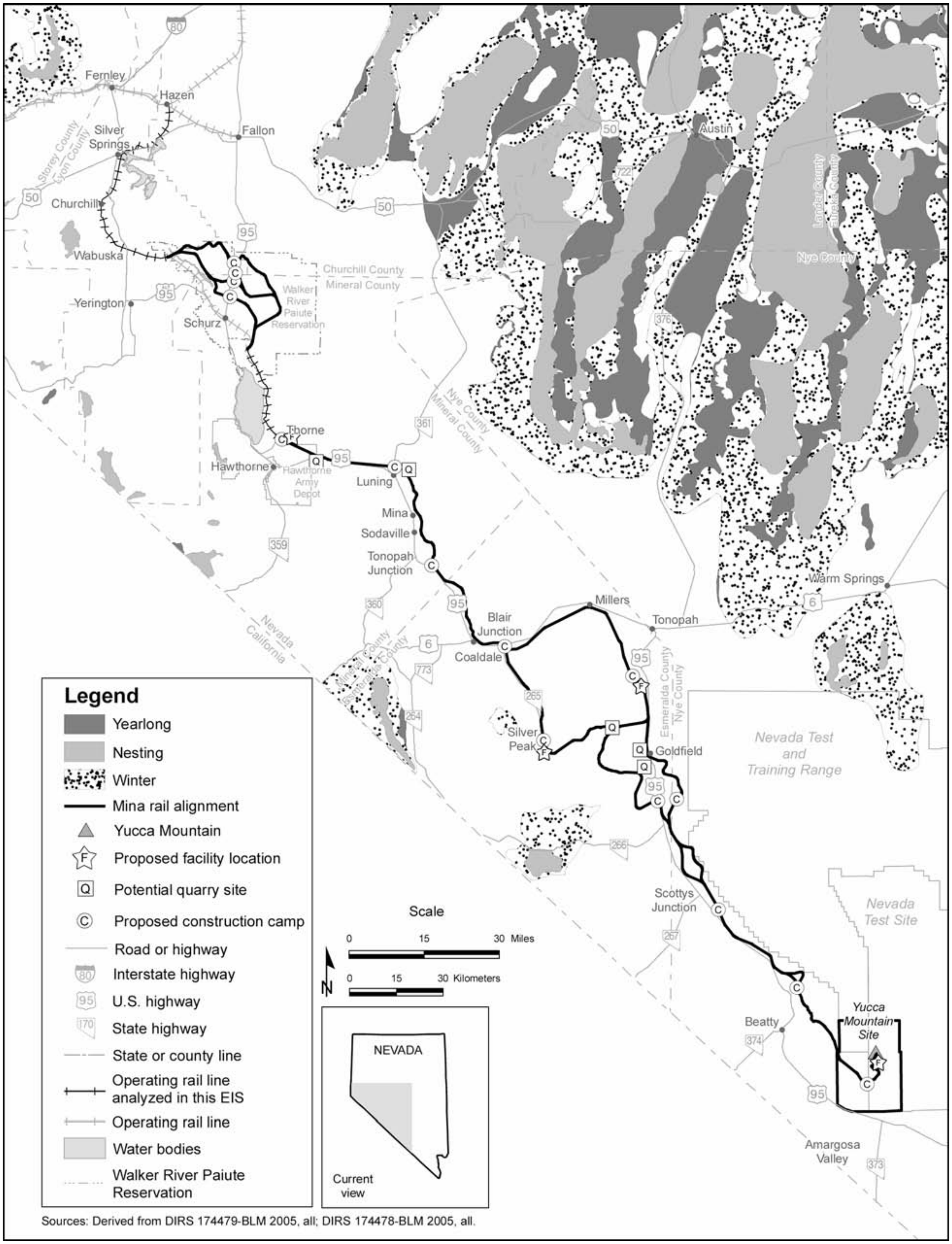


Figure 3-219. Potential greater sage-grouse habitat along the Mina rail alignment.

Populations of raptors are typically low in numbers and occurrence in the rail line construction right-of-way due to minimal roosting, nesting, and foraging potential along the alignment. Raptors observed during field surveys included prairie falcon (*Falco mexicanus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*Buteo lagopus*), northern harrier (*Circus cyaneus*), burrowing owl (*Athene cunicularia*), great-horned owl (*Bubo virginianus*), turkey vulture (*Cathartes aura*), and golden eagle (*Aquila chrysaetos)*. In addition, ferruginous hawks (*Buteo regalis*) have been reported to occupy, and in some cases nest in, areas with trees adjacent to the construction right-of-way (DIRS 174519-Bennet 2005, Plate 5).

Waterfowl are abundant within the study area in the vicinity of the Walker River. Common species include mallard (*Anas playrhynchos*), Canada goose (*Branta canadensis*), and blue-winged teal (*Anas discors*) (DIRS 182302-Miller Ecological Consultants 2005, p.3-30).

Populations of bird species that rely on sagebrush habitat in Nevada are declining because cattle grazing and the proliferation of nonnative weeds have degraded the native sagebrush habitat (DIRS 174518-BLM 2005, pp. 3.6-10 and 3.6-11). Sagebrush-dependent species that might occupy habitat along the proposed rail alignment could include sage thrasher (*Oreoscoptes montanus)*, sage sparrow (*Amphispiza belli*), Brewer's sparrow (*Spizella breweri*), and vesper sparrow (*Pooecetes gramineus*). The Mina rail alignment (Montezuma alternative segments 2 and 3) would cross sagebrush habitat in southeastern Railroad Valley and the Montezuma Range.

3.3.7.3.2.3 Reptiles. A variety of species of lizards and snakes are present throughout the southern Great Basin Desert and northern Mojave Desert and along the Mina rail alignment. Table H-6 in Appendix H lists the reptiles that could occur along the Mina rail alignment The desert tortoise *(Gopherus agassizii)* is found within the proposed rail alignment at its southern end, from the Goldfield area to Yucca Mountain. The most common lizard species observed during the 2005 and 2006 field surveys were:

- Western fence lizard (*Sceloporus occidentalis*)
- Western whiptail lizard (*Cnemidophorus tigris*)
- Long-nosed leopard lizard (*Gambelia wislezenii*)
- Side-blotched lizard (*Uta stansburiana*)
- Sagebrush lizard (*Sceloporus graciosus*)
- Desert horned lizard (*Phrynosoma platyrhinos*)

Other lizard species that were observed, but did not appear to be common, were:

- Zebra-tailed lizard (*Callisaurus draconoides*)
- Desert spiny lizard (*Sceloporus magister*)
- Desert iguana (*Dipsosaurus dorsalis*)

Great Basin collared lizards (*Crotaphytus bicinctores*) and desert night lizards (*Xantusia vigilis*) were not observed during field surveys, but probably occur in the study area and potentially in the construction right-of-way. Chuckwalla (*Sauromalus ater*) commonly occurs in the southern portion of common segment 6, although none were observed during field surveys. This species is found in rocky outcrops and is rarely seen above ground. Various other species of snakes are likely to occur in the study area and potentially in the construction right-of-way, but were not directly observed during field surveys.

3.3.7.3.2.4 Aquatic Species. Aquatic species are species that require wet environments for at least part of their life cycle. The only native fish species found within the Mina rail alignment study area are special status species and include:

- Lahontan cutthroat trout (*Onchorynchus clarki henshawii*)
- Railroad Valley springfish (*Crenichthys nevadae*)
- Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6 [unnamed])

Nine other species of amphibians may be found in the southern Great Basin Desert and northern Mojave Desert outside of the rail alignment study area or construction right-of-way and are listed in Appendix H. Potential amphibian habitat correlates with the riparian and wetland habitat found along the rail alignment. The Amargosa toad (*Bufo nelsoni*) occurs only in Oasis Valley north of Beatty. Nonnative bullfrogs (*Rana catesbeiana*) are also present in some waterways and water bodies in the Mina rail alignment study area.

3.3.7.3.3 Special Status Species

Special status species are plants or wildlife species that are afforded some level of protection or special management under federal or state laws or regulations. Sections 3.3.7.3.3.1 and 3.3.7.3.3.2 describe two categories for special status species, including threatened or endangered species and BLM special status (designated sensitive) and State of Nevada protected species. Table 3-133 lists special status species, their BLM, State, and federal status, and their likely occurrence within the Mina rail alignment study area. Figures 3-212 and 3-213 show documented locations of special status species along the rail alignment from the Nevada Natural Heritage Program database. Not all special status species listed in Table 3-133 appear on the figures because this table represents a compilation of sources including the BLM, the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, or the Nevada Division of Forestry, and the Nevada Natural Heritage Program database (DIRS 182061-Hopkins 2006, all). The review of the Nevada Natural Heritage Program database for the study area revealed 54 special status species that occur or may occur within the study area and potentially within the construction right-of-way.

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 1 of 5).

Common name	Species name	Status			Portion of the Mina rail alignment where species could be found
		BLM[b]	State[c]	FWS[d]	
Plants					
Bodie Hills rockcress	*Arabis bodiensis*				
Eastwood milkweed	*Asclepias eastwoodiana*	N		xC2	Montezuma alternative segments 2 and 3
Cima milkvetch	*Astragalus cimae* var. *cimae*				Schurz alternative segments 4 and 5
Sodaville milkvetch	*Astragalus lentiginosus var. sesquimetralis*		P		Mina common segment 1
Black woollypod	*Astragalus funereus*	N		xC2	Common segment 6; Oasis Valley alternative segments 1 and 3
Tiehm buckwheat	*Eriogonum tiehmii*	N		xC2	Mina common segment 1
Dune sunflower	*Helianthus deserticola*				All
Oryctes	*Oryctes nevadensis*				Department of Defense Branchline South; Staging Yard at Hawthorne; Mina common segment 1

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 2 of 5).

Common name	Species name	Status			Portion of the Mina rail alignment where species could be found
		BLM[b]	State[c]	FWS[d]	
Plants (continued)					
Nevada dune beardtongue	*Penstemon arenarius*	N		xC2	Mina common segment 1; Schurz alternative segments 1, 4, and 5; Montezuma alternative segments 2 and 3; common segment 5
Pahute Mesa beardtongue	*Penstemon pahutensis*	N		xC2	Montezuma alternative segments 1 and 3
Rock purpusia	*Ivesia arizonica var. saxosa*	N			Common segment 6
Wassuk beardtongue	*Penstemon rubicundus*				All
Mono County phacelia	*Phacelia monoensis*	N		xC2	
Lone Mountain tonestus	*Tonestus graniticus*	N		xC2	Montezuma alternative segments 1 and 3
Invertebrates					
Oasis Valley pyrg	*P. micrococcus*	N		xC2	Oasis Valley alternative segments 1 and 3; common segments 5 and 6
Nevada viceroy	*Limenitis archippus lahontani*	N		xC2	
Early blue	*Euphilotes enoptes primavera*	N			Department of Defense Branchline South
White Mountains icarioides blue	*Icaricia icarioides albihalos*			xC2	Mina common segment 1
Fish					
Railroad Valley springfish	*Crenichthys nevadae*	--	T	LT	Schurz alternative segments 1 and 6
Oasis Valley speckled dace	*Rhinichthys osculus* spp. 6	N	P	--	Common segments 5 and 6; Oasis Valley alternative segments 1 and 3
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	--	G	LT	Schurz alternative segments 1 and 6; Department of Defense Branchline South
Amphibians and reptiles					
Amargosa toad	*Bufo nelsoni*	N	P	--	Oasis Valley alternative segments 1 and 3; common segments 5 and 6
Southwestern toad	*Bufo microscaphus*	N			Common segment 6
Desert tortoise (Mojave Desert pop.)	*Gopherus agassizii*	N	T	LT	Common segment 6
Chuckwalla	*Sauromalus ater*	N	--	xC2	Common segment 6
Birds					
Common loon	*Gavia immer*	--	P	--	Department of Defense Branchline South
Western snowy plover	*Charadrius alexandrinus nivosus*	N	P	LT*	Department of Defense Branchline South
Western least bittern	*Ixobrychus exilis hesperis*	N	P	xC2	Montezuma alternative segments 1, 2 and 3; common segment 5

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 3 of 5).

Common name	Species name	Status: BLM[b]	State[c]	FWS[d]	Portion of the Mina rail alignment where species could be found
Birds (continued)					
White-faced ibis	*Plegadis chihi*	N	P	xC2	Union Pacific Railroad Hazen Branchline; Department of Defense Branchline South; Mina common segment 1; Oasis Valleyalternative segments 1 and 3; common segment 6
Western burrowing owl	*Athenes cunicularia*	N		xC2	All
Flammulated owl	*Otus flammeolus*	N	P	--	None
California spotted owl	*Strix occidentalis occidentalis*	N	P	xC2	None
Greater sage-grouse	*Centrocercus urophasianus*	N	G	--	Union Pacific Railroad Hazen Branchline; Montezuma alternative segment 1
Western yellow-billed cuckoo	*Coccyzus americanus*		P	C	Montezuma alternative segments 2 and 3
Southwestern willow flycatcher	*Empidonax traillii extimus*		E	LE	Montezuma alternative segments 2 and 3; Oasis Valley alternative segments 1 and 3
Ferruginous hawk	*Buteo regalis*	N		xC2	Montezuma alternative segments 2 and 3; common segment 5
Swainson's hawk	*Buteo swainsoni*	N		--	Schurz alternative segment 2; Oasis Valley; common segment 6
Peregrine falcon	*Falco peregrinus*	N	E	NL	Oasis Valley; common segment 6
Bald eagle	*Haliaeetus leucocephalus*	N	E	Delisted 2007	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South
Loggerhead shrike	*Lanius ludovicianus*	N	S	xC2	All
Sage thrasher	*Oreoscotes montanus*	N	S	--	Oasis Valley; Montezuma alternative segments 2 and 3
Phainopepla	*Phainopepla nitens*	N		--	Oasis Valley; common segment 6
Brewer's sparrow	*Spizella breweri*	N	S	--	Oasis Valley; Montezuma alternative segments 2 and 3; common segment 6
Mammals					
Pygmy rabbit	*Brachylagus idahoensis*	N	G	xC2	Montezuma alternative segments 1 and 3
Pale kangaroo mouse	*Microdipidops pallidus*	--	P	--	Montezuma alternative segments 2 and 3
Dark kangaroo mouse	*Microdipodops megacephalus albiventer*	N	P	xC2	Montezuma alternative segments 2 and 3
Desert bighorn sheep	*Ovis canadensis*	N	G	--	Mina common segment 1; Montezuma alternative segments 2 and 3; Mina common segment 2; Bonnie Claire alternative segment 2; common segment 5; common segment 6

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 4 of 5).

Common name	Species name	Status BLM[b]	Status State[c]	Status FWS[d]	Portion of the Mina rail alignment where species could be found
Mammals (continued)					
Townsend's big-eared bat	*Corynorhinus townsendii*	N	S	--	Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; Oasis Valley alternative segments 1 and 3; common segment 6
Spotted bat	*Euderma maculatum*	--	T	xC2	Schurz alternative segments 1 and 4; Department of Defense Branchline South
Western red bat	*Lasiurus blossivillii*	N	S	--	Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segments 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
California myotis	*Myotis californicus*	N	--	--	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
Little brown myotis	*Myotis lucifugus*	N	--	--	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
Small-footed myotis	*Myotis ciliolabrum*	N	--	xC2	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; Goldfield alternative segment 4; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6
Fringed myotis	*Myotis thysanodes*	N	P	xC2	Union Pacific Railroad Hazen Branchline; Schurz alternative segments 1 and 4; Department of Defense Branchline South; common segment 6
Big brown bat	*Eptesicus fuscus*	N			All segments
Greater western mastiff bat	*Eumops perotis*	N	S	xC2	All segments
Allen's lappet-browed bat	*Idionycteris phyllotis*	N	P	xC2	All segments
Hoary bat	*Lasiurus cinereus*	N			All segments
Pallid bat	*Antrozous pallidus*		P		All segments
Silver-haired bat	*Lasionycteris noctivagans*	N			All segments
California leaf-nosed bat	*Macrotus californicus*	N	S	xC2	All segments
Long-eared myotis	*Myotis evotis*	N			All segments
Cave myotis	*Myotis velifer*	N		xC2	All segments
Long-legged myotis	*Myotis volans*	N			All segments

Table 3-133. Special status species potentially within the Mina rail alignment study area[a] (page 5 of 5).

Common name	Species name	Status			Portion of the Mina rail alignment where species could be found
		BLM[b]	State[c]	FWS[d]	
Mammals (continued)					
Yuma myotis	*Myotis yumanensis*	N			All segments
Western pipistrelle	*Pipistrellus hesperus*	N			All segments
Brazilian free-tailed bat	*Tadariada brasilliansis*	N	P		All segments

a. Source: DIRS 182061-Hopkins 2006, all.
b. BLM = U.S. Bureau of Land Management. Status definitions: N = designated sensitive by the BLM state office.
c. State = State of Nevada Protected Species (under NAC 503). Status definitions: G = game; P = protected; T = threatened; E = endangered; S = sensitive; CE = critically endangered plant; CY = state-protected cactus and yucca; CE# = recommended for listing as CE.
d. FWS = U.S. Fish and Wildlife Service. Status definitions: LE = listed endangered; LT = listed threatened; C = candidate, xC2= former Category-2 Candidate, now "species of concern;" NL = not listed (removed from list); * = not listed part of range that overlaps project.
e. Numbers refer to unnamed subspecies.

3.3.7.3.3.1 Threatened and Endangered Species. Table 3-133 identifies six federally listed fish and wildlife species, or candidates for listing, with the potential to occur along the Mina rail alignment, including two fish, one reptile, and three bird species. However, in 2007, the U.S. Fish and Wildlife Service de-listed the bald eagle and the golden eagle. These two species are protected under the Bald and Golden Eagle Protection Act, but are no longer federally listed (see Section 3.3.7.3.3.2). There are no federally listed mammals or plant species along the Mina rail alignment.

Fish The Lahontan cutthroat trout was listed as threatened in 1970 under the Endangered Species Act. This species is found in Walker Lake and its associated tributaries, including the Walker River up to the Weber Dam. Currently no Lahontan cutthroat trout are within the area proposed for the crossing of the Walker River due to the passage barrier of Weber Dam. In 2005 the Bureau of Reclamation completed the Record of Decision to repair and modify Weber Dam and include a fish passage structure. This structure is consistent with the recovery plan and will provide passage into the Walker River to the site where the rail line crossing would take place. The analysis for Lahontan cutthroat trout for the Mina rail alignment is based on the future foreseeable action of the Bureau of Reclamation's Record of Decision.

The Lahontan cutthroat trout is an inland subspecies of cutthroat trout belonging to the Salmonidae family. Life history characteristics are greatly influenced by stream conditions. Stream-dwellers generally live less than 5 years, and lake-dwellers live between 5 and 9 years. Lahontan cutthroat trout range between 25 and 38 centimeters (10 and 15 inches) in length, and feed on terrestrial and aquatic insects (DIRS 181900-USFWS 1995, p.22). Lahontan cutthroat trout, like other trout species, are found in a wide variety of cold-water habitats including large terminal alkaline lakes, such as Walker Lake. Generally, Lahontan cutthroat trout occur in cool flowing water with available cover, velocity breaks, well-vegetated and stable stream banks, and relatively silt free, rocky ***substrate*** in riffle-run areas. Spawning occurs in spring or early summer, the timing depending on stream flow and temperature.

Lacustrine Lahontan cutthroat trout populations have adapted to a wide variety of lake habitats from small alpine lakes to large desert waters.

The Railroad Valley springfish was listed as threatened in 1986 under the Endangered Species Act. The Railroad Valley springfish is the only fish species native to the thermal spring systems of Railroad Valley, Nye County, Nevada, and have been introduced into four other springs in Nevada. This species is typically found in warm spring pools, outflow streams, and adjacent marshes. Railroad Valley springfish have been documented to occur at the southernmost of two spring groups near Sodaville, Nevada. Railroad Valley springfish are uniquely adapted to survive in an environment of high water temperature (30° to 38° Centigrade [86° to 100° Fahrenheit] at the spring source) and low dissolved-oxygen content

(1.5 to 6.0 parts per million). In their natural environment, Railroad Valley springfish will occupy habitats with water temperatures at the extremes of their tolerance limits for limited amounts of time. There are no known springfish within the construction right-of-way or habitat that supports them that would be impacted by the Mina alignment.

Amphibians and Reptiles The desert tortoise, which is listed as threatened under the Endangered Species Act and by the State of Nevada (Mojave Desert population only), is found along the southern end of the Mina rail alignment from approximately Beatty Wash to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 57 to 72). The desert tortoise's range in this portion of Nevada extends approximately 16 kilometers (10 miles) north of Beatty near Springdale (DIRS 176649-Williams 2003, all). Approximately 48 kilometers (30 miles) of the rail alignment is within potentially suitable desert tortoise habitat (Figure 3-220). Mojave Desert tortoises are generally confined to warm, creosote bush and shadscale (*Atriplex confertafolia*) scrub habitats with well-drained sandy loam soils. These soils are composed of sand or sandy gravel that permit the tortoises to burrow and nest (DIRS 102475-Brussard et al. 1994, p.15). The area through which common segment 6 would pass and the location of the Rail Equipment Maintenance Yard are not designated as critical habitat for the desert tortoise. This area is primarily considered low-density for the desert tortoise, with the population of tortoises at a low level in relation to other areas within the range of this species in Nevada. There are 12 records of this species along common segment 6; the closest record is approximately 0.2 kilometer (0.12 mile) away from common segment 6, which is outside of the construction right-of-way (Figure 3-220).

Birds The southwestern willow flycatcher, listed as endangered under the Endangered Species Act, is potentially present in Nevada from May through September, where it breeds in dense riparian habitat. This species' preferred habitat is typically dominated by willows, cottonwood, or invasive tamarisk. Southwestern willow flycatchers have been documented to occur approximately 19 kilometers (12 miles) north of Beatty, near Oasis Valley (DIRS 182061-Hopkins 2006, all). This recorded occurrence was approximately 4.4 kilometers (2.7 miles) southwest of Oasis Valley alternative segment 1 and well outside the Mina rail alignment construction right-of-way. Potentially suitable foraging and roosting habitat exists along Schurz alternative segments 1 and 4, where it passes within 0.8 kilometer (0.5 mile) of the Walker River. The nearest documented occurrence of this species is approximately 4.5 kilometers (2.8 miles) away from Oasis Valley alternative segment 1, outside the construction right-of-way (DIRS 182061-Hopkins 2006, all). There is no suitable breeding habitat for southwestern willow flycatchers within the construction right-of-way and this species has not been documented within the construction right-of-way. The area with the greatest potential for southwestern willow flycatchers is the area where the new construction would be on the old rail roadbed and where the river crossings would require some of the trees and surrounding riparian vegetation to be removed. However, this habitat is marginal and only a small amount would be affected by construction.

The yellow-billed cuckoo is a federal ***candidate species*** under the Endangered Species Act. The nearest documented nest site for this species was recently located near the City of Caliente and approximately 260 kilometers (160 miles) east of the Mina rail alignment (DIRS 173227-Micone and Tomlinson 2000; DIRS 173228-Gallagher et al. 2001, p. 10; DIRS 173229-Furtek et al. 2002, p. 13-21; DIRS 173230-Furtek et al. 2003, p. 18-23; DIRS 173231-Furtek and Tomlinson 2003, p. 16-22). Yellow-billed cuckoos nest in tall cottonwood trees and willow riparian woodlands in the West and require patches of an average of 0.17 square kilometer (42 acres) of dense riparian habitat with at least 0.03 square kilometer (7 acres) of it closed canopy (DIRS 175505-Laymon and Halterman 1987, pp. 19-25). There is no suitable breeding habitat for yellow-billed cuckoos within the Mina rail alignment construction right-of-way. Potential suitable foraging and roosting habitat for this species is limited to riparian habitat along the Carson and Walker Rivers. These areas of riparian vegetation would not be disturbed during the construction phase. The lack of confirmed records for this species throughout Nevada and the lack of sufficient breeding habitat within the Mina rail alignment construction right-of-way suggest that it is highly unlikely that the yellow-billed cuckoo would occur within the project area.

3.3.7.3.3.2 BLM Special Status and State of Nevada Protected Species. The BLM State Office and the State of Nevada have identified a number of species as requiring conservation and protection. The BLM State Office designates species as sensitive and the State of Nevada designates species as protected. Many of the species designated as sensitive by the BLM are also designated as protected by the State of Nevada. Additionally, a few ***BLM-designated sensitive species*** and State of Nevada-designated protected species are also listed as threatened, endangered, proposed, or candidate under the Endangered Species Act. Federally listed species are addressed above in Section 3.3.7.3.3.1. Table 3-133 lists BLM-designated sensitive and State of Nevada-designated protected species and provides information on their status and known or potential locations along the Mina rail alignment. These species are described below by plant and animal categories.

Plants DOE performed field surveys in June 2006 to confirm the presence of BLM-designated sensitive species and to identify potential habitat for such species along the Mina rail alignment. Appendix H contains detailed survey information.

In addition to location records for BLM-designated sensitive species obtained from the Nevada Natural Heritage Program (DIRS 182061-Hopkins 2006, all), these species were passively observed in other locations with habitat characteristics of the species. Because the field surveys did not cover the entire construction right-of-way, and there is both seasonality to the presence or absence of visible signs of plants and annual variability among plant species, the fact that a BLM-designated sensitive species was not documented at a specific location does not indicate a definitive absence of the species.

Bodie Hills rockcress is found growing in dry, rocky granitic sites associated with sagebrush within pinyon-juniper and mountain sagebrush communities in the range of 2,048-3,039 meter (6,720-9,970 feet) elevations (DIRS 181868-NNHP 2001). This species' known population in Nevada is limited to Mineral county within the Walker River watershed (DIRS 182068-NatureServe 2007). Potential habitat for this species occurs within the Wassuk Range and White Mountains west of Schurz but is not found within the construction right-of-way.

The Eastwood milkweed has been documented approximately 8 kilometers (5 miles) east of Montezuma alternative segments 2 and 3, near Mud Lake (DIRS 182061-Hopkins 2006, all), outside the construction right-of-way. It is also known to occur west of Tonopah and north of Silver Peak, 4.6 kilometers (2.9 miles) east of Montezuma alternative segment 1. Typical habitat for this species consists of sandy soils in mixed desert shrub or salt desert scrub, and sagebrush from 1,400 to 2,150 meters (4,600 to 7,000 feet) elevation (DIRS 181869-NNHP 2001, all).

Typical habitat for Cima milkvetch includes dry, barren calcareous slopes at elevations ranging from 1,554 to 1,956 meters (5,100 to 6,416 feet) (DIRS 181870- NNHP 2001). There are several areas along the Mina rail alignment that support potential habitat for this species, including the Calico Hills within the Terrill Mountain Range on the Walker River Paiute Reservation (Schurz alternative segments 4 and 5) and the southeast-facing side of the Montezuma Mountain Range (Montezuma alternative segments 1 and 3). There is a documented occurrence about 7 kilometers (4 miles) east of Department of Defense Branchline South on the west side of Highway 95 (DIRS 182061-Hopkins 2006, all) but no occurrences within the construction right-of-way for all segments.

Sodaville milkvetch has a limited range in Nevada and is associated with moist, alkaline drainages within the *Sarcobatus* ssp. community type and is wetland-dependent (DIRS 181871-NNHP 2001). This species was proposed to be listed under the Endangered Species Act in 1992 but the proposal was withdrawn in 1998 due to insufficient evidence of its habitat being threatened, and because one population occurs

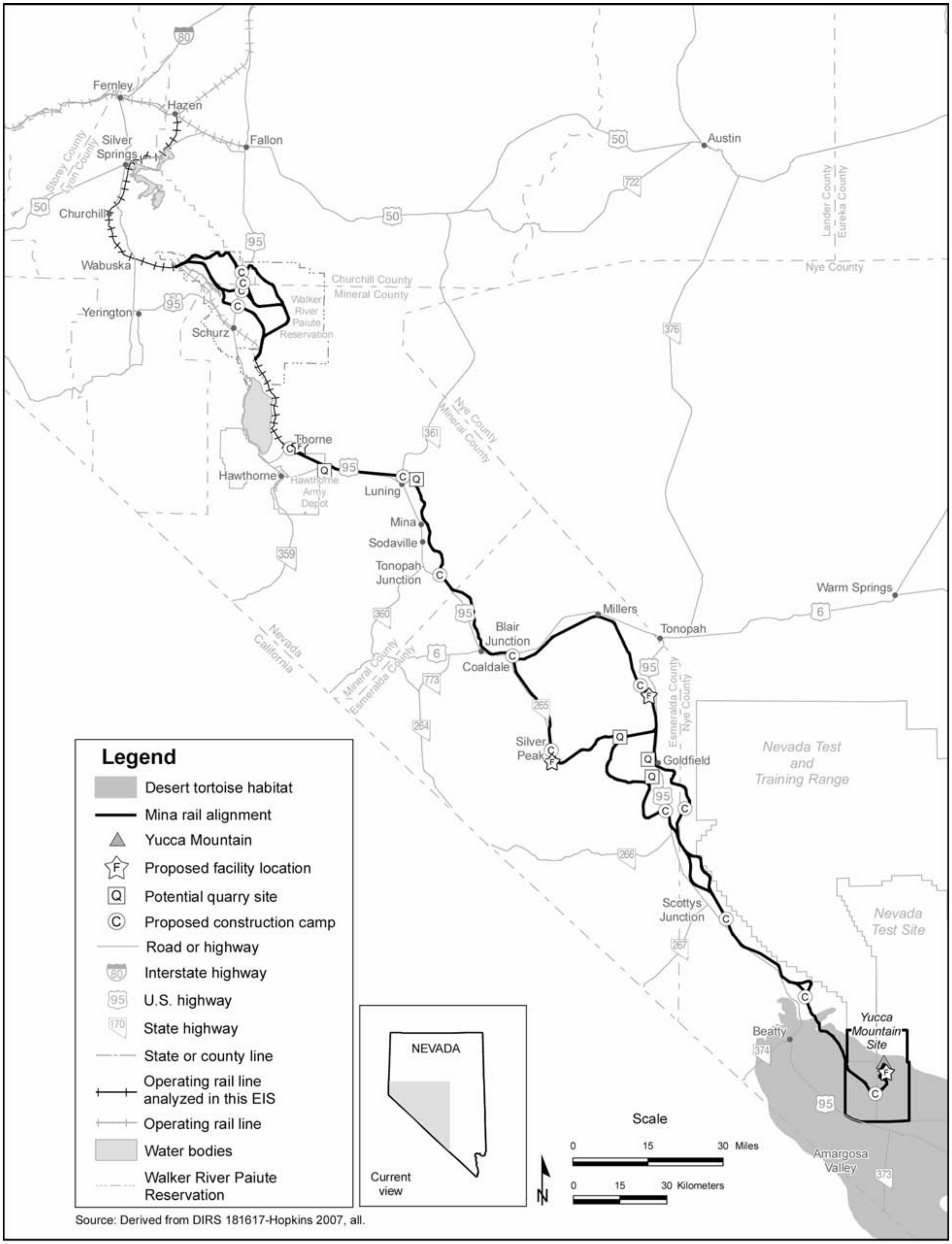


Figure 3-220. Estimated northern extent of potential desert tortoise habitat in relation to the Mina rail alignment.

within lands designated as wilderness, where potential threats are minimized (Death Valley National Monument (*Endangered and Threatened Wildlife and Plants; Withdrawal of Proposed Rule to List the Plants Astragalus Lentiginosus var. micans (shining milk-vetch) and Astragalus Lentiginosus var. sesquimetralis (Sodaville milk-vetch) as Threatened* [63 *FR* 53631, October 6, 1998]). One population has been documented near Sodaville, 2.5 kilometers (1.5 miles) west of Mina common segment 1 (DIRS 182061-Hopkins 2006, all) outside the construction right-of-way. Habitat for this population is associated with Soda Springs.

The black woollypod has been observed approximately 6 kilometers (4 miles) east of U.S. Highway 95, near Beatty Wash (Figure 3-216). The closest occurrence to the alignment is 240 meters (790 feet) southeast of the centerline of common segment 6, within the construction right-of-way. Field surveys along common segment 6 in Beatty Wash confirmed the presence of this species. This plant is common locally on very steep, gravelly slopes of light-colored volcanic tuff in the area where there is little competition from other species. Habitat for this species is characterized by open, talus, or gravelly slopes on alluvium soils composed of volcanic tuff around 975 to 2,340 meters (3,200 to 7,700 feet) elevation (DIRS 181872-NNHP 2001).

Tiehm buckwheat is known to occur within a small distribution range in Nevada in the Silver Peak Range. This species' preferred habitat consists of light-colored clay soils on steep slopes within the *Atriplex confertifolia* community type (DIRS 181873- NNHP 2001). Potential habitat occurs on the slopes within Soda Spring Valley, in the vicinity of Mina common segment 1. However, there are no documented occurrences of this species within the study area or construction right-of-way.

The Dune sunflower is dependent on stabilized vegetated sand dunes or deep, loose sand on flats or slopes, associated with *Tetradymia* ssp. and *Sarcobatus* ssp. community types (DIRS 182786-NNHP 2001). This species has been found just north of the Terrill Mountains, 1.8 kilometers (1 mile) north of Schurz alternative segment 6 and 0.8 kilometer (0.5 mile) southwest of Schurz alternative segment 1. Potential habitat for this species occurs throughout the Mina rail alignment construction right-of-way where deep sandy soils and sand dunes are present, but no species were found.

Oryctes is dependent on sand dunes or deep, loose sand within washes or flats and is associated with various salt desert shrubs (DIRS 181874-NNHP 2001). This species is widely distributed in Nevada but population density at known locations were found to be low (DIRS 181883- NatureServe 2006). Potential habitat occurs on the eastside of Walker Lake at the base of the Agai Pah Hills. There is a known occurrence just northeast of Walker Lake about 4 kilometers (2.5 miles) from Department of Defense Branchline South, and another occurrence 1.4 kilometers (0.8 mile) northeast of Department of Defense Branchline South and 1.2 (0.7 mile) kilometers northwest from the proposed Hawthorne Staging Yard. An additional occurrence is located within Soda Spring Valley, 0.5 kilometer (0.3 mile) from Mina common segment 1 (DIRS 182061-Hopkins 2006, all).

Nevada dune beardtongue is known to occur within sandy soils associated with *Sarcobatus vermiculatus* and *Atriplex canescens* at elevations between 1,195 to 1,817 meters (3,920 to 5,960 feet) (DIRS 181875-NNHP 2001). Potential habitat for this species occurs throughout the proposed Mina rail alignment construction right-of-way, primarily within the areas associated with Mina common segment 1 and Montezuma alterative segments 2 and 3. It has been documented 0.8 kilometer (0.5 mile) west of common segment 5 (DIRS 182061-Hopkins 2006, all).

Potential habitat for the Pahute Mesa beardtongue occurs within juniper-pinyon or sagebrush communities at elevations between 1,634 to 2,512 meters (5,360 to 8,240 feet) in rocky or loose soils (DIRS 181876- NNHP 2001). This species is known to occur within the Montezuma Range, 5.5 kilometers (3.4 miles) from Montezuma alternative segments 1 and 3 (DIRS 182061-Hopkins 2006, all).

Wassuk beardtongue potential habitat occurs within the entire Mina rail alignment. This species prefers rocky to gravelly soils with ephemeral washes, roadsides, and recently disturbed areas (DIRS 181877-NNHP 2001). This species is documented within the east side of the Wassuk Range. The closest recorded occurrence is 6.8 kilometers (4.2 miles) from the Department of Defense Branchline South (DIRS 182061-Hopkins 2006, all). However, several barriers (preventing population expansion and any potential impacts) occur between the rail alignment and this occurrence, including Walker Lake and Highway 95.

Mono County phacelia is typically found within sparsely vegetated disturbed soils or road berms associated with alkaline or clay-like soils at elevations between 1,804 to 2,760 meters (5,920 to 9,055 feet). Documented populations occur within the Wassuk Range (DIRS 181873-NNHP 2001). However, there are no documented occurrences of this species within the study area or construction right-of-way.

Lone Mountain tonestus or granite serpent weed grows within crevices or rock outcrops of granite at high elevations, 2,377 meters (7,800 feet), in the pinyon-juniper zone (DIRS 181878- NNHP 2001). One occurrence has been documented within the Weepah Hills, south of Montezuma alternative segments 2 and 3, and north of Montezuma alternative segment 1, but these occurrences are outside of the study area. There is potential habitat for this species within the Montezuma Peak area within the study area of Montezuma alternative segments 1 and 3, but no individuals were observed within the construction right-of-way during the 2006 and 2007 field surveys.

As defined in Section 3.3.7.3.3, special status species are species that are afforded some level of protection or special management under federal or state laws or regulations. As such, all cacti and yucca are considered special status because they are protected by the State of Nevada and the BLM. All cacti, yucca, and Christmas trees have special consideration under Nevada Revised Statutes Section 527.050, and are protected from unauthorized removal. Removal or possession of any cactus, yucca, or Christmas tree for commercial purposes on any state, county, or privately owned lands is regulated by the State Forester Fire Warden. Removal of such species from private lands would require a permit requisition from the State Forester Fire Warden. DOE would salvage cacti and yucca in accordance with this law and the requirements of applicable land management agencies during the construction phase. Stipulations for salvage are outlined in BLM Manual 6840, *Special Status Species Management* (DIRS 172901-BLM 2001).

Invertebrates The Oasis Valley pyrg, a snail, is known to occur in the Amargosa River drainage in Oasis Valley. Specifically, this snail has been documented to occur in an unnamed spring near Fleur de Lis Spring 12 kilometers (7.5 miles) from the community of Springdale (see Figure 3-220) (DIRS 104593-CRWMS M&O 1999) and potentially inhabits other springs in the Amargosa River drainage. It has been documented to occur approximately 2 kilometers (1.2 mile) southeast of the Oasis Valley alternative segment 1 (DIRS 182061-Hopkins 2006, all). This snail inhabits small springs and stream outflows where it is typically found on stone, travertine, watercress, and plant debris (DIRS 175029-NatureServe Explorer 2005, all).

The larval host plant for the colonial early blue butterfly is wild buckwheat (*Eriogonum* spp.) (DIRS 182785-UC Davis). The closest documented occurrence of this colonial butterfly is approximately 10.5 kilometers (6.5 miles) west of Department of Defense Branchline South (DIRS 182061-Hopkins 2006, all).

In Nevada, the White Mountains Icarioides blue is currently known from Esmeralda and Mineral counties (DIRS 181845- NatureServe 2007) where it feeds primarily on lupine (*Lupinus* spp.). The closest documented occurrence of this rare butterfly is approximately 7.9 kilometers (5 miles) from Mina common segment 1 (DIRS 182061-Hopkins 2006, all).

Fish The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near Springdale and Beatty, approximately 3 kilometers (1.8 mile) southeast from Oasis Valley alternative segment 1 (see Figure 3-220). This subspecies has a very limited range and is only known from the watershed in Oasis Valley. Specific distribution of this fish varies with available water.

Amphibians and Reptiles The Amargosa toad is found in or near riparian habitats associated with the Amargosa River drainage (Oasis Valley) and at Fleur de Lis Spring, Crystal Spring, Indian Spring, and other springs and seeps near the towns of Springdale and Beatty (DIRS 174414-Stebbins 2003, pp. 209 and 210; DIRS 104593-CRWMS M&O 1999, p. 3-20). Vegetation bordering this toad's habitat includes cottonwood trees, cattails, and sedges. Adult toads hide and rest under bushes and in rodent burrows, and generally hibernate from November to March. If moist soil is available, open water might not be necessary for the adult toad to survive (DIRS 176795-BLM n.d.). The nearest documented occurrence of this species is approximately 2.7 kilometers (1.7 miles) away from Oasis Valley alternative segment 1. This species has also been documented along common segment 6 (DIRS 182061-Hopkins 2006, all).

The chuckwalla has been documented in the southeastern foothills of Yucca Mountain, adjacent to common segment 6. This area represents the chuckwalla's northern-most range in southern Nevada. This large lizard is typically found among talus slopes, large rocky outcrops and boulders, which provide cover and basking sites (DIRS 174414-Stebbins 2003, p. 269-270). This species has not been documented within the study area.

Birds Western burrowing owls are known to occur throughout the Mojave and Great Basin Deserts (DIRS 176455-Dickinson 1999, p. 256). DOE identified one burrowing owl burrow, which appeared to be active, near the Mina rail alignment in the vicinity of Yucca Mountain. Typical burrowing owl habitat is characterized by well-drained, level-to-gently sloping areas in arid or semi-arid environments. This species has been known to overwinter throughout Nevada; however, they are predominantly encountered during their breeding season from mid-March through September (DIRS 176361-Klute et al. 2003, p. 1-12).

Bald eagles almost exclusively occupy habitat associated with large bodies of water during the breeding season, but occasionally use upland areas for food and roost sites. They usually nest in tall trees and they feed opportunistically on fish, waterfowl and seabirds, various mammals, and carrion. In the winter, bald eagles preferentially roost in large, shelter-providing trees (DIRS 180967-NatureServe 2006, all). Nevada's only nesting pair of bald eagles has been documented at the Lahontan Reservoir and approximately 0.97 kilometer (0.6 mile) east of the existing Union Pacific Hazen Branchline (DIRS 181844-Jeffers 2007). In addition to using the Lahontan Reservoir, this species is likely to forage in the Carson and Walker Rivers and Walker Lake and Weber Reservoir.

Ferruginous hawks have been reported to occupy and, in some cases, nest in areas adjacent to the Mina rail alignment (DIRS 174519-Bennet 2005, plate 5). The ferruginous hawk is a relatively rare breeder in the study area. This species prefers to nest in trees; however, in Nevada tall trees are scarce, so the species is often found in pinyon-juniper associations or occasionally on shrubs or rocks on the ground. Potentially suitable habitat for this species is present in higher elevation woodlands near Montezuma alternative segments 1 and 3. No ferruginous hawks or nests were observed during the 2005 or 2006 field surveys, although they have been previously reported in the area.

Peregrine falcons are found in a wide variety of habitats during the breeding season, from tundra, moorlands, steppe, and seacoasts to mountains, open forested regions, and human population centers. They typically nest on rocky cliffs. Outside the breeding season, the falcons occur in areas where prey (primarily birds) concentrate, including farmlands, marshes, lakeshores, river mouths, tidal flats, dunes and beaches, broad river valleys, cities, and airports (DIRS 180966- NatureServe 2006, all). There is potential nesting habitat for peregrine falcons on cliffs throughout the Mina rail alignment but outside the construction right-of-way for all segments.

Loggerhead shrikes have been documented along the Mina rail alignment where suitable habitat is present. Habitat used by this species during the breeding season includes open country with scattered trees and shrubs, savanna, desert scrub (southwestern U.S.) and, occasionally, open woodlands (DIRS 180963- NatureServe 2006, all). They typically nest in thick brush, shrubs, or small trees in open areas. Potentially suitable habitat for loggerhead shrikes occurs along all segments of the Mina rail alignment.

Sage thrashers are known to occur in sagebrush habitat within the Mina rail alignment construction right-of-way. Habitat for this bird species consists of large stands of sagebrush, which can be found in areas where the rail alignment would cross mountain ranges, including the Blow Sand Mountains, Wassuk Range, Clayton Ridge, Goldfield Hills, and Montezuma Range. There is potential sagebrush habitat within the Railroad Valley.

Phainopepla is known to occur in the southern portion of the Mina rail alignment at Oasis Valley and common segment 6. This species inhabits desert scrub and desert woodland habitats (DIRS 176455-Dickinson 1999, p. 364).

Brewer's sparrows are strongly associated with sagebrush over most of their range, in areas with scattered shrubs and short grass (DIRS 180959- NatureServe 2006, all). Sagebrush habitat can be found in areas where the rail alignment would cross mountain ranges, including Blow Sand Mountains, Wassuk Range, Clayton Ridge, Goldfield Hills, and Montezuma Range. Brewer's sparrows are likely to occur in sagebrush habitat within the Mina rail alignment construction right-of-way.

Mammals The State of Nevada classifies desert bighorn sheep as a game species. As further discussed in Section 3.3.7.3.5, the State of Nevada manages the desert bighorn sheep as a game species throughout the state.

The pygmy rabbit (*Brachylagus idahoensis*), a small sagebrush-dependent rabbit, is well distributed throughout the Great Basin; however, overall the populations tend to be locally clustered in areas of high-density sagebrush, which they use for both cover and food. Field surveys did not indicate the presence of pygmy rabbit habitat in the study area of the Mina rail alignment (DIRS 174519-Bennett 2005, Plate 3). The nearest documented sign (scat) of a pygmy rabbit is from the Kawich Range in Nye County and more than 120 kilometers (75 miles) east of the Mina rail alignment study area (DIRS 181899-USAF 2007, pp. 50 and 51. There is no known suitable pygmy rabbit habitat within the construction right-of-way or study area of the Mina alignment.

The dark kangaroo mouse and the closely related pale kangaroo mouse are known to occur in appropriate habitat near Goldfield (DIRS 174519-Bennett 2005, plate 1 and 2). Habitat for these two mice species is characterized by alkali (salt) sinks and desert scrub dominated by shadscale or big sagebrush. These rodents usually prefer soft sand accumulated at bases of shrubs for burrow sites (DIRS 176370-O'Farrell and Blaustein 1974, p. 1-2; DIRS 176372-O'Farrell and Blaustein 1974, p. 1).

There are 23 species of bats in Nevada. In general, bats are highly mobile and all of the 23 species could at some time of the year fly over or, if appropriate habitat exists, roost and forage near the Mina rail alignment. Twenty-one of the 23 species of bats that occur in Nevada are considered BLM-sensitive (DIRS 172900-BLM 2003, p. 2) and nine are State of Nevada protected. Of these bat species, seven have a strong probability of utilizing habitat along the rail alignment (DIRS 181865-Bradley et al. 2006), as follows:

- Pallid bat
- Townsend's big-eared bat
- Small-footed myotis bat
- Western pipistrelle bat

- Big brown bat
- California myotis bat
- Brazilian free-tailed bat

All of these bat species are commonly found throughout the Mojave and southern Great Basin Deserts. These species are known to roost in cliff faces, caves, rocky outcrops, and man-made structures where available. Bats are also known to forage over natural or artificial water sources.

3.3.7.3.4 Migratory Birds

More than 300 species of birds are commonly observed in southern Nevada, including year-round residents, seasonal migrants that breed in southern Nevada, winter residents that breed in the north, and seasonal migrants that pass through southern Nevada while traveling in spring and fall between breeding ranges to the north and winter ranges to the south. All of the migratory birds found along the Mina rail alignment are protected under the Migratory Bird Treaty Act (16 U.S.C. 703 *et seq*.) and Executive Order 13186. Appendix H, Table H-4, lists bird species that could occur in the construction right-of-way.

3.3.7.3.5 State of Nevada Game Species

The Mina rail alignment would cross several areas designated as game habitat (DIRS 173224-BLM 1997, Maps 9-13; DIRS 174518-BLM 2005, Maps 3.6-1 to 3.6-4). As shown in Table 3-133, three game species that occur, or have the potential to occur, within or near the construction right-of-way are cross-listed as BLM-designated sensitive, are state protected, or both. The game species that are also BLM-designated sensitive include greater sage-grouse, pygmy rabbit, and desert bighorn sheep. The Nevada Department of Wildlife actively manages the desert bighorn sheep as a big game animal. Its distribution is shown on Figure 3-221. Other game species that could be affected by the proposed railroad construction and operation include mule deer, pronghorn antelope, and mountain lion. Figures 3-222 and 3.3.7-28 indicate the general habitat locations for mule deer and pronghorn antelope, respectively. Mountain lions occur throughout the State of Nevada in canyon, mountain, and forested areas; therefore, no distribution map is included for this species.

3.3.7.3.5.1 Desert Bighorn Sheep. Desert bighorn sheep are found predominantly in lower foothills and grasslands of mountain ranges, often where terrain is rough, rocky and steep, and broken up by canyons and washes. Desert bighorn sheep require access to freestanding water, especially during the summer, and distribution of water holes significantly influences patterns of home-range movement (DIRS 176363-Shackleton 1985, p. 4). Any natural or artificial water sources within this species' range could be subject to desert bighorn use. Year-round habitat for this species is found throughout much of the Mina alignment from south of Schurz to the Yucca Mountain Site. Common segment 6 would cross a ***movement corridor***, or an area of high use at certain times of the year, in the Beatty Wash area (Figure 3-221). The Mina rail alignment does not cross any crucial habitat for this species.

3.3.7.3.5.2 Mule Deer. Mule deer are fairly common in southern Nevada and throughout the western United States, and are found in a variety of habitats from coniferous forests at high elevations to desert shrub, chaparral, and grasslands at lower elevations (DIRS 176454-Whitaker 1992, p. 652). Mule deer are often associated with successional vegetation, especially near agricultural lands. Mule deer are found along the entire Mina rail alignment (Figure 3-222), but would most likely be encountered near the communities of Wabuska and Silver Peak. The rail alignment would not cross any mule deer crucial habitat.

3.3.7.3.5.3 Pronghorn Antelope. Most of the Mina rail alignment would abut year-round pronghorn antelope habitat located east of the rail alignment from Schurz to Beatty (Figure 3-223). The only areas of the rail alignment that would cross year-round pronghorn habitat would be between Churchill and Wabuska and also between Mills and Goldfield. Pronghorn antelope are generally found at lower elevations in open desert grasslands, salt desert scrub, or bunchgrass-sagebrush vegetation in the valleys and foothills throughout the western United States. This species also occurs in dense sagebrush communities at higher elevations during the breeding season (DIRS 176454-Whitaker 1992, pp. 662 and 663). The Nevada Department of Wildlife did not identify these areas as pronghorn antelope augmentation sites.

3.3.7.3.5.4 Mountain Lion. Mountain lions occur throughout the State of Nevada in low numbers in canyon, mountainous, and forested areas (DIRS 103439- Hall 1995, pp. 269 to 271) and are known to occur within the study area of the Mina rail alignment. Adult mountain lions are generally tawny in color with a white underbelly and are approximately 6 to 8 feet long (DIRS 103439- Hall 1995, pp. 269 to 271). The mountain lion's diet consists mostly of deer; however, they will also feed on rabbits and large rodents. This species is shy, solitary, secretive, and active mostly at night (DIRS 103439-Hall 1995, pp. 269-271).

Section 3.3.7.3.5 provides more information on this species and the other game mammals present in the study area.

3.3.7.3.6 Wild Horses and Burros

Wild horses are generally presumed to descend from horses that were released by, or escaped from, settlers of western North America, possibly dating as far back as Spanish settlers in the 1600s. The size, color, and confirmation of the horses depend on the type of stock or breed from which the wild horses descended (DIRS 174518-BLM 2005, p. 3.8-1).

Generally, burros live in the lower elevations year-round, while wild horses reside in the higher elevations in summer and migrate to the lower elevations in winter. Both wild horses and burros will travel as far as 16 kilometers (10 miles) away from permanent water sources. Their diets vary–burros prefer shrubs, horses tend to prefer grasses (DIRS 103079-BLM 1998, p. 3-48).

Wild horse herd areas were originally identified by federal agencies in 1971, with passage of Public Law 92-195, the Wild Free-Roaming Horses and Burros Act. The BLM has delineated herd management areas within the wild horse herd areas. Each herd management area has an appropriate management level determined by the BLM through a rangeland assessment and a public review process. The appropriate management level is the number of wild horses and burros the herd management area population is managed to, and it is established to avoid the ecological degradation of the herd management area and any riparian areas within each herd management area (DIRS 176364-State of Nevada [n.d.], all)

The Mina rail alignment would cross approximately 7 designated wild horse and burro herd management areas (Figure 3-214). Appendix H provides detailed information on the individual herd management areas. Table 3-134 identifies each Mina rail alignment alternative segment and common segment that would cross or lie within herd management areas and describes the location, size, and management level of each herd management area.

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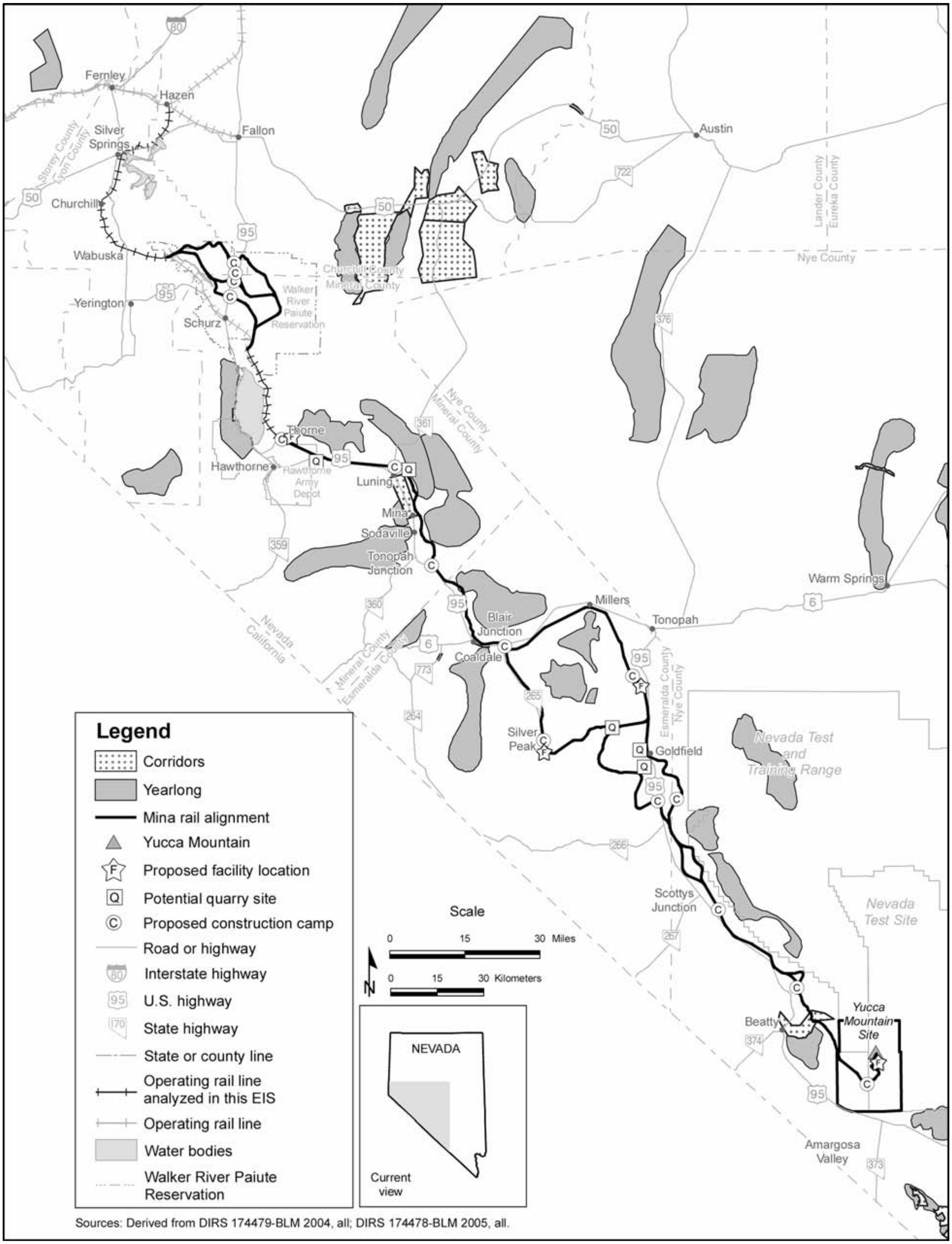
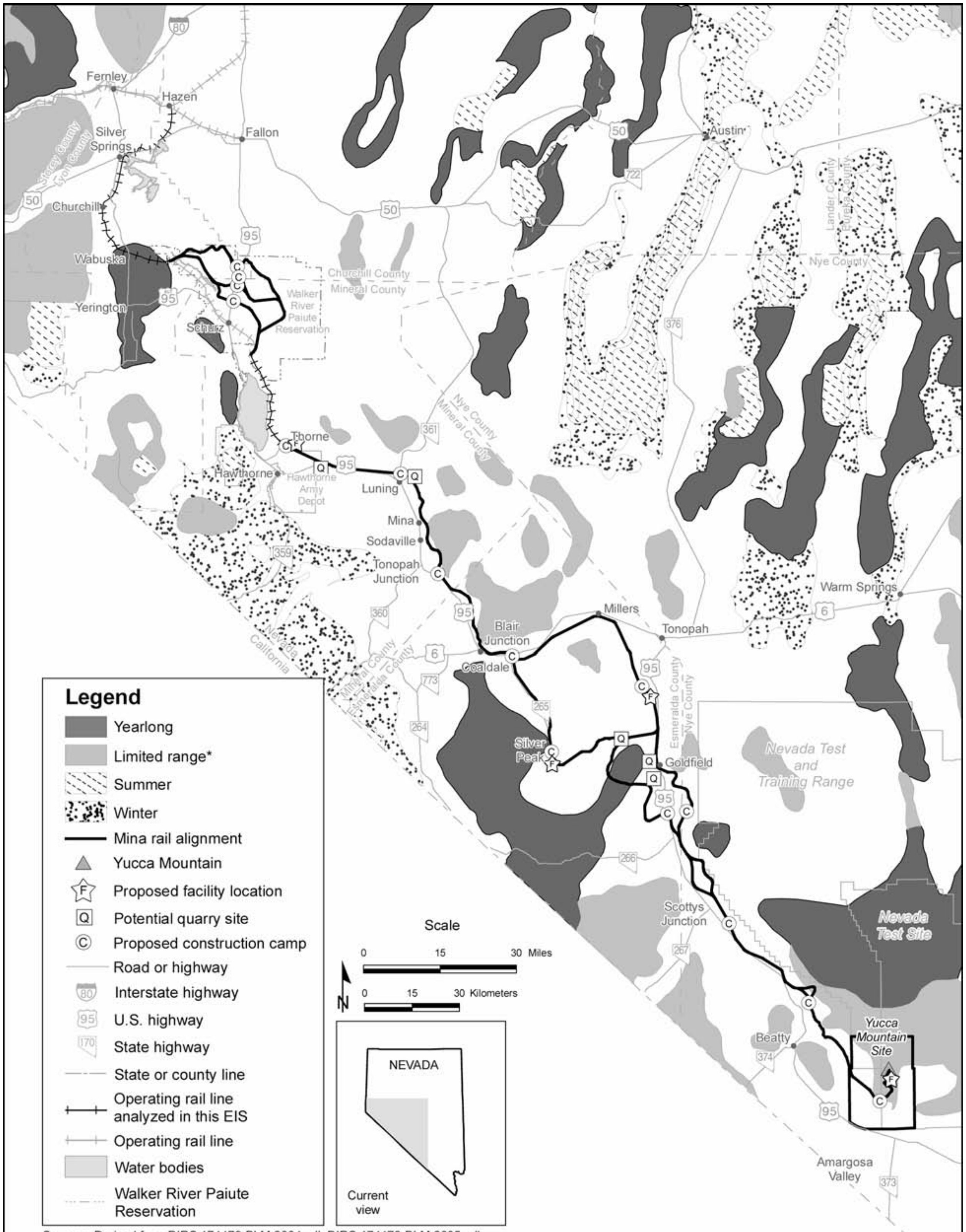


Figure 3-221. Desert bighorn sheep habitat along the Mina rail alignment.



Sources: Derived from DIRS 174479-BLM 2004, all; DIRS 174478-BLM 2005, all.
* Limited range is habitat that is occasionally inhabited and/or contains small populations of mule deer.

Figure 3-222. Mule deer habitat along the Mina rail alignment.

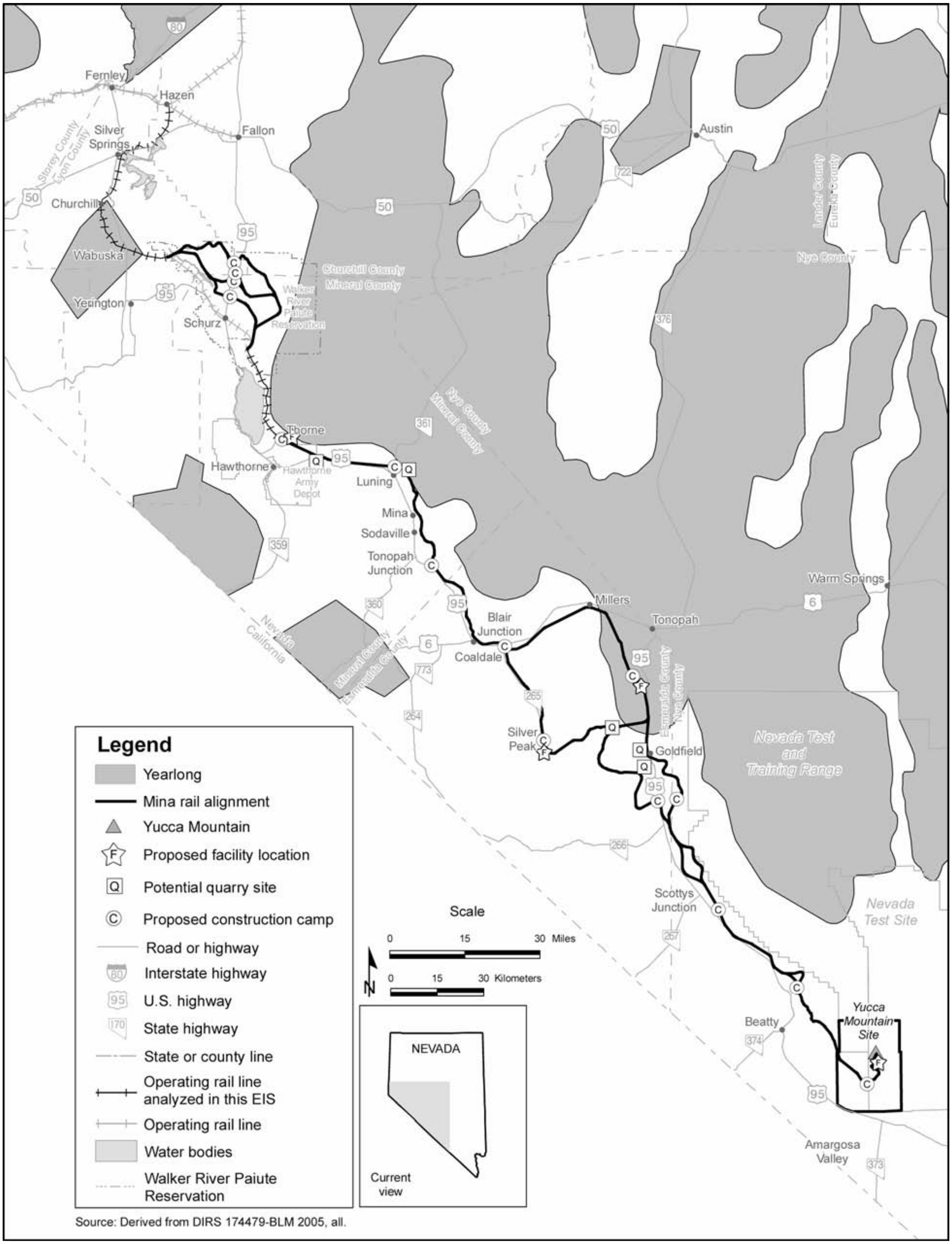


Figure 3-223. Pronghorn antelope habitat along the Mina rail alignment.

Table 3-134. Herd management areas the Mina rail alignment would cross.[a]

Herd management area	Location[b]	Area (square kilometers)[c]	Appropriate management level	Segment that would cross area
Horse Mountain	North of Schurz	193	0	Schurz alternative segment 6
Pilot Mountain	North-northeast of U.S. Highway 95, from Thorne to Blaire Junction	1,937	346 horses 0 burros	Mina common segment 1
Silver Peak	East of Silver Peak	970	61 horses 15 burros	Montezuma 1
Goldfield	East of Goldfield	260	125 horses 50 burros	Montezuma 2
Montezuma Peak	West of Goldfield	310	146 horses 10 burros	Montezuma alternative segments 1, 2, and 3
Stonewall	West of Lida Junction and south of Goldfield	100	50 horses 25 burros	Mina common segment 2; Bonnie Claire alternative segments 2 and 3
Bullfrog	Surrounds Beatty	520	12 horses 185 burros	Oasis Valley alternative segments 1 and 3; common segment 6

a. Sources: DIRS 174047-Bennett 2005; DIRS 174046-Bennett 2005; DIRS 174479-BLM 2003; DIRS 174478-BLM 2005; DIRS 174329-BLM n.d.; DIRS 174333-BLM n.d.; DIRS 174332-BLM n.d.; DIRS 174330-BLM n.d.; DIRS 173064-BLM 2007; DIRS 173063-BLM 2005; DIRS 173062-BLM 2005; DIRS 173061-BLM 2005; DIRS 173060-BLM 2005; DIRS 173059-BLM [n.d.]; DIRS 173057-BLM 2005; DIRS 174518-BLM 2005, DIRS 181843 Axtell 2007.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert square kilometers to acres, multiply by 247.10.

3.3.8 NOISE AND VIBRATION

This section describes existing noise and vibration in the Mina rail alignment region of influence. Section 3.3.8.1 describes the region of influence; Section 3.3.8.2 describes general regional characteristics for noise and vibration; and Section 3.3.8.3 describes the existing noise and vibration in more detail for the Mina rail alignment alternative segments and common segments.

Noise is considered a source of pollution because it can be a human health hazard. Potential health hazards range from hearing impairment at very high noise levels to annoyance at moderate to high noise levels. Sound waves are characterized by frequency and measured in ***hertz***; sound pressure is expressed as ***decibels*** (dB). Appendix I, Noise and Vibration Assessment Methodology, provides more information on the fundamentals of analyzing noise.

With the exception of prohibiting nuisance noise, neither the State of Nevada nor local governments have established numerical noise standards. Nevertheless, many federal agencies use ***day-night average noise levels*** (DNL) as guidelines for land-use compatibility and to assess the impacts of noise on humans.

> **Day-night average noise level (DNL):** The energy average of A-weighted decibels (dBA) sound level over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the day.
>
> **A-weighted decibels (dBA):** A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

For the operation of trains during proposed railroad construction and operations, DOE analyzed noise impacts under established STB criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by DNL of 3 ***A-weighted decibels*** (dBA) or more.
- An increase to a noise level of 65 DNL or greater.

If the estimated noise level increase at a location exceeds either of these criteria, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, current noise research indicates that both criteria components must be met to cause an adverse impact from noise (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more for an adverse noise impact to occur.

There are three potential ground-borne vibration (vibration propagating through the ground) impacts of general concern: annoyance to humans, damage to buildings, and interference with vibration-sensitive activities. To evaluate potential impacts of vibration from construction and operations activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded 80 VdB (human annoyance criterion for infrequent events) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inches per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be an impact from vibration (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

3.3.8.1 Region of Influence

Ambient noise: The sum of all noise (manmade and natural) at a specific location over a specific time is called ambient noise.

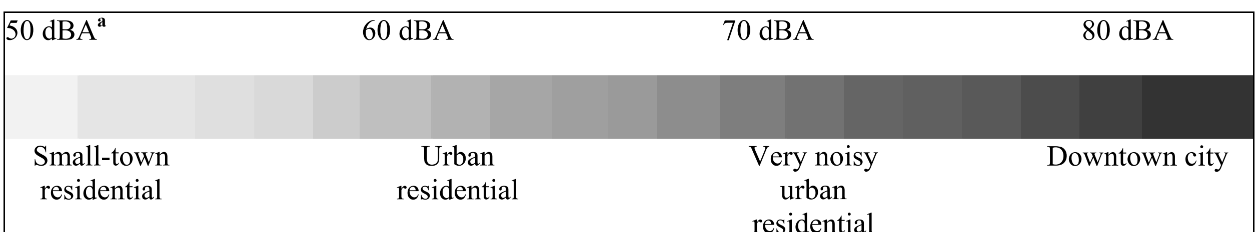
The region of influence for noise and vibration for construction and operation of a rail line along the Mina rail alignment includes the construction right-of-way out to variable distances, depending on several analytical factors (***ambient noise*** level, train speed, number of trains per day, and number of railcars). Similarly, the region of influence for the railroad construction and operations support facilities depends on the magnitude of noise that would be generated and ambient noise levels, which would affect how far away the noise might be heard.

The region of influence for the Mina rail alignment also includes the existing Union Pacific Hazen Branchline from Hazen to Wabuska and the existing Department of Defense Branchlines (North, through Schurz, and South) from Wabuska to Hawthorne. These existing rail lines are included in the region of influence because under the Proposed Action, rail traffic on these lines would increase substantially above existing levels. STB regulations at 49 CFR Part 1105.7(e)(6) require analysis of potential noise impacts where a proposed action would result in an increase in rail traffic of at least 100 percent (measured in gross ton miles annually).

In areas with low ambient noise conditions along the Mina rail alignment, project-related noise might be heard farther away. Therefore, the region of influence varies along the rail alignment. In addition, DOE has reviewed recent aerial photographs along the entire rail alignment to identify the locations of receptors in the region of influence that might be affected by noise, vibration, or both.

3.3.8.2 General Regional Characteristics for Noise and Vibration

The Mina rail alignment is primarily in a quiet desert environment where natural phenomena such as wind, rain, and wildlife account for most of the ambient noise. Manmade noise in some areas of the region of influence is caused by vehicles traveling along public highways and high altitude commercial jets. At present, there is train activity on the existing Union Pacific Hazen Branchline from Hazen to Wabuska and on the existing Department of Defense Branchline from Wabuska to Hawthorne. Baseline noise conditions vary somewhat along the rail alignment and are site-specific. Most of the region of influence for the Mina rail alignment is typical of other desert environments in which the DNL values range from 14 decibels on a calm day to 38 decibels on a windy day (DIRS 102224-Brattstrom and Bondello 1983, p. 170). Areas within the region of influence are sparsely populated and, in general, ambient noise levels are low. The noise level at a specific location depends on nearby and distant sources of noise. Noise levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation noise (Figure 3-224).



a. dBA = A-weighted decibels.
b. Source: DIRS 101821-EPA 1974, p. 23.

Figure 3-224. Typical DNLs for residential areas.[b]

Ground-borne vibration occurs as a result of both natural phenomena (such as seismic activity) and manmade activities (such as construction and transportation activities). Human activities that can create perceptible levels of ground-borne vibration are important when sensitive sites, structures, or activities could be affected. Background vibration exists as a component of the overall effects of ground-borne vibration, higher in areas with more human activity, lower in areas more distant from human activities. Vibration levels in populated areas tend to be higher than in unpopulated areas because of human activity and higher levels of transportation vibration. Background levels of ground-borne vibration along the Mina rail alignment are low.

3.3.8.3 Existing Environments for Noise and Vibration at Four Measurement Locations along the Mina Rail Alignment

DOE evaluated existing noise and vibration conditions along the Mina rail alignment and compiled the detected ranges of noise and vibration levels at different locations under different conditions. Up to four trains per week travel on the existing track in Silver Springs and two trains per week in Schurz. Locomotive horns are currently sounded at three grade crossings in Silver Springs. Because existing rail traffic volume is low, DOE measured existing noise and vibration to represent existing conditions. Most of the region of influence for the rail alignment is sparsely populated and, in general, ambient noise levels are low and there are no detectable vibrations. DOE measured ambient noise and vibration levels from March 5 to March 6, 2007, at two locations along the Mina rail alignment (Silver Peak and Mina) and two locations along the existing Union Pacific Hazen Branchline and Department of Defense Branchlines (Schurz and Silver Springs). DOE had also taken ambient noise and vibration measurements at Goldfield on January 12, 2005. DOE selected these locations for ambient noise and vibration measurements because they are representative of the few populated areas within the region of influence. The ambient noise measurements at these representative locations along the rail alignment ranged from 34 to 48 DNL and ambient vibration levels were so low that they were essentially unmeasurable for Silver Springs, Schurz, Mina, and Silver Peak. The measured ambient vibration level in Goldfield was 25 VdB. Table 3-135 summarizes the measured ambient noise levels in Goldfield, Silver Peak, Mina, Schurz, and Silver Springs.

Table 3-135. Ambient noise measurements along the Mina rail alignment.

Location	DNL dBA[a]
Silver Springs	47
Schurz	48
Mina	44
Silver Peak	34
Goldfield	47

a. DNL dBA = day-night average noise level in A-weighted decibels.

3.3.8.3.1 Silver Peak

DOE took noise measurements for a 24-hour period in Silver Peak, Nevada, on March 5, 2007. The measured DNL was 34 dBA. Because there was almost no observable human activity in this area during the measurements, noise levels were very low. Measured noise levels at Silver Peak are substantially lower than the "small-town residential" category shown on Figure 3-224.

Figure 3-225 shows measured noise levels taken at Silver Peak over a 24-hour period. Hourly ***equivalent sound levels*** ranged from 17 to 39 dBA. There was little observable human activity during the measurements, except for very infrequent car passbys and occasional high-altitude commercial jet aircraft. Figure 3-226 shows the location where DOE took the ambient noise measurements in Silver Peak.

Equivalent sound level (Leq): A single value of sound level for any desired duration (such as 1 hour), which includes all of the time-varying sound energy in the measurement period. Leq correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant.

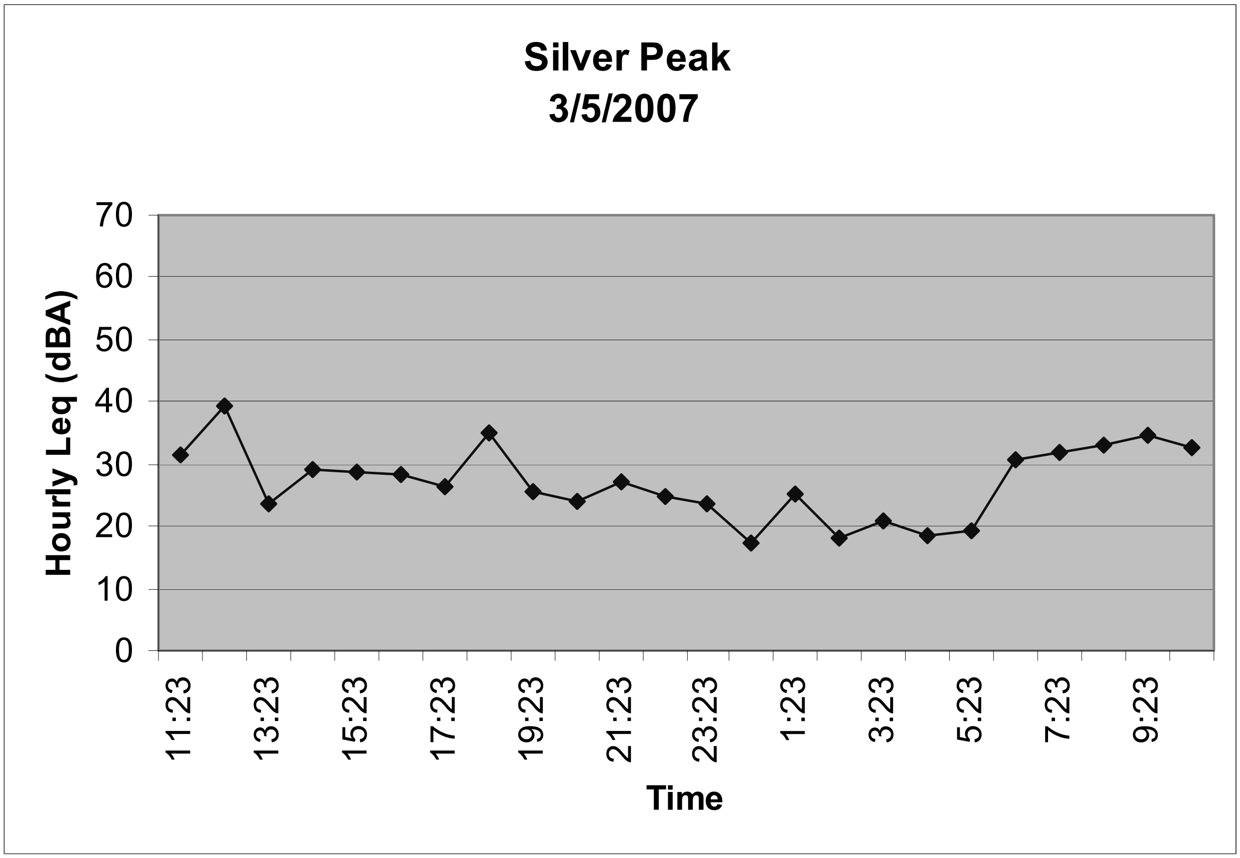


Figure 3-225. Measured noise levels over a 24-hour period in Silver Peak, Nevada.

DOE also took ambient ground-borne vibration measurements at Silver Peak on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

3.3.8.3.2 Mina

DOE took noise measurements for 24 hours on March 6, 2007, in Mina, Nevada. Hourly equivalent sound level values ranged from 30 to 40 dBA, as shown on Figure 3-227. Noise sources included occasional traffic on U.S. Highway 95, which passes through Mina. Figure 3-228 shows where DOE took the ambient noise measurements in Mina. The measured DNL in Mina was 44 dBA, which is lower than the "small town residential" category shown on Figure 3-224.

DOE also took ambient ground-borne vibration measurements at Mina on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

3.3.8.3.3 Schurz

DOE measured noise in Schurz near the existing Department of Defense Branchline on the Walker River Paiute Reservation for 24 hours on March 5, 2007. Hourly equivalent sound level values ranged from 32 to 56 dBA, as shown on Figure 3-229.

Figure 3-226. Ambient noise monitoring location at Silver Peak, Nevada.

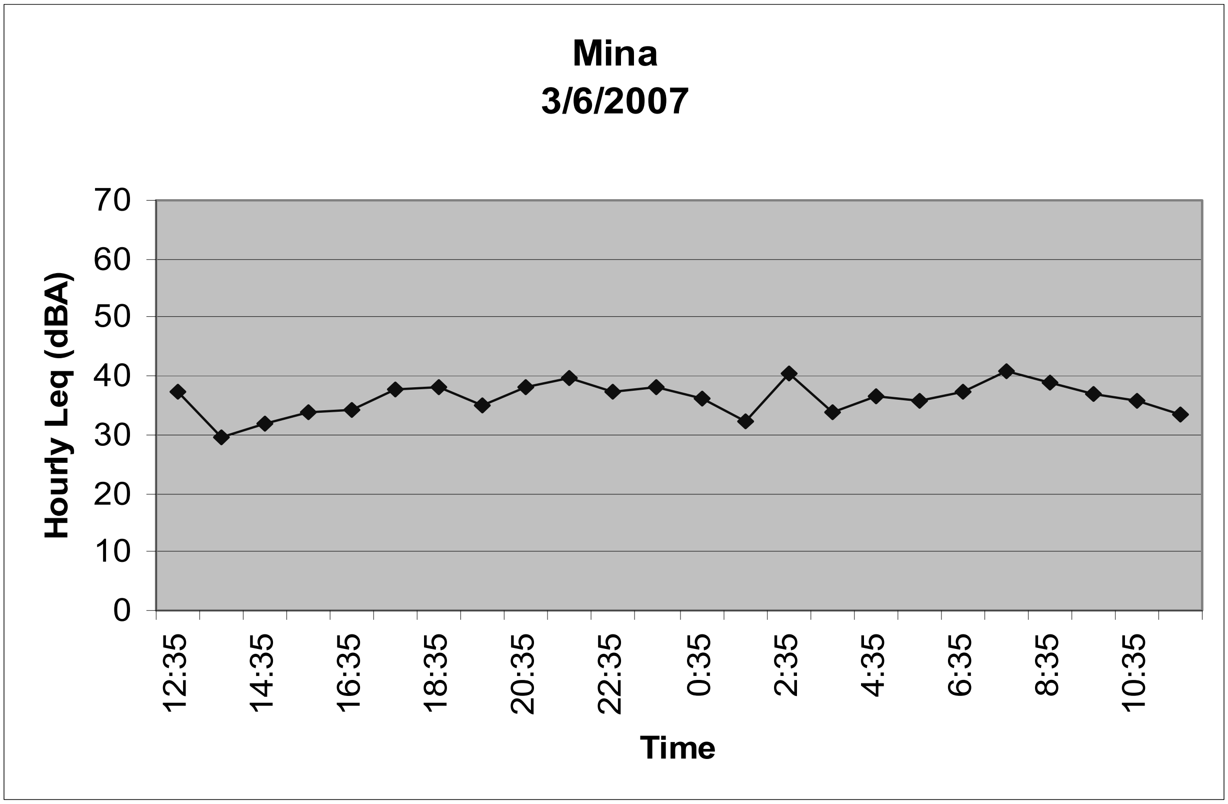


Figure 3-227. Measured noise levels over a 24-hour period in Mina, Nevada.

Noise sources included traffic on nearby local streets, and horses, dogs, and other animals on a nearby farm. Figure 3-230 shows where DOE took the ambient noise measurements in Schurz. The measured DNL in Schurz was 48 dBA, which is very close to the "small-town residential" category shown on Figure 3-224.

DOE also took ambient ground-borne vibration measurements at Schurz on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration-producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

3.3.8.3.4 Silver Springs

DOE took noise measurements near the existing Union Pacific Hazen Branchline in Silver Springs for 24 hours on March 5, 2007. Hourly equivalent sound level values ranged from 23 to 60 dBA, as shown on Figure 3-231. Noise sources included traffic on local streets. Figure 3-232 shows where DOE took the ambient noise measurements in Silver Springs. The measured DNL in Silver Springs was 47 dBA, which is lower than the "small-town residential" category shown on Figure 3-224.

DOE also took ambient ground-borne vibration measurements at Silver Springs on March 5, 2007. Ground-borne vibration was not measurable at this location because the vibration level was very low. Ambient vibration levels were very low at this location because of the lack of vibration-producing activities. Ambient vibration levels of this magnitude are lower than human perception levels.

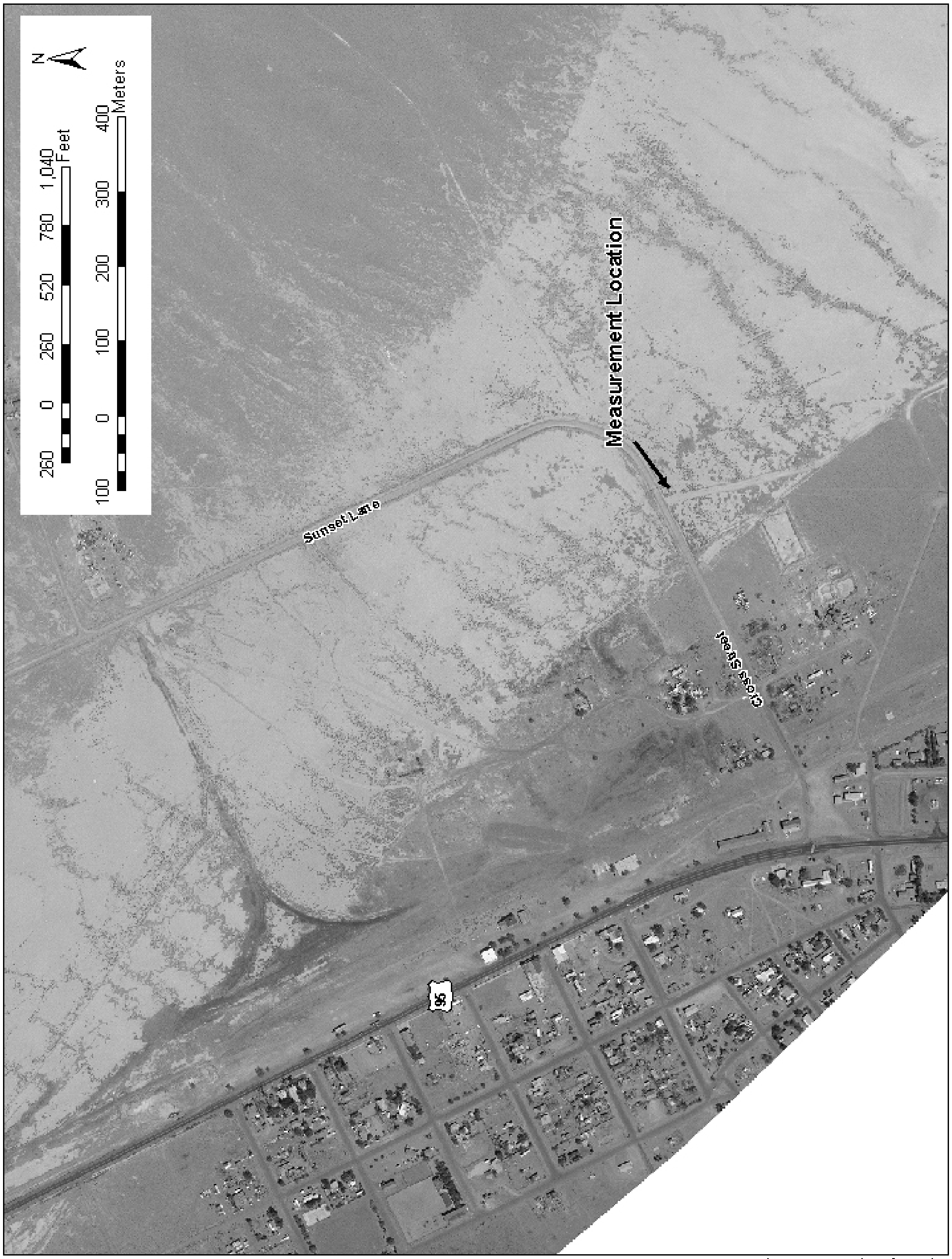


Figure 3-228. Ambient noise monitoring location at Mina, Nevada.

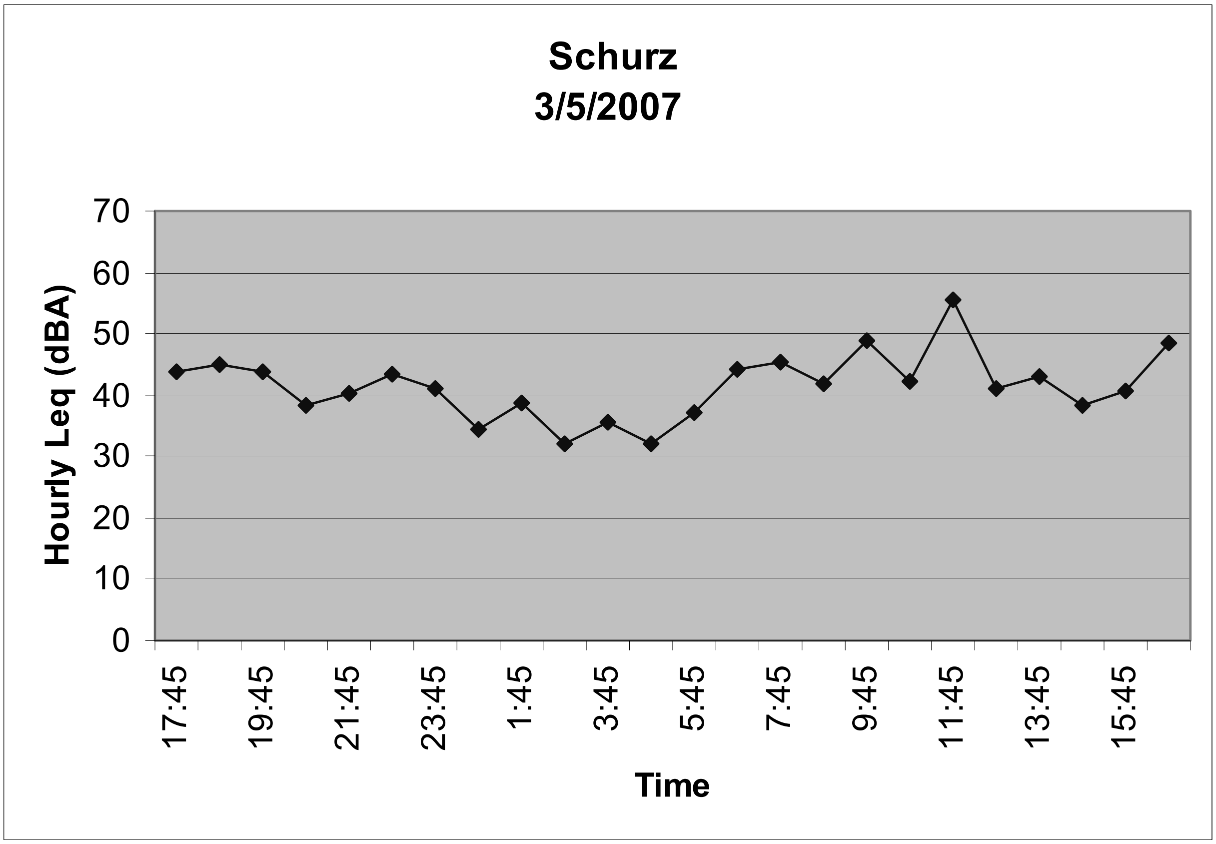


Figure 3-229. Measured noise levels over a 24-hour period in Schurz, Nevada.

3.3.8.3.5 Goldfield

DOE conducted noise measurements for 24 hours in Goldfield on January 12, 2005. Hourly equivalent sound level values ranged from 30 to 44 dBA, as shown on Figure 3-233. The DNL at this location measured 47 dBA. Noise sources included occasional vehicular traffic on U.S. Highway 93, barking dogs, wind, and occasional front-end-loader noise from the U.S. Department of Transportation maintenance station. Figure 3-234 shows where DOE took ambient noise measurements in the Goldfield area. Measured noise levels at Goldfield are lower than values associated with the "small-town residential" category, which is consistent with the low population density and desert environment. DOE also took ambient ground-borne vibration measurements at Goldfield on January 12, 2005. The ground-borne vibration measurement was 25 VdB. Ambient vibration levels are low because of low population density and the resulting lack of ***ground vibration***-producing activity. Ambient vibration levels of this magnitude are lower than human perception levels.

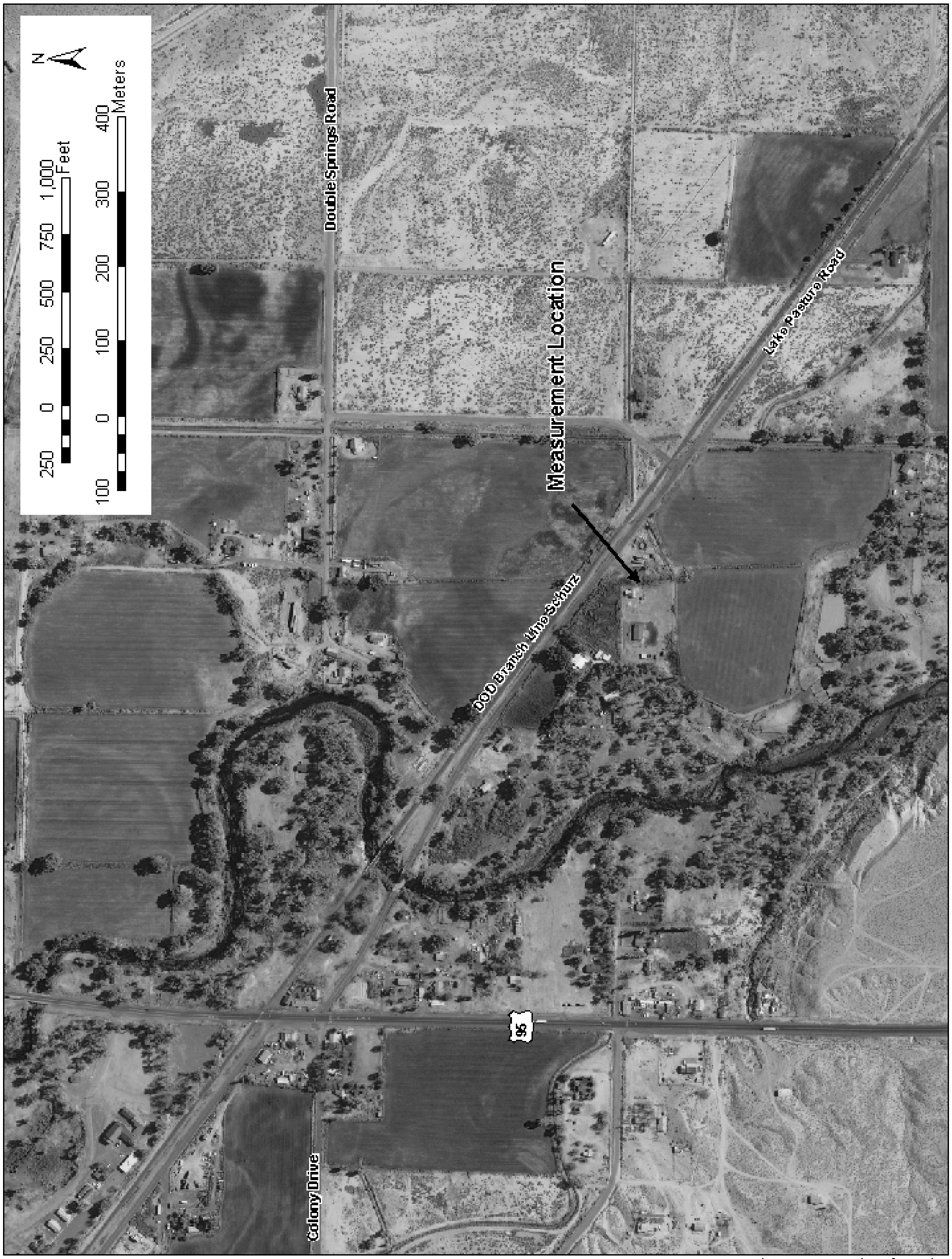


Figure 3-230. Ambient noise monitoring location at Schurz, Nevada.

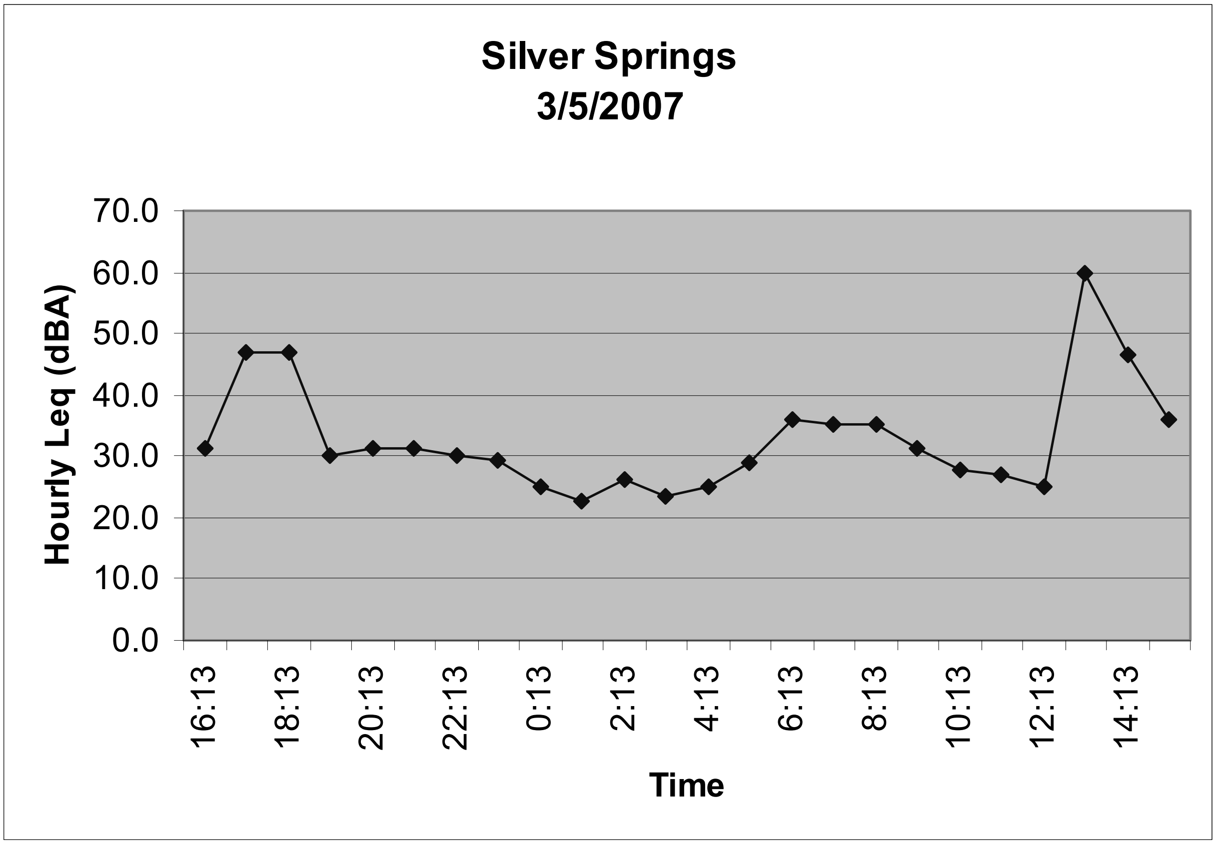


Figure 3-231. Measured noise levels over a 24-hour period in Silver Springs, Nevada.

Figure 3-232. Ambient noise monitoring location at Silver Springs, Nevada.

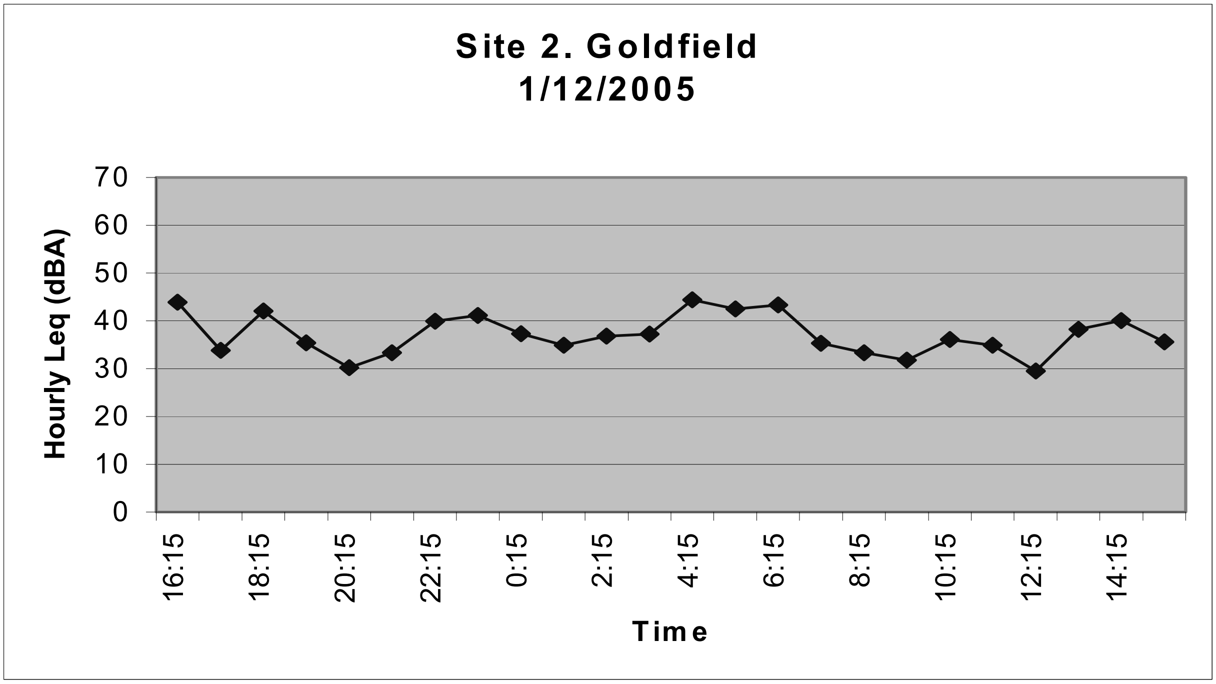


Figure 3-233. Measured noise levels over a 24-hour period in Goldfield, Nevada.

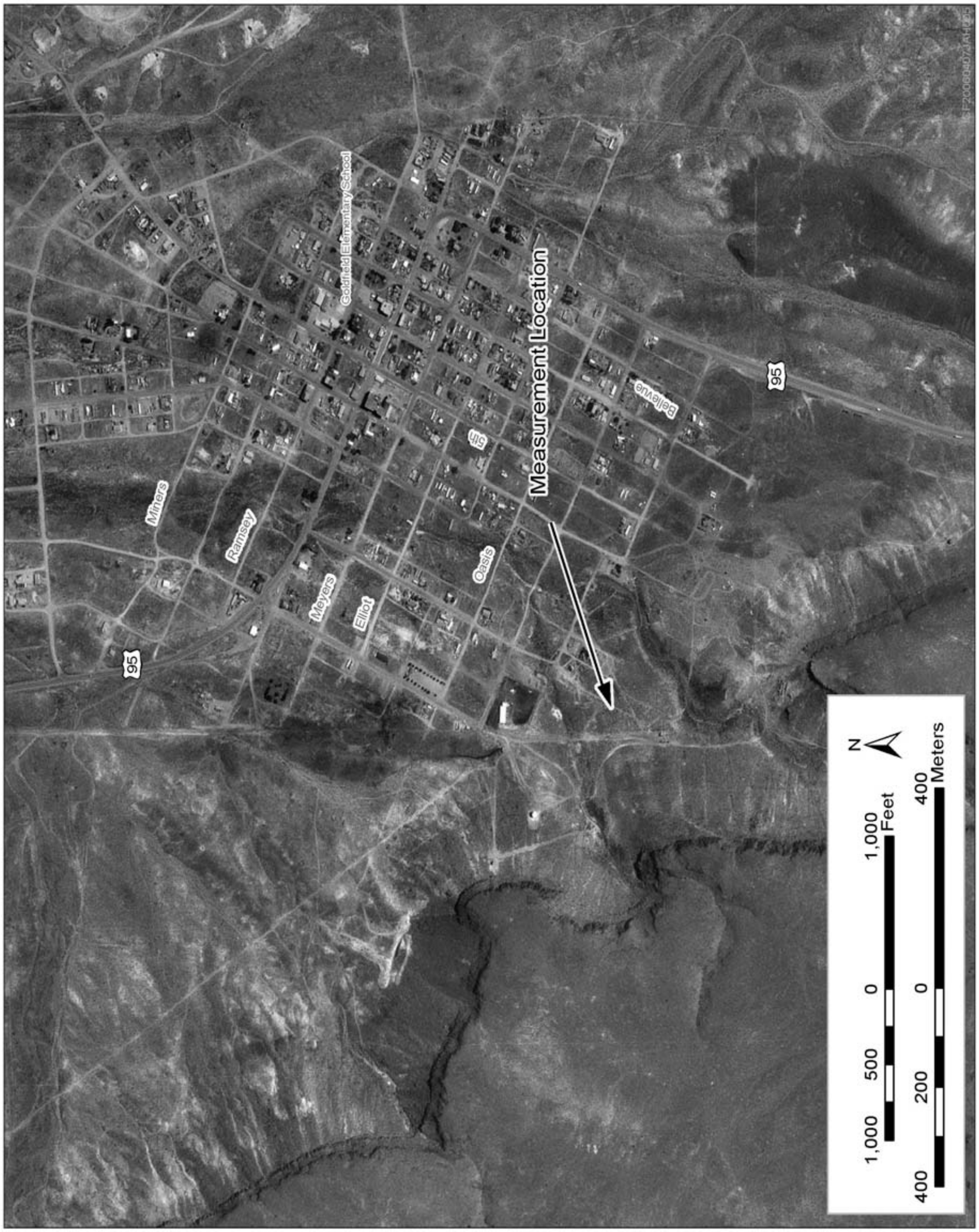


Figure 3-234. Ambient noise monitoring location on the southwestern edge of Goldfield, Nevada.
(Source: Basemap derived from DIRS 174497-Keck 2004, filename 37117F21.sid.)

3.3.9 SOCIOECONOMICS

This section describes the existing socioeconomics conditions (population, housing, employment and income, public services, and transportation) along the Mina rail alignment. Section 3.3.9.1 defines the region of influence for socioeconomics; Section 3.3.9.2 summarizes the method DOE used to establish baseline socioeconomic conditions in the region of influence; and Section 3.3.9.3 describes general regional socioeconomic characteristics.

3.3.9.1 Region of Influence

The region of influence for the Mina rail alignment socioeconomics analysis is Lyon, Mineral, Nye, Esmeralda, and Clark Counties, and the Walker River Paiute Reservation (Figure 3-235). The figure also shows Washoe County and Carson City as part of the region of influence, for reasons described below.

Construction and operation of a railroad along the Mina rail alignment could affect social and economic activities and public services in these areas. This section examines baseline socioeconomic conditions for the counties and selected communities in the counties that would likely be affected during construction and operation of the proposed railroad. This socioeconomics analysis does not include Churchill County, except for transportation effects, because DOE expects that Churchill County would not experience any other noticeable socioeconomic impacts during construction and operation of the proposed railroad. The main analysis presents some socioeconomics detail for Clark County because, even though the rail line would not cross Clark County, construction workers for construction of the rail and associated facilities (except those in Nye County) are assumed to come from Clark County. This is because Clark is the only county with a sufficient workforce. DOE assumes that 80 percent of construction and operations workers for facilities in Nye County would reside in Clark County and 20 percent would reside in Nye County, reflecting historical patterns.

DOE also considers an alternative analysis in which the Department assumes that half of the construction workers for the Mina rail alignment reside in the combined Washoe County-Carson City area, and the other half reside in Clark County. DOE considered this alternative analysis because Washoe County and Carson City might be more likely than Clark County to supply construction workers for the northern portions of the Mina rail alignment. Therefore, for the purposes of this alternative analysis this section presents some socioeconomic detail for Washoe County and Carson City.

Operations workers for facilities outside Nye County are assumed to reside in the county of the facility. Furthermore, Clark County medical facilities could receive medical cases from the construction camps and construction sites. The region of influence does not extend beyond these counties in Nevada because there is no indication of a regional or national socioeconomic effect from goods and services purchased outside the region of influence, and demand for goods and services would not be likely to adversely affect regional or national supplies. The Yucca Mountain FEIS examined the possibility that socioeconomic effects from purchasing construction materials could be felt beyond the region of influence and concluded that there would be little or no impact (DIRS 155970-DOE 2002, Section 4.1.11.2, p. 4-77).

The region of influence for the analysis of transportation resources includes public roadways in the vicinity of the Mina rail alignment, and the rail alignment itself.

During rail line construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. Most of the rail alignment would be within Nevada Department of Transportation District 1, crossing Nye and Esmeralda Counties, with a portion in District 2 crossing Churchill County, Lyon County and Mineral County northwest of Luning.

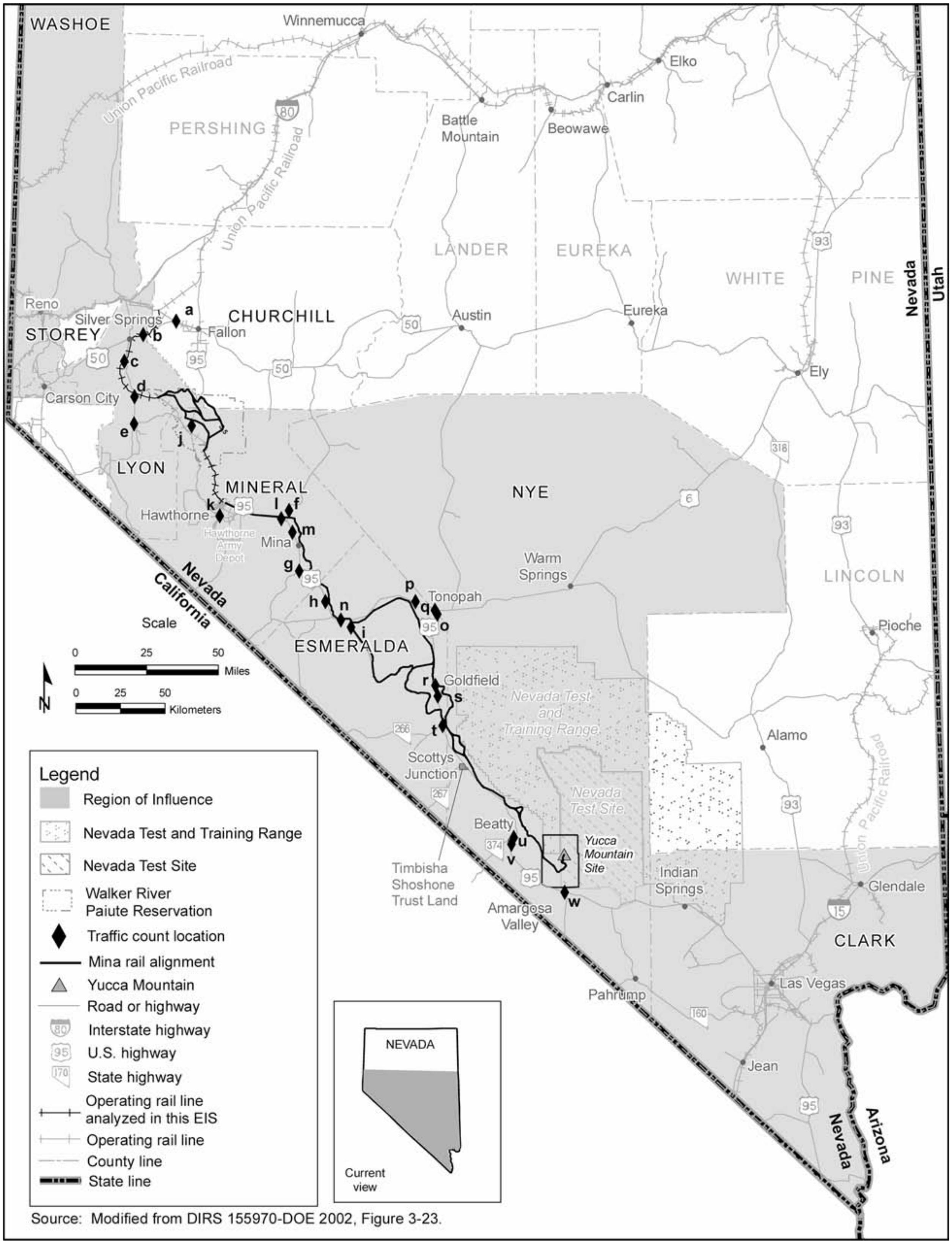


Figure 3-235. Mina rail alignment socioeconomics region of influence.

There are two operating railroads along the Mina rail alignment: the Union Pacific Railroad Hazen Branchline and branchlines operated by the Department of Defense from near Wabuska to Hawthorne. Churchill County is included in the transportation region of influence because it has grade crossings that would be affected by the additional rail traffic along the existing Union Pacific Railroad Hazen and Department of Defense Branchlines from Hazen to Hawthorne.

3.3.9.2 Methodology for Determining Existing Socioeconomic Conditions

DOE characterized socioeconomic activities and resources in the region of influence with a particular emphasis on community-level resources, as appropriate.

For this analysis, DOE used the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3) as a basic source of data, and supplemented that data where possible with current community-level data for the Walker River Paiute Reservation and Lyon, Mineral, Nye, and Esmeralda Counties. DOE used an economic-demographic forecasting model known as *Policy Insight*, developed by Regional Economic Models, Inc. (DIRS 178610-Bland 2007, all), to generate employment, ***real disposable income***, and ***gross regional product*** data for Lyon, Mineral, Clark, Nye, Esmeralda and Washoe Counties and Carson City. *Policy Insight* is an eight-region model, six of the regions being Lyon, Mineral, Clark, Nye, Esmeralda Counties and Washoe County-Carson City. Due to a limitation in the structure of the model, Carson City and Washoe County are considered as a single economic entity. Therefore, the analysis presents the *Policy Insight* data for these areas as one, combined result. The model forecast for Mineral County includes the Walker River Paiute Reservation. Due to data limitations, the model is unable to provide a forecast for the Walker River Paiute Reservation alone. Appendix J, Socioeconomics, contains the results of the *Policy Insight* model runs.

The description of existing economic conditions in the region of influence of the Mina Rail Alignment and the forecast values of populations, gross regional product, and real disposable income draw on data from version 9.0 of *Policy Insight* (DIRS 182251-REMI 2007, all). The description includes revenue from DOE's Payments Equal to Taxes program, described in detail in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 3-90), and the Repository SEIS. Revenue from this program is not described separately. Because the model is based on nationally collected data for which there is a lag between collection and issuance by the national agencies, and another lag before the data are incorporated into the *Policy Insight* model, there is always a gap of approximately 2 to 3 years between the current year and the last history year. The year 2004 is the last history year for the *Policy Insight* model (version 9.0) used in this baseline forecast. To compensate for this time lag, the model's employment update feature is specifically designed to accommodate new historical data provided by users, which update the model's growth-rate assumptions. *Policy Insight* version 9.0 uses an employment update module that relies on years 2004 to 2006 data from the Nevada Department of Education, Training, and Rehabilitation (DIRS 180712-NDETR 2006, all; DIRS 180740-DETR [n.d.], all; DIRS 180741-DETR 2005, all; DIRS 180742-DETR [n.d.], all). This version also incorporates information from the latest Clark County population projections prepared by the University of Nevada, Las Vegas (DIRS 178806-CBER 2006, all) and the latest population projections developed by the Nevada State Demographer (DIRS 178807-Hardcastle 2006, all).

Data for the affected environment (both those taken from the Yucca Mountain FEIS and supplemental information included here) come from various state, federal, community, and proprietary sources. Current and historical population data were drawn from a report prepared for the Nevada Small Business Development Center (DIRS 177656-Nevada State Demographer's Office 2006, all). The Department obtained housing data, including information on housing stock, vacancy rates, median housing values, and gross rents, from the Nevada Small Business Development Center, which compiled the information from U.S. Census Bureau data (DIRS 180476-Nevada Small Business Development [n.d.], all;

DIRS 180475-Nevada Small Business Development Center [n.d.], all; DIRS 180477-Nevada Small Business Development Center [n.d.], all; DIRS 180478-Nevada Small Business Development Center 2003, all; DIRS 180479-Nevada Small Business Development Center [n.d.], all; DIRS 173564-Nevada Small Business Development Center 2003, all; DIRS 173566- Nevada Small Business Development Center 2003, all; DIRS 173567-Nevada Small Business Development Center 2003, all). DOE uses the U.S. Census Bureau housing data because county-collected housing data can be inconsistent across counties due to unique county assessment practices. In addition, the Census Bureau's housing data contain characteristics that county housing data sources do not, such as whether a property is a rental property or owner-occupied and whether a property is occupied or vacant.

Income, poverty, and unemployment data come from the U.S. Census Bureau (DIRS 176856-U.S. Census Bureau 2003, all). DOE obtained current values for employment, real disposable income, and gross regional product for Lyon, Mineral, Nye, Esmeralda, and Clark Counties from the *Policy Insight* model, as previously described. DOE compiled business-establishment data from the *Nevada Workforce Informer, Data Analysis* (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all; DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all). DOE obtained data on public services mainly from interviews with county representatives in the region of influence and from the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 3), augmented in some instances with information from other sources cited in the text herein. Yucca Mountain Oversight Office in Esmeralda County provided contact information for county agencies and suggested data sources for this section. The County Manager provided similar assistance for Nye County. DOE obtained health data from the Nevada State Health Division (DIRS 173560-State of Nevada [n.d.], all); education data from Nevada District Accountability Reports (DIRS 180463-Lyon County School District [n.d.], all; DIRS 180465-Mineral County School District [n.d.], all; DIRS 177759-Nye County School District [n.d.], all; DIRS 177760-Esmeralda County School District [n.d.], all); and law enforcement data from the Department of Public Safety (DIRS 173399-State of Nevada 2004, all; DIRS 177747-State of Nevada 2005, all; DIRS 177748-State of Nevada 2006, all).

DOE based the description of the affected transportation environment on existing traffic volumes on the roadways (measured as average daily traffic counts) and on the Union Pacific Railroad Hazen Branchline. The Department obtained traffic volumes for roads from the Nevada Department of Transportation traffic report for 2005 (DIRS 178749-NDOT [n.d.], all), and then estimated levels of service for the affected roadways using the Highway Capacity Manual guidelines (DIRS 176524-Transportation Research Board 2001, all). DOE based rail traffic estimates on personal communication with Union Pacific Railroad and U.S. Army representatives (DIRS 178017-Holder 2006, all).

3.3.9.3 General Regional Socioeconomic Characteristics

DOE examined baseline socioeconomic conditions for selected communities within the region of influence that would likely be affected by railroad construction and operations. These communities include Yerington in Lyon County; Hawthorne, Mina, and Luning in Mineral County; Schurz on the Walker River Paiute Reservation; Tonopah, Beatty, the Town of Amargosa Valley, and Pahrump in Nye County; and Goldfield in Esmeralda County. Baseline conditions for Clark County are presented at the county level, primarily in relation to economic measures and health-care capacity. DOE assumes that there would be an overall income effect on Clark County from the workers residing there and commuting to work on the proposed railroad project, but because of the large population of Clark County, the effect would be minimal. For the alternative analysis, baseline conditions for the combined area of Washow County-Carson City are presented.

3.3.9.3.1 Employment and Income

Due to the lack of data, DOE is unable to characterize the local economy of the Walker River Paiute Reservation.

Lyon County's economy is smaller than Nye County's, with a total estimated employment count of 15,591 in 2007, according to the *Policy Insight* (DIRS 181908-Bland 2007, all) baseline projections listed in Table 3-136. As discussed in Section 3.3.9.2, these projections are from county and state baseline data sources, together with employment-trend information also taken from county and state sources. The three largest employment sectors in Lyon County are services (with 34 percent of the employed population), retail trade (16 percent), and state and local government (14 percent). Construction is also an important employment sector, with 12 percent of the employed population. According to *Policy Insight* baseline projections, the gross regional product of the county in 2007 is projected to be $840.1 million, and the real disposable income $1.04 billion. Large employers include Amazon.com, which employs between 1,000 and 1,499 people in the area, and local government agencies such as the Lyon County School District (DIRS 181908-DETR [n.d.], all).

Mineral County's economy is the second smallest in the region of influence, with a total estimated employment count of 2,352 projected for 2007, according to the *Policy Insight* (DIRS 178610-Bland 2007, all) baseline projections listed in Table 3-136. The three largest employment sectors in Mineral County are services (with 42 percent of the employed population), state and local government (22 percent), and retail. Major employers include the Day and Zimmerman Hawthorne Corporation, which employs between 400 and 499 people; El Capitan Casino, which employs between 100 and 199 people; and local government, such as the Mineral County School District (DIRS 181907-DETR [n.d.], all).

Mina County's economy is the second smallest in the region of influence, with a total estimated employment count of 2,352 in 2007, according to the *Policy Insight* (DIRS 178610-Bland 2007, all) baseline projections listed in Table 3-136. The three largest employment sectors in Mineral County are services (with 42 percent of the employed population), state a local government (22 percent), and retail trade (10 percent). According to *Policy Insight* baseline projections, the gross regional product of the county in 2007 was $131.0 million, and the real disposable income was $108.8 million.

Nye County has the third largest economy in the region of influence. Total estimated employment in Nye County in 2007 is projected to be 18,184 people (Table 3-136). The largest employment sectors were services (44 percent of the employed population), followed by retail trade (12 percent), and then transportation warehousing, information, and finance and insurance (11 percent collectively). State and local government and construction are also important sectors. The importance of construction reflects the county's population growth rates from 1990 to 2003 because new residents and businesses require construction materials and labor, and a range of services. Large employers include National Security Technologies, LLC (NSTec), the management and operating contractor for DOE at the Nevada Test Site, which employs between 1,000 and 1,500 people in the area, although many Nevada Test Site employees live in Clark County (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all). Local government agencies such as the Nye County School District and Nye County, and mining companies such as the Round Mountain Gold Corporation, are also major employers (DIRS 173544-Nevada Department of Employment, Training & Rehabilitation 2005, all).

Nye County employment rebounded after a 15 percent decrease between 1990 and 1995 (DIRS 155970-DOE 2002, p. 3-87). According to *Policy Insight* baseline projections, the gross regional product of Nye County in 2007 will be $1.16 billion, and the real disposable income will be $1.12 billion.

Table 3-136. Lyon, Mineral, Esmeralda, Nye, and Clark County employment by industry, 2007.[a,b]

	County					
Industry sector	Lyon	Mineral	Nye	Esmeralda	Clark	Washoe-Carson City
Private sector						
Forestry and fisheries	53	6	67	3	306	320
Mining	249	150	1,094	84	1,420	2,607
Construction	1,814	61	1,793	32	124,771	27,805
Utilities	84	26	185	0	3,798	1,067
Manufacturing	582	18	342	1	28,737	17,997
Wholesale trade	722	37	186	12	26,567	12,843
Retail trade	2,439	237	2,140	30	121,883	32,992
Transportation and warehousing, information, and finance and insurance	1,304	210	1,975	23	158,506	45,084
Farm	717	16	283	67	312	599
Services	5,329	987	8,088	112	577,086	129,099
Public sector						
Federal Government–civilian	72	77	161	6	11,409	3,852
Federal Government–military	95	12	79	4	12,663	887
State and local government	2,132	515	1,792	101	83,135	33,470
Totals[c]	15,591	2,352	18,184	475	1,150,594	308,623

a. Source: DIRS 178610-Bland 2007, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.
c. Totals might differ from sums of values due to rounding.

Esmeralda County has the smallest economy of the other counties in the region of influence. The county's three largest employment sectors are services, state and local government, and mining, which account for 24, 21, and 18 percent of the employed population, respectively (Table 3-136). Employers include government agencies such as the State of Nevada and the Esmeralda County School District, and mining companies such as the Chemetall Foote Corporation, which runs Silver Peak Mine and Lode Star Gold, Inc. (DIRS 173545-Nevada Department of Employment, Training & Rehabilitation 2005, all). According to *Policy Insight* baseline projections, the gross regional product of Esmeralda County in 2007 will be $25.7 million, and the real disposable income will be $29.3 million.

Clark County's economy dominates southern Nevada. The largest employment sectors are services (50 percent of the employed population; 46 percent of services employment is within the Accommodations and Food Services sectors); transportation warehousing, information, and finances and insurance (14 percent); construction (11 percent); and retail trade (11 percent). According to *Policy Insight* baseline projections, Clark County surpasses the other counties with a gross regional product of $95.4 billion, which is more than 80 times that of Nye County. According to *Policy Insight* baseline projections, Clark County residents had $60.7 billion in ***real disposable personal income*** in 2007.

Washoe County-Carson City's largest employment sectors are services; transportation and warehousing, information, and finance and insurance; and state and local government. These sectors account for 42, 15, and 11 percent of the employed population, respectively. According to *Policy Insight* baseline projections, the gross regional product of Washoe County-Carson City in 2007 will be $24.4 billion, and the real disposable income will be $16.8 billion.

3.3.9.3.1.1 Mining and Agriculture. This section describes existing conditions for mining and agricultural activities, because a railroad along the Mina rail alignment would be likely to affect these interests more than other economic activities.

Mining In 2007, the mining industry employed nearly 18 percent of the 475 workers in Esmeralda County and 6 percent of workers in Nye County. Mining also constitutes a large part of the total personal income generated in the region of influence counties. In Esmeralda County in 2002, almost 18 percent of personal income came from mining, making it the single largest source of personal income in the County (DIRS 173546-BEA 2004, Table CA05N). Almost 7 percent of personal income in Nye County came from the mining industry in 2002 (DIRS 173548-BEA 2005, Table CA05N).

Mined minerals in the study area include gold, silver, aggregate (consisting of crushed stone, natural sands, and gravel), salt, and a wide range of other nonmetallic minerals. Gold is central to Nevada's mining industry, and at $2.4 billion in revenue (DIRS 169127-Driesner and Coyner 2003, all; DIRS 173554-Price and Meeuwig 2003, all), it brings in more revenue than any other type of mining. Silver production is also important and was Nevada's fourth leading mineral commodity in 2002, valued at $62 million.

The Mina rail alignment would cross some mining areas and districts in Mineral, Nye, and Esmeralda Counties. Schurz alternative segment 1 would pass through the very southern portion of the Calico Hills Mining District. Schurz alternative segment 4 would pass through the Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 5 would pass through the Benway, Calico Hills, Double Springs Marsh, and Buckley Mining Districts. Schurz alternative segment 6 would pass through the Holy Cross, Double Springs Marsh, and Buckley Mining Districts.

Mina common segment 1 would pass through the Santa Fe, Rock Hill, and Coaldale Mining Districts. The construction right-of-way would also intersect the outermost boundaries of the Pilot Mountains, Rhodes Marsh, and Candelaria Mining Districts.

Montezuma alternative segment 1 would pass through the Silver Peak Marsh, Montezuma, and Cuprite Mining Districts. Montezuma alternative segment 2 would pass through the Goldfield and Stonewall Mining Districts. Montezuma alternative segment 3 would pass through the Montezuma and Cuprite Mining Districts.

Mina common segment 2, the Bonnie Claire alternative segments, common segment 5, and the Oasis Valley alternative segments would not cross any mining districts.

Common segment 6 would cross the northeastern portion of the Bare Mountain Mining District, although the vast majority of past mining activity occurred more than 3 kilometers (2 miles) south of this common segment. The district contains gold-bearing veins, and some veins contain silver. The district also contains a variety of minerals and semi-precious stones, including opal, malachite, galena, pyrite, hematite, fluorite, fluorspar, and gypsum.

Agriculture The primary agricultural activity that would be intersected by the Mina rail alignment would be grazing. As discussed in Section 3.3.2, Land Use and Ownership, there are 12 active grazing allotments, and three inactive allotments along the proposed rail alignment. In Section 3.3.2, Land Use and Ownership, Tables 3-84 and -85 list and describe these grazing allotments, and Figures 3-143 through 3-152 show the locations of the allotments.

The permitted grazing operations support employment and provide income for ranchers and their workers, and income for the respective counties. BLM-issued grazing permits authorize these operations, and specify the total number of animal unit months apportioned (an animal unit month represents enough dry forage for one mature cow for 1 month). For those allotments with information available (see Table 3-85), animal unit months range from 303 to 7,900, and land area ranges from 21 to 2,074 square kilometers (5,124 to 512,000 acres). The BLM established the property base for each allotment based on land or water rights.

In addition to grazing, farming is an important source of both income and employment for the counties in the region of influence. As discussed in Section 3.3.1.2.3, less than 1 percent of soils along the proposed rail alignment are classified as prime farmlands. Less than 1 percent, or approximately 0.04 square kilometer (9.2 acres), of the entire Mina rail line construction right-of-way contains soils the Natural Resources Conservation Service considers prime farmland (see Section 3.3.1, Physical Setting, Figure 3-128). The prime farmland soils the proposed alignment would cross are concentrated on the Walker River Paiute Reservation, which has a total of 5.5 square kilometers (1,400 acres) of prime farmland soil.

3.3.9.3.1.2 Personal Income, Poverty, and Unemployment. As shown in Table 3-137, Washoe and Clark Counties have the highest median income in the region of influence, followed by Carson City, Lyon, Nye, Esmeralda, and Mineral Counties and the Walker River Paiute Reservation. While Washoe, Lyon, Nye, and Clark Counties and Carson City showed the highest incomes and the lowest percentage of residents in poverty in 1999 (see note on Table 3-137 for information on poverty thresholds), the unemployment rates in these counties were higher than Esmeralda County in 2000. The unemployment rates in Lyon, Mineral, Clark, Washoe, and Nye Counties decreased between 2000 and 2005, while Esmeralda County's unemployment rate increased over the same period. The Walker River Paiute Reservation had the highest unemployment rate in the region of influence in 2000.

At the community level, Beatty has the highest median income ($41,076), although its poverty rate (13 percent) is third highest after Yerington in Lyon County (18 percent) and the Town of Amargosa Valley (15 percent). Schurz, on the Walker River Paiute Reservation, has the highest unemployment rate (15.8 percent) of all communities in the region of influence. Tonopah and Beatty in Nye County have higher median incomes, and lower poverty and unemployment rates, than Yerington in Lyon County.

3.3.9.3.2 Population

Table 3-138 lists the county and community populations in the Mina rail alignment region of influence in 1990, 2000, and 2005.

According to Census data from 2000, the Walker River Paiute Reservation had a population of 850. The Reservation's population increased by 5 percent between 1990 and 2000.

According to the Nevada State Demographer's Office Nevada 2000 census data (DIRS 180476-Nevada Small Business Development Center [n.d.], p. 1), Lyon County is approximately 50-percent rural. It has a population density of only 6.7 people per square kilometer (17.3 people per square mile). Yerington isthe largest Lyon County town that is close to the Mina rail alignment. The population of Yerington in 2005 was 2,980.

Mineral County has the second smallest county in the region of influence. In 2005, Mineral County's population was 4,629. Mineral County has a population density of 0.54 people per square kilometer (1.4 people per square mile). Thirty-one percent of the population in Mineral County is considered rural, according to population estimates and rural figures from the Nevada State Demographer's Office.

Table 3-137. County and place-level personal income, poverty, and unemployment.[a]

County, city/community	Median household income in 1999 (dollars)[b]	Poverty in 1999 (percent)[b]	Unemployment in 2000 (percent)[b]	Unemployment in 2005 (percent)[c]
Walker River Paiute Reservation	24,412	33	22.6	Not available
County				
Lyon	40,699	10	6.9	5.3
Mineral	32,891	15	12.9	5.9
Esmeralda	33,203	15	3.3	5.3
Nye	36,024	11	7.1	5.2
Clark	44,616	11	6.6	4.0
Washoe County	45,815	10	4.9	4.0
Carson City	41,809	10	4.6	4.7
City/community				
Schurz	24,265	27	15.8	Not available
Yerington	31,151	18	9.1	Not available
Hawthorne	34,413	11	11.1	Not available
Tonopah	38,029	11	7.9	Not available
Pahrump	35,313	9	7.5	Not available
Goldfield	32,969	12	3.2	Not available
Amargosa Valley	34,432	15	3.2	Not available
Beatty	41,076	13	5.6	Not available

a. The U.S. Census Bureau defines poverty based on estimates of how much money families need to meet their nutritional needs for 1 year. Poverty thresholds and a more thorough definition of poverty are available from the U.S. Census Bureau at http://www.census.gov/acs/www/UseData/Def/Poverty.htm, all.
b. Source: DIRS 176856-Census Bureau 2003, Tables 7, 13, 15, 36, 37, and 40.
c. Source: DIRS 177755-BLS [n.d.], all.

Table 3-138. County and community populations, Mina rail alignment, 1990 to 2005[a] (page 1 of 2).

County	City/ community	1990 population[b]	2000 population	2005 population	1990 to 2000 change (percent)	2000 to 2005 change (percent)
Walker River Paiute Reservation		811	850	Not available	5	Not available
	Schurz	617	711[c]	Not available	15	Not available
Lyon		20,590	35,685	48,860	73	37
	Yerington	2,380	2,938	2,980	23	1
Mineral		6,470	5,071	4,629	-22	-9
	Hawthorne	4,162	3,134	2,956	-25	-6
	Mina	484	307	276	-37	-10
	Luning	Not available	86	87	Not available	1

Table 3-138. County and community populations, Mina rail alignment, 1990 to 2005[a] (page 2 of 2).

County	City/ community	1990 population[b]	2000 population	2005 population	1990 to 2000 change (percent)	2000 to 2005 change (percent)
Nye		18,190	32,978	41,302	81	25
	Tonopah	3,616	2,833	2,607	-23	-8
	Amargosa Valley	761	1,167	1,383	61	19
	Beatty	1,623	1,152	1,032	-31	-10
	Pahrump	7,424	24,235	33,241	226	37
Esmeralda		1,350	1,061	1,276	-21	20
	Goldfield	672	424	438	-37	3
	Silver Peak	Not available	161	126	Not available	-22
Clark		770,280	1,394,440	1,815,700	81	29
Washoe County		257,120	341,935	396,844	33	16
Carson City		40,950	53,208	57,104	30	7

a. Source: DIRS 177656-Nevada State Demographer's Office 2006, all.
b. 1990 estimates for Tonopah, Amargosa Valley, Beatty, Pahrump, and Goldfield were not available through the Nevada State Demographer's Office; therefore, subdivision-level data for these locations were taken from the U.S. Census DP-1 (DIRS 179132-Bureau of Census [n.d.], all). The Census data reflect a different time series than the Governor's Certified Estimates.
c. Schurz is on the Walker River Paiute Reservation. However, the Nevada State Demographer and the U.S. Census Bureau categorize the town's population within Mineral County.

The largest town in Mineral County is Hawthorne, with a 2005 population of 2,956, which accounts for more than 60 percent of the population in Mineral County. Mineral County also includes Schurz, Mina, and Luning, which are along the Mina rail alignment. Schurz, on the Walker River Paiute Reservation, is the most populated of these communities.

Nye County is the second most populous county in the region of influence. According to the U.S. Bureau of Census (DIRS 173530-Bureau of Census 2005, all), in 2005 the county had a population density of 0.69 people per square kilometer (1.8 people per square mile); according to population estimates and rural figures from the Nevada State Demographer's Office (DIRS 173564-Nevada Small Business Development Center 2003, p. 1), 55 percent of the population is considered rural. The largest town in Nye County is unincorporated Pahrump, which accounts for 80 percent of the county's population. Although Pahrump is not in the immediate vicinity of the Mina rail alignment, it is reasonably foreseeable that some construction and operations workers would live in Pahrump, based on historical and current patterns of workers at the Nevada Test Site and the Yucca Mountain Site. Nye County also includes the communities of Tonopah, Beatty, and the Town of Amargosa Valley, all of which are near the Mina rail alignment. Tonopah is the most populated of these communities.

Esmeralda County is the least populated of the counties in the Mina rail alignment region of influence. Esmeralda is also the least densely populated county, with a density of 0.11 people per square kilometer (0.3 people per square mile) (DIRS 173534-Bureau of Census 2005, all) and a 100-percent rural population (DIRS 173566-Nevada Small Business Development Center 2003, p. 1). The community of Goldfield is close to the Mina rail alignment, and its population accounts for more than one-third of Esmeralda County's population.

Clark County, which includes Las Vegas, is the most populated county in Nevada. It has a population density of 67 people per square kilometer (173.9 people per square mile) (DIRS 173533-Bureau of Census 2005, all), and a rural population of only 2 percent (DIRS 173567-Nevada Small Business

Development Center 2003, p. 1). No part of the Mina rail alignment is in or near Clark County; the closest part of the alignment would be common segment 6, 48 kilometers (30 miles) west of the Clark County boundary, in Nye County. However, a substantial proportion of the railroad construction workforce would probably come from Clark County.

In terms of population change, southern Nevada has been and continues to be among the fastest-growing areas in the United States (DIRS 155970-DOE 2002, p. 3-84). In the region of influence, Lyon and Nye Counties both experienced population increases from 1990 to 2000, with Nye County's growth of 81 percent being similar to Lyon County's growth of 73 percent. The populations of Esmeralda and Mineral Counties decreased between 1990 and 2000 by 21 and 22 percent, respectively. The growth and overall population count of Clark County is substantial, with an increase of 81 percent during the same years.

Communities within these counties have also been undergoing population changes, though these shifts have not necessarily been in the same direction as the respective county. For example, Nye County experienced a substantial population increase of 8,324 people (25 percent) between 2000 and 2005. The increase was largely fueled by population growth in Pahrump, while Tonopah's population declined by 226 people (8 percent), and Beatty's declined by 120 people (10 percent) during the same period. The population of Goldfield in Esmeralda County increased by 14 people (3 percent) between 2000 and 2005, which is consistent with the county's increase in population of 215 people (20 percent).

According to *Policy Insight* model baseline projections shown in Table 3-139, most of the counties in the region of influence are expected to grow through 2067, independent of potential project-related effects. These projections assume that current trends continue and incorporate county and state (Nevada State Demographer's Office) demographic and economic data sources. Population projections for Lyon, Mineral, Nye, and Esmeralda Counties through 2026 are from the Nevada State Demographer's Office (DIRS 178807-Hardcastle 2006, all); population projections for these areas after 2026 assume constant growth at 2026 rates. Clark County projections to 2035 are from the University of Nevada Las Vegas Center for Business and Economic Research projections (DIRS 178806-CBER 2006, all), and projections to 2067 assume constant growth at 2035 rates. Because these projections assume a constant rate of growth over the period, rather than a growth rate that increases at a decreasing rate (which would be expected for population projections for Clark and Nye Counties), the projected populations are high estimates.

This is a conservative assumption when analyzing for total radiological ***dose*** to resident populations, which is another use of the projections by the Yucca Mountain Project. By 2067, the population of Nye County is projected to increase to 131,074 people (187 percent over 2007 levels). Lyon County's population is also projected to increase during the same period, to 172,376 people (220 percent increase over 2007 levels). Esmeralda County's population is projected to decline to 1,083 people by 2067 (11 percent decrease from 2007 levels). Mineral County's population is expected to decrease to 3,715 people (20 percent decrease from 2007 levels). Clark County is projected to increase to approximately 5 million people (151 percent increase over 2007 levels). Washoe County-Carson City's combined population is expected to increase by approximately 625,737 people (132 percent increase over 2007 levels).

3.3.9.3.3 Housing

Table 3-140 lists housing characteristics in the Mina rail alignment region of influence in 2000. The housing stock in Lyon County is 14,279 units, consisting mostly of single-family homes. In Yerington, single-family, multiple-family, and mobile (manufactured) homes make up 65 percent, 22 percent, and 14 percent of the total housing units, respectively. More than 10 percent of the housing in Yerington is vacant.

Table 3-139. Projected values for population, employment, and economic variables, 2010 to 2067[a,b] (page 1 of 3).

Economic parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Population														
Lyon County	53,832	60,939	71,795	80,930	88,548	95,811	103,724	112,292	121,567	131,609	142,480	154,249	166,990	172,376
Mineral County	4,626	4,667	4,759	4,566	4,398	4,309	4,224	4,140	4,058	3,977	3,898	3,898	3,744	3,715
Nye County	45,737	51,971	60,803	67,707	73,155	78,364	84,005	90,053	96,535	103,484	110,933	118,919	127,480	131,074
Clark County	1,990,481	2,258,748	2,652,070	2,946,350	3,169,797	3,358,455	3,544,362	3,739,880	3,946,181	4,163,863	4,393,553	4,635,913	4,891,642	4,997,841
Esmeralda County	1,215	1,147	1,069	1,012	997	1,007	1,016	1,027	1,038	1,048	1,058	1,068	1,079	1,083
Washoe County-Carson City	475,172	508,629	565,044	615,124	657,701	698,856	743,091	790,139	840,182	893,410	950,008	1,010,192	1,074,189	1,100,909
All of Nevada	2,745,469	3,064,179	3,539,284	3,902,058	4,185,507	4,431,901	4,680,591	4,943,171	5,221,096	5,515,255	5,826,285	6,155,203	6,503,050	6,647,735
Employment														
Lyon County	15,591	16,697	18,273	19,411	20,435	21,490	22,739	24,323	26,040	28,087	30,407	32,919	35,638	36,787
Mineral County	2,352	2,407	2,460	2,339	2,295	2,267	2,253	2,256	2,254	2,259	2,214	2,170	2,127	2,110
Nye County	18,184	19,194	20,585	21,683	22,628	23,706	24,923	26,310	27,732	29,274	31,381	33,640	36,062	37,079
Clark County	1,150,594	1,239,364	1,325,133	1,391,701	1,453,024	1,524,248	1,601,285	1,692,833	1,778,852	1,860,856	1,963,506	2,071,818	2,186,105	2,233,566
Esmeralda County	475	466	451	442	436	434	432	435	438	443	447	452	456	458
Washoe County-Carson City	315,776	332,279	356,087	370,019	382,854	397,125	412,807	432,986	452,149	472,506	502,440	534,270	568,116	582,248
All of Nevada	1,609,884	1,719,682	1,834,877	1,918,883	1,996,005	2,085,078	2,182,024	2,299,188	2,409,726	2,518,704	2,659,417	2,808,145	2,965,352	3,030,717

Table 3-139. Projected values for population, employment, and economic variables, 2010 to 2067[a,b] (page 2 of 3).

Economic parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Gross regional product[b, c]														
Lyon County	0.840	0.956	1.165	1.358	1.557	1.775	2.026	2.328	2.672	3.081	3.335	3.611	3.909	4.034
Mineral County	0.131	0.140	0.159	0.163	0.176	0.191	0.208	0.228	0.249	0.271	0.266	0.261	0.256	0.254
Nye County	1.164	1.302	1.550	1.798	2.052	2.340	2.664	3.037	3.447	3.903	4.184	4.485	4.808	4.943
Clark County	95.392	109.494	131.517	151.836	172.974	197.204	224.494	256.596	291.013	327.876	345.963	365.047	385.184	393.546
Esmeralda County	0.026	0.027	0.029	0.032	0.035	0.039	0.042	0.046	0.050	0.056	0.057	0.057	0.058	0.058
Washoe County-Carson City	24.39	27.70	33.94	39.29	44.82	50.97	57.79	65.77	74.26	83.59	88.89	94.52	100.51	103.01
All of Nevada	129.036	147.283	177.133	204.369	232.647	264.813	300.888	343.229	388.550	437.450	461.921	487.785	515.120	526.484
Government spending[c,d]														
Lyon County	0.208	0.242	0.303	0.355	0.398	0.443	0.490	0.544	0.598	0.652	0.706	0.764	0.827	0.854
Mineral County	0.037	0.039	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.040	0.039	0.039	0.038
Nye County	0.174	0.202	0.252	0.291	.323	0.356	0.390	0.427	0.466	0.503	0.539	0.578	0.620	0.637
Clark County	7.269	8.460	10.543	12.146	3.427	14.617	15.780	17.043	18.266	19.411	20.482	21.612	22.804	23.299
Esmeralda County	0.007	0.007	0.007	0.007	.007	0.007	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008
Washoe County-Carson City	1.98	2.17	2.56	2.89	.17	3.46	3.77	4.10	4.43	4.74	5.04	5.36	5.70	5.85
All of Nevada	10.592	12.085	14.762	16.841	8.541	20.159	21.769	23.523	25.226	26.830	28.335	29.925	31.607	32.307

Table 3-139. Projected values for population, employment, and economic variables, 2010 to 2067[a,b] (page 3 of 3).

Economic parameter	Year													
	2007	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060	2065	2067
Real disposable income[b, c]														
Lyon County	1.040	1.169	1.367	.547	.737	1.938	2.177	2.465	2.788	3.194	3.458	3.744	4.053	4.184
Mineral County	0.109	0.116	0.122	.119	.122	0.125	0.128	0.132	0.136	0.144	0.141	0.138	0.135	0.134
Nye County	1.117	1.250	1.439	.605	.775	1.969	2.203	2.466	2.768	3.132	3.358	3.599	3.858	3.967
Clark County	60.731	68.974	79.836	9.500	9.788	111.517	124.864	140.518	156.612	173.027	182.571	192.642	203.269	207.682
Esmeralda County	0.029	0.030	0.033	.035	.037	0.041	0.043	0.047	0.050	0.054	0.054	0.055	0.055	0.056
Washoe County-Carson City	16.81	18.52	21.29	3.64	6.19	28.84	31.70	35.13	38.60	42.43	45.12	47.98	51.02	52.29
All of Nevada	85.032	95.636	110.205	23.098	36.861	152.183	169.418	189.600	210.290	232.015	245.035	258.799	273.350	279.400

a. Sources: DIRS 178610-Bland 2007, all; DIRS 178806- CBER 2006, all; DIRS 178807- Hardcastle 2006, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.
c. Values from *Policy Insight* (DIRS 182251-REMI 2007, all), converted to 2006 dollars using the ratio of the 2000 annual Consumer Price Index (CPI) and the annual CPI from 2006.
d. 2006 dollars in billions.

Table 3-140. Housing characteristics in the Mina rail alignment region of influence, 2000.[a]

Geographic area	Total housing units	Single-family homes	Multiple-family homes	Mobile homes	Occupied housing units	Vacant housing units	Vacancy rate (percent)	
							Homeowner	Rental
Walker River Paiute Reservation[b]	348	308	6	34	304	44	NA[c]	NA
Schurz Census Designated Place[d]	320	280	6	34	276	44	0.5	6.7
Lyon County[e]	14,279	8,046	1,161	5,072	13,007	1,272	3.0	11.5
Yerington City[f]	1,328	861	286	181	1,182	146	2.3	14.0
Mineral County[g]	2,866	1,803	307	756	2,197	669	3.6	28.1
Hawthorne Census Designated Place[h]	1,813	1,177	219	417	1,470	343	3.8	28.6
Nye County[i]	15,934	6,383	1,014	8,537	13,309	2,625	3.4	17.9
Tonopah Census County Division[j]	1,608	766	385	457	1,152	456	3.6	32.3
Beatty Census County Division[j]	746	181	97	468	548	198	2.6	33.0
Amargosa Census County Division[j]	536	73	7	456	422	114	2.4	17.9
Pahrump[j]	8,206	3,660	479	4,067	7,234	972	3.2	11.8
Esmeralda County[k]	833	269	121	443	455	378	4.4	40.5
Goldfield Census County Division[j]	429	162	61	206	224	205	5.7	43.8
Clark County[l]	559,799	321,801	203,411	34,587	512,253	47,546	2.6	9.7
Washoe County	143,908	84,327	46,735	12,386	132,084	11,824	NA	NA
Carson City	21,283	12,872	5,364	2,985	20,171	1,112	NA	NA

a. Total Housing Units, Occupied Housing Units, and Vacant Housing Units counts were taken from Summary File 1 U.S. Census Bureau data, and Single Family Homes, Multiple Family Homes, and Mobile Homes counts were taken from Summary File 3 U.S. Census data. Because Summary File 1 data are collected from all households, while Summary File 3 data are compiled from a sample of approximately 19 million housing units (approximately 1 in 6 households), total housing counts differ slightly from the sum of "Single Family Homes, Multiple Family Homes, and Mobile Homes."
b. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 41 and 43.
c. NA = not available.
d. Source: DIRS 180475-Nevada Small Business Development Center [n.d.], p. 55.
e. Source: DIRS 180476- Nevada Small Business Development Center [n.d.], p. 55.
f. Source: DIRS 180479-Nevada Small Business Development Center [n.d.], p. 55.
g. Source: DIRS 180477-Nevada Small Business Development Center [n.d.], p. 55.
h. Source: DIRS 180478-Nevada Small Business Development Center 2003, p. 55.
i. Source: DIRS 173564-Nevada Small Business Development Center 2003, p. 55.
j. Source: DIRS 173535-Bureau of Census 2000, all.
k. Source: DIRS 173566-Nevada Small Business Development Center 2003, p. 55.
l. Source: DIRS 173567-Nevada Small Business Development Center 2003, p. 55.

Compared to Lyon County, Mineral County has a much smaller housing stock at 2,866 units (DIRS 180477-Nevada Small Business Development Center [n.d.], p. 55). Most of these units are single-family homes (63 percent). The Hawthorne Census Designated Place consists of 1,813 housing units with single-family homes, multiple-family homes, and mobile (manufactured) homes totaling 65 percent, 12 percent, and 23 percent of the housing stock, respectively. The Schurz Census Designated Place has 320 housing units which are predominantly single-family homes. The Walker River Paiute Reservation's housing stock is nearly identical to Schurz. In Hawthorne, nearly 30 percent of the rental units are vacant.

Nye County has similar housing stock to Lyon County, with 15,934 units, as indicated by Census 2000 data (DIRS 173564-Nevada Small Business Development Center 2003, all). Most of these units are mobile homes; the housing stock in the Beatty Census County Division and the Amargosa Census County Division consists of 63 percent and 85 percent mobile homes, respectively (DIRS 173564-Nevada Small Business Development Center 2003, all). In Tonopah, almost one-third of the housing units are vacant, particularly in the rental segment.

Esmeralda County has the smallest housing stock. More than half of the county's 833 units are in Goldfield, where 48 percent are mobile homes, and 49 percent of all units were vacant in 2000. The housing stock of Clark County in 2000 was 559,799, which reflects an increase of slightly more than 75 percent over the 1990 count (DIRS 173531-Bureau of Census 2000, Table DP-5 STF3). This increase is accounted for by the large population and employment growth in Clark County, which has spurred housing construction. Vacancy rates in both the homeowner and rental segments in Clark County tend to be lower than the rates in the other counties in the region of influence.

The housing stock in Washoe County in 2000 was 143,908. Only 8 percent of these housing units are vacant. Similarly, the occupancy rate in Carson City's housing stock is relatively low. Only 1,112 housing units are vacant, or just over 5 percent. As shown in Table 3-141, the median values of housing on the Walker River Paiute Reservation ($57,300), in Mineral County ($59,500), and Esmeralda County ($75,600), as listed by the U.S. Census Bureau in 2000, were considerably below the median values in Lyon County ($119,200), Nye County ($122,100), Carson City ($136,300), Clark County ($139,500), and Washoe County ($149,500). Similarly, rent levels in Mineral and Esmeralda Counties were approximately half those for Clark County and approximately two-thirds those of Nye County. Additionally, housing values in all of Southern Nevada rose rapidly since the 2000 Census. A Las Vegas-based housing research firm, Home Builders Research Inc., reported that the median price of the recorded new homes in the area in November 2005 was $301,519, which was a 5.9 percent annual increase. Omitting apartment conversions, the median price for new homes was $336,645, or an 18.2 percent annual increase (DIRS 176007-Home Builders Research 2005, all).

There are lodging options along U.S. Highway 95 in and around Yerington, Hawthorne, Walker Lake, Mina, Goldfield, Beatty, and Town of Amargosa Valley. In Yerington, there are four hotels with 118 total rooms and four recreational vehicle parks with 109 total spaces.

Visitors to Hawthorne may stay at any of the eight hotels (which have a total of 243 rooms). In addition, Hawthorne has two recreational vehicle parks with a total of 46 spaces. Walker Lake, Nevada, has one hotel with 20 rooms, while Mina has one recreational vehicle park with 26 spaces. Visitors to Goldfield can stay in the Goldfield recreational vehicle park, which has 20 spaces (DIRS 182379-Nevada Commission on Tourism 2007, all). Beatty has a much higher accommodation capacity. The town has six motels with a total 275 rooms, and three recreational vehicle parks with a total 63 spaces (DIRS 182381-Nevada Commission on Tourism 2007, all; DIRS 182384-Nevada Commission on Tourism 2007, all).

Table 3-141. Median housing values and gross rents in the region of influence, 2000.[a]

Geographic area	Median value (dollars)[b]	Median monthly gross rent (dollars)
Walker River Paiute Reservation	57,300	200
Schurz Census Designated Place	56,800	200
Lyon County	119,200	591
Yerington City	99,200	436
Mineral County	59,500	398
Hawthorne County Designated Place	58,700	426
Nye County	122,100	541
Tonopah Census County Division	78,200	478
Beatty Census County Division	93,700	368
Amargosa Valley Census County Division	80,800	380
Pahrump	135,100	614
Esmeralda County	75,600	381
Goldfield Census County division	71,300	389
Clark County	139,500	716
Washoe County	149,500	675
Carson City	136,300	650

a. Source: DIRS 176856-U.S. Census Bureau 2003, Tables 25, 29, 45, and 47.
b. Median value applies to owner-occupied units.

Town of Amargosa Valley features a combined 60-room hotel and 51-space recreational vehicle park, one additional motel (17 rooms), and one additional recreational vehicle park (97 spaces) (DIRS 182380-Nevada Commission on Tourism 2007, all; DIRS 182383-Nevada Commission on Tourism 2007, all).

3.3.9.3.4 Public Services

This section summarizes conditions for health care, education, fire protection, and law enforcement. Section 3.3.11, Utilities, Energy, and Materials, describes utilities-related public services.

3.3.9.3.4.1 Health Care. While Lyon, Mineral, Nye, and Esmeralda Counties have some health care facilities, all four counties are federally designated as health professional shortage areas for primary, dental, and mental health care (DIRS 180466-State of Nevada 2005, all; DIRS 180467-State of Nevada 2005, all; DIRS 173559-State of Nevada [n.d.], all; and DIRS 173560-State of Nevada [n.d.], all). Health care services in the region of influence are concentrated in Clark County, particularly in the Las Vegas area.

There is a public health clinic on the Walker River Paiute Reservation in Schurz. This clinic is staffed full time with a doctor and a nurse (DIRS 180118-Gormsen and Merritt 2007, all). This facility also has emergency medical services and emergency medical technicians (DIRS 180118-Gormsen and Merritt 2007, all).

Lyon County is served by four rural community health offices (DIRS 180153-Gormsen 2007, all). One of the health offices is in Yerington and has full-time public health services, such as family planning, sexually transmitted disease clinics, and immunization clinics. Yerington's community health office is the only provider of immunizations in the Smith Valley and Mason Valley region (DIRS 180153-Gormsen 2007, all).

Lyon County is also served by the South Lyon Medical Center in Yerington. The facility has 63 hospital beds and a 24-hour emergency room (DIRS 178100-State of Nevada 2006, p. v).

Mineral County has a community health nurse who provides immunizations, conducts general health checks (such as checking blood pressure), and examines ears, eyes, noses, and throats when those services are within the community health nurse's scope of practice (DIRS 180118-Gormsen and Merritt 2007, all). The community health nurse visits a Senior Care and Share center in Mina once a month to provide these public health services. Mina also has emergency medical team services available (DIRS 180118-Gormsen and Merritt 2007, all).

Mineral County is also served by Mount Grant Hospital in Hawthorne. This 35-bed facility offers a wide range of services, including acute, long-term, and emergency care (DIRS 180692-Mineral County Nuclear Projects Office 2004, p. 21). The hospital has a surgical suite for minor elective surgery (orthopedic, podiatry, and ophthalmology) (DIRS 180692-Mineral County Nuclear Projects Office 2004, p. 22).

According to a Nye County assessment, emergency service (county-wide medical and Pahrump's fire protection) personnel are currently overextended (DIRS 174548-Abaris Group 2004, pp. 2 and 3). Nye County medical services are distributed widely and consist of a mixture of public and private clinics. The communities of Beatty, Pahrump, and Town of Amargosa Valley all have access to ambulance service, and are served by preventative care clinics staffed by physician assistants or community health nurses. These clinics focus on women's health and immunizations. They are funded in part by the State Rural Health Division (DIRS 174736-Arcaya 2005, all). Pahrump has a pediatric physician who runs a separate clinic in the community, a Veterans Administration clinic, and several private dermatologists, dentists, and chiropractors (DIRS 174736-Arcaya 2005, all; DIRS 174972-Arcaya 2005, all).

Additionally, Desert View Regional Medical Center (DVRMC), Pahrump's first hospital, opened in April 2006. The hospital has 24 beds and a 24-hour emergency room. The facility has a maternity ward, full-service lab and radiology services, as well as physical therapy services (DIRS 181897-Desert View Regional Medical Center 2007, all).

Nye County is also served by the Nye Regional Medical Center, a small, private hospital in Tonopah that has ambulance services. The center has 44 beds, 26 of which are long-term-care beds reserved for the hospital's nursing-home wing. Two full-time-equivalent physicians provide coverage for both the 24-hour emergency room and all other patients. The hospital's nursing home maintains 24-hour coverage consisting of one registered nurse and one certified nursing assistant. The Nye Regional Medical Center is able to perform diagnostic imagery and to provide services from its on-site laboratory, pharmacy, and outpatient clinic. However, the facility is not licensed for surgery. Nye County patients in need of more advanced care than can be provided at Tonopah's hospital are transported by helicopter to Reno or Las Vegas by Flight for Life, a medical air service (DIRS 174732-Arcaya 2005, all).

Although Nye County continues to be a medically underserved area and a health professional shortage area, Table 3-142 shows that the capacity of the health care system in Nye County improved between 1995 and 2000, with increases in the average number of beds and the number of beds per 1,000 residents.

Table 3-142. Hospital use in Nye County.[a]

County	1995	1998	2000
Average number of beds	21	10	44
Beds per 1,000 residents	0.86	0.33	1.3
Patient days	1,900	560	No data available

a. Source: DIRS 174732-Arcaya 2005, all.

Esmeralda County had no practicing doctors or dentists in 2005 (DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). The U.S. Health Resources and Services Administration designated Esmeralda County as both a health professional shortage area and a medically underserved population for primary health, dental, and mental-health care for 2004 (DIRS 173560-State of Nevada [n.d.], all). Because Esmeralda County has no health-care facilities, the county has submitted a proposal to fund a new facility (DIRS 175507-McCorkel et al. 2005, all).

Clark County has 13 general acute care medical centers with a combined total of 3,439 beds (1.9 beds per 1,000 residents) and 2,729 active, licensed physicians practicing throughout the county in 2005 (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). Sunrise Hospital and Medical Center, in Las Vegas, is the largest hospital in Nevada with 701 beds (DIRS 178100-State of Nevada 2006, p. v). It is also capable of providing all medical services and staffs a 24-hour emergency room. Of the remaining 12 hospitals in Clark County, eight (Desert Springs Hospital, Mountain View Hospital, North Vista Hospital, Southern Hills Hospital and Medical Center, Spring Valley Hospital Medical Center, Summerlin Hospital and Medical Center, University Medical Center, and Valley Hospital and Medical Center) are in Las Vegas, two (Saint Rose Dominican Hospital and Saint Rose Siena Campus) are in Henderson, one (Boulder City Hospital) is in Boulder City, and one (Mesa View Regional Hospital) is in Mesquite (DIRS 178100-State of Nevada 2006, p. v).

Washoe County has five general acute care hospitals with a combined total of 1,066 beds and 952 active, licensed physicians practicing throughout the county in 2005 (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7). According to 2005 data, Carson City has one general acute care hospital with 144 beds and 143 active, licensed physicians (DIRS 178100-State of Nevada 2006, p. v; DIRS 177749-Nevada State Board of Medical Examiners [n.d.], p. 7).

3.3.9.3.4.2 Education. Lyon County has a total of 16 elementary, middle, and high school facilities. During the 2005 to 2006 school year, Lyon County schools had a total enrollment of 8,688 students and a graduation rate for the class of 2005 of 83 percent (DIRS 180463-Lyon County School District [n.d.], pp. 2 and 10). The average student-to-teacher ratio for kindergarten through eighth grades is 21 to 1 (DIRS 180463-Lyon County School District [n.d.], p. 9). This is slightly higher than the 2003 national average student-to-teacher ratio of 16 to 1 across elementary and secondary grades levels (DIRS 177757-Snyder, Tan, and Hoffman 2006, Table 62). Lyon County is the fastest growing school district in Nevada (DIRS 180463-Lyon County School District [n.d.], p. 1). The school district hired more than 100 teachers for the 2005-2006 school year and will open new elementary schools in Fernley and Dayton for the 2006-07 and 2007-08 school years, respectively (DIRS 180463-Lyon County School District [n.d.], p. 1).

Mineral County has a total of three elementary, middle, and high school facilities. During the 2005 to 2006 school year, Mineral County schools had a total enrollment of 624 students and a graduation rate for the class of 2005 of 73 percent (DIRS 180465-Mineral County School District [n.d.], pp. 2 and 7). The average student-to-teacher ratio for kindergarten through eighth grades is 16 to 1 (DIRS 180465-Mineral County School District [n.d.], p. 6). This is consistent with the 2003 national average student-to-teacher ratio of 16 to 1 across elementary and secondary grades levels (DIRS 177757-Snyder, Tan and Hoffman 2006, Table 62).

During the 2005 to 2006 school year, Nye County had approximately 6,088 students. The county's 2005 graduation rate was approximately 60 percent (DIRS 177759- Nye County School District [n.d.], p. 11). The average student-to-teacher ratio for kindergarten through fifth grades is 20 to 1 (DIRS 177759-Nye County School District [n.d.], p. 10). Tonopah has elementary, middle, and high school facilities.

Nye County's school system saw an approximate 10 percent increase in enrollment in the 2004-2005 school year over the previous year. Most of this growth was due to increases in Pahrump's population. Pahrump is home to four elementary schools, one middle school, and one high school. Table 3-143 lists enrollment for each school. All of these schools are functioning at or above maximum design capacity (that is, they are all serving as many or more students than they were originally built to accommodate). To alleviate overcrowding, all six schools were scheduled to receive modular units over the summer of 2005 that would each hold two additional classes. A bond for a new elementary school is also under consideration for the area, with a timeline of roughly 18 months for discussion and a decision on the bond. The new elementary school would likely be designed to hold between 400 and 600 students, making it roughly equal in size to the four existing elementary schools (DIRS 174737-Arcaya 2005, all).

Table 3-143. Enrollment in Pahrump area schools, 2004-2005.[a]

School Name	Type	2004-2005 Enrollment
Pahrump Valley	High school	987
Rosemary Clark	Middle school	1,122
Hafen	Elementary school	560
JG Johnson	Elementary school	555
Mt. Charleston	Elementary school	574
Manse	Elementary school	478

a. Source: DIRS 174737-Arcaya 2005, all.

In Nye County, the Community College of Southern Nevada has a campus in Pahrump that provides postsecondary school education. The facility offers courses to fulfill general education requirements, with 4-year degree programs planned (DIRS 174737-Arcaya 2005, all). Some of these programs are also offered as distance learning courses that can be accessed at a secondary facility in Tonopah equipped for videoconferencing (DIRS 174737-Arcaya 2005, all). The nearest major university to southern Nye County is the University of Nevada, Las Vegas, 105 kilometers (65 miles) from Pahrump. The University of Nevada, Reno, is the closest major university to northern Nye County. In addition, the University of Nevada, Reno, has a Cooperative Extension Center in Pahrump.

In Esmeralda County, 86 students were enrolled in school during the 2005-2006 school year (DIRS 177760-Esmeralda County School District [n.d.], p. 3). Three schools in the county serve kindergarten through eighth grade students. These schools are in Dire, Silver Peak, and Goldfield. The average student-to-teacher ratio is 12 to 1 (DIRS 177760-Esmeralda County School District [n.d.], p. 7). The county employs seven certified teachers and one certified literacy coordinator (DIRS 174970-Arcaya 2005, all). There is no high school in Esmeralda County; high-school students from Esmeralda County attend school in Tonopah, Nye County (DIRS 155970-DOE 2002, p. 3-156).

3.3.9.3.4.3 Fire Protection. Lyon County is divided into four fire districts to meet fire suppression needs: North Lyon County Fire District, Central Lyon County Fire District, Mason Valley Fire District, and Smith Valley Fire District. In total, there are 31 career firefighters and 117 volunteer firefighters spread across these fire districts (DIRS 180693-Gormsen 2007, all). The Central Lyon, Mason Valley, and Smith Valley Fire Districts are part of a quad-county partnership with Douglas County, Storey County, and Carson City. These fire districts are weapons-of-mass-destruction and hazardous-materials certified, and will provide assistance to events in any of the four partner counties. All four of the fire districts have received at least one Fire Act grant in the last 3 years. In addition, the county receives sporadic grants from state agencies (DIRS 180693-Gormsen 2007, all).

Mineral County has four fire departments: Hawthorne Volunteer Fire Department, Mina Volunteer Fire Department, Luning Volunteer Fire Department, and Walker Lake Volunteer Fire Department. Among these four departments, the county has a total of 43 volunteer and three career firefighters. Hawthorne Volunteer Fire Department uses three Type 1 fire apparatuses, and the other three departments use one Type 1 apparatus each.

Nye County has 11 volunteer fire departments, including one in Beatty and one in Town of Amargosa Valley. The county's only paid fire department is in Pahrump. The county recently spent $2.5 million to upgrade its fire trucks and has adequate fire protection in all areas of the county except for Pahrump, which is overextended (DIRS 174731-Arcaya 2005, all). A 2004 audit of the Pahrump Valley Fire-Rescue Service commissioned by the Pahrump Town Board found that "the community is currently underserved by fire suppression and emergency medical services operational staff' and suggested that staff be added to the service, specifically an additional daily three-person team (DIRS 174548-Abaris Group 2004, p. 3). The audit also noted that Pahrump has no overall fire suppression and emergency medical services master plan, and recommended that one be developed.

Currently, the Nevada Test Site provides fire protection services to the Yucca Mountain Site. The Nevada Test Site has two active fire departments that operate 24 hours a day, 7 days a week. One of the fire departments is in Mercury, Nevada (Area 23), and the other is in Area 6 on the Nevada Test Site. The Yucca Mountain Site has two paramedics, a small medical facility, and an ambulance for emergency response. The site also has two fully trained underground rescue teams available any time underground work is underway (DIRS 177762-Gormsen 2006, all).

The BLM Las Vegas and Battle Mountain Field Offices supplement Nye County's fire-protection resources by providing wildfire suppression services to all the public lands within Nye County that are managed by BLM and the U.S. Forest Service (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all). The Las Vegas Field Office provides fire suppression resources for wildfires during peak fire season, which is generally from April through October. The Battle Mountain Field Office provides fire suppression support from three locations in northern Nye County: Austin, Eureka, and Battle Mountain. In addition to firefighters, the fire suppression resources available through these locations include Type-4 and Type-3 wildfire engines, a Type-3 helicopter, Type-3 incident commanders, and single engine air tanker and air attack bases (DIRS 177867-Gormsen 2006, all; DIRS 177925-Gormsen 2006, all).

In Esmeralda County, Goldfield has nine volunteer firefighters and three fire trucks; Gold Point has eight volunteer firefighters and three fire trucks; Silver Peak has six volunteer firefighters and three fire trucks; and Fish Lake Valley has 16 volunteer firefighters and three fire trucks (DIRS 180977-Gormsen 2007, all). The community fire departments have access to the county's road department vehicles, if needed.

3.3.9.3.4.4 Law Enforcement. The Walker River Paiute Reservation has a police department with four law enforcement officers (DIRS 181594- Zuber, 2007). This yields a ratio of 3.4 officers per 1,000 residents.

The Lyon County Sheriff's Office has 78 sworn officers, 13 of whom are assigned to the detention facility. This yields a ratio of 1.6 sworn personnel per 1,000 residents (DIRS 180693-Gormsen 2007, all).

The Mineral County Sheriff's Office is currently staffed with 18 sworn officers to provide administrative, communications, detention, and patrol services in the county (DIRS 180221-Gormsen and Merritt 2007, all). This yields a ratio of 3.9 sworn officers per 1,000 residents.

The Nye County Sheriff's Office has 105 sworn officers, 85 who conduct street patrols, and 20 who are corrections and detention officers (DIRS 174974-Arcaya 2005, all). This yields a ratio of 2.2 patrol officers per 1,000 residents. The Nye County Sheriff's Office receives some funding in the form of occasional grants from state and federal agencies (DIRS 177756-Gormsen 2006, all).

The Esmeralda County Sheriff's Office has 14 employees: six officers who handle patrol (one sheriff, one sergeant, two resident deputies, and two full-time street deputies), three corrections officers, four full-time dispatchers, and one part-time civilian dispatcher (DIRS 174753-Arcaya 2005, all). This yields a ratio of 5 officers per 1,000 residents in Esmeralda County. By comparison, the national officer-to-population ratio is 2.4 officers per 1,000 residents (DIRS 155970-DOE 2002, p. 3-92). The Esmeralda County Sheriff's Office receives limited state and federal support in the form of occasional equipment grants (DIRS 178094-Arcaya 2006, all). The county does not receive ongoing grant support or training administered by state or federal agencies.

As Table 3-144 shows, crime rates for Lyon, Mineral, Nye, Esmeralda Counties and Carson City are below the national average, and, with the exception of Mineral County, have decreased between 2003 and 2005.

Table 3-144. Crime rates in the Mina rail alignment region of influence, 2003 to 2005.

Area	Crime rate[a] (percent)		
	2003[b]	2004[c]	2005[d]
Lyon County	23	22	21
Mineral County	12	13	16
Nye County	35	35	31
Esmeralda County	13	10	7
Clark County	51	51	51
Washoe County	51	47	46
Carson City	38	35	31
National	45	44	Not available

a. The crime rate is based on the occurrence of an offense per 1,000 residents.
b. Sources: DIRS 173399-State of Nevada 2004, all; DIRS 177747-State of Nevada 2005, all; DIRS 177748-State of Nevada 2006, all.

3.3.9.3.5 Transportation Infrastructure

This section describes the public roadways and mainline railroads in the area around the Mina rail alignment.

3.3.9.3.5.1 Public Roadways. Because the Mina rail alignment region of influence for transportation resources is primarily in remote and rural areas, the rail line would cross paved highways and roads with low traffic, and low-usage unpaved roads, including county roads, private roads, and off-road vehicle trails. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these roads are not heavily traveled. The exception is the existing Union Pacific Railroad Hazen Branchline between Hazen and Wabuska, which crosses public roads with moderate traffic (such as U.S. Highway 50A in Hazen, U.S. Highway 50 in Silver Springs, and U.S. Highway 95A in Churchill and Wabuska). Section 4.3.10, Occupational and Public Health and Safety, describes safety issues concerning rail line crossings of public roads, and road traffic related to construction and operation of the proposed railroad.

In addition to the state and federal roads discussed below, there are three paved roads with rail-public highway crossings on the Union Pacific Railroad Hazen Branchline: First Avenue, Fifth Street, and Ninth Street in Silver Springs. There are also three paved roads the Mina rail alignment would intersect and would require rail-highway crossings: Silver Peak Road in Silverpeak and two Nevada Test and Training Range access roads (one approximately 19 kilometers [12 miles] east of Tonopah off U.S. Highway 6 and the other off U.S. Highway 95 between Scottys Junction and Beatty).

Generally, the main roads within the region of influence are two-lane highways with very little daily traffic. Table 3-145 lists annual average daily traffic volumes along primary roads in the region of influence, which DOE obtained from the Nevada Department of Transportation's 2005 annual traffic report (DIRS 178749-NDOT [n.d.], all). These traffic volumes indicate that roadways near the Mina rail alignment are not congested.

All references to levels of service of roads shown in Table 3-145 are defined by the Highway Capacity Manual 2000, which is an industry standard for traffic engineering published by the Transportation Research Board (DIRS 176524-Transportation Research Board 2001, all). This manual defines six levels of service that reflect the level of traffic congestion and qualify the operating conditions of a roadway.

The six levels are given letter designations ranging from A to F, with A representing the best operating conditions (free flow, little delay) and F the worst (congestion, long delays) (DIRS 176524-Transportation Research Board 2001, all). Various factors that influence the operation of a roadway or intersection include speed, delay, travel time, freedom to maneuver, traffic interruptions, comfort, convenience, and safety. The Highway Capacity Manual describes the ***levels of service*** as follows:

- Level of service A describes completely free-flow conditions. Individual drivers are virtually unaffected by the presence of other vehicles in the traffic stream.
- Level of service B also indicates free flow, but the presence of other vehicles becomes more noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from Level of Service A.
- Level of service C is in the range of stable flow, but marks the beginning of the range of flow in which operation of individual drivers becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by others and maneuvering requires substantial vigilance on the part of the driver.
- Level of service D represents high density but stable flow. Speed and freedom to maneuver are severely restricted, and the driver experiences a generally poor level of comfort and convenience.
- Level of service E represents operating conditions at or near capacity. All speeds are reduced to a low, but relatively uniform, value.
- Level of service F is used to define breakdown of traffic flow or stop-and-go traffic. This condition exists wherever the amount of traffic approaching a point exceeds the amount that can cross the point. Queues form behind such locations. Operations within the queue are characterized by stop and-go waves, and they are extremely unstable.

Levels of service A, B, and C are typically considered good operating conditions in which motorists experience minor or tolerable delays of service. Based on the traffic counts listed in Table 3-145, State Routes 361, 360, and 265 are operating at a level of service A. Most of U.S. Highway 95 and 95A within the region of influence are operating at a level of service B, except for a portion that is operating at a level of A, and another at level C. The section of U.S. Highway 50 within the region of influence operates at a level of service B, while U.S. Highway 50A operates at a level of service C. Sections 3.3.10 and 4.3.10, Occupational and Public Health and Safety, discuss highway accidents and fatalities.

3.3.9.3.5.2 Mainline Railroads. Two major freight railroads, both Class I, serve Nevada: the Union Pacific Railroad and the Burlington Northern and Santa Fe Railway. Union Pacific is the dominant carrier of the two in terms of tonnage of freight hauled and miles of track. The Union Pacific Railroad mainlines consist of two northern routes and one southern route that cross Nevada east to west. The region of influence for rail transportation includes the Union Pacific Railroad Hazen Branchline, and the Department of Defense Branchlines from near Wabuska to Hawthorne.

Union Pacific Railroad Hazen Branchline shipments totaled 1,419 railcars in 2005 (DIRS 178017-Holder 2006, all), which can generate from one to five trains per week. Of the 1,419 railcars, 98 railcars were shipped to the Hawthorne Army Depot. For purposes of analysis in this Rail Alignment EIS, DOE assumes that the existing rail traffic on the Union Pacific Railroad Hazen Branchline consists of an average of four trains per week (two Union Pacific trains plus two U.S. Army trains). Since the Union Pacific Railroad trains only operate as far as the end of the Union Pacific Railroad Hazen Branchline near Wabuska, DOE assumes that the existing rail traffic on the Department of Defense Branchlines averages two trains per week.

Sections 3.3.10 and 4.3.10, Occupational and Public Health and Safety, discuss rail transportation in relation to public safety.

Table 3-145. Annual average daily traffic counts in southern and western Nevada (2005)[a].

Roadway and location of traffic count station	Legend in Figure 3-235	Vehicles per day[b]	Level of service
U.S. Highway 50A			
0.8 kilometer (0.5 mile) west of the junction of U.S. Highway 50 (Churchill County)	a	7,900	C
U.S. Highway 50			
2.4 kilometers (1.5 miles) east of U.S. Highway 95A (Lyon County)	b	2,200	B
U.S. Highway 95A			
13 kilometers (8 miles) south of Silver Springs (Lyon County)	c	NA[c]	A
1 kilometer (0.6 mile) south of the railroad crossing at Wabuska (Lyon County)	d	2,850	B
0.16 kilometer (0.1 mile) east of Miley Road (Lyon County)	e	1,800	B
State Route 361 (Gabbs Valley Road)			
32 kilometer (0.2 mile) north of U.S. Highway 95 in Luning (Mineral County)	f	120	A
State Route 360 (Mina-Basalt Cutoff Road)			
0.4 kilometer (0.25 mile) west of U.S. Highway 95 south of Sodaville (Mineral County)	g	690	A
U.S. Highway 6 and U.S. Highway 95			
76.2 meters (250 feet) west of State Route 265 to Silver Peak (Esmeralda County)	n	2,000	B
State Route 265 (Silver Peak Road)			
0.16 kilometer (0.1 mile) south of U.S. Highway 6 and U.S. Highway 95 (Esmeralda County)	i	90	A
U.S. Highway 95			
61 meters (200 feet) north of railroad grade crossing in Schurz (Mineral County)	j	2,550	B
0.40 kilometer (0.25 mile) south of State Route 362 (Hawthorne Truck Bypass Road) (Mineral County)	k	2,850	B
0.40 kilometer (0.25 mile) north of State Route 361 to Gabbs (Mineral County)	l	2,300	B
6.6 kilometers (4.1 miles) north of Mina (Mineral County)	m	2,300	B
1 kilometer (0.6 mile) north of U.S. Highway 6 (Esmeralda County)	h	1,700	B
0.3 kilometer (0.2 mile) south of U.S. Highway 6 in Tonopah (Nye County)	q	5,550	C
20.3 kilometers (12.6 miles) west of the Nye-Esmeralda county line (Esmeralda County)	p	2,050	B
At the Nye-Esmeralda county line south of Tonopah (Esmeralda County)	o	2,100	B
Just south of the town of Goldfield (Esmeralda County)	r	1,950	B
South of Goldfield at mp ES-8.8 (Esmeralda County)	s	200	A
0.16 kilometer (0.1 mile) south of State Route 266 at Lida Junction (Esmeralda County)	t	2,150	B
1.6 kilometers (1 mile) north of State Route 374 (Death Valley Road) (Nye County)	u	2,400	B
0.2 kilometer (0.1 mile) south of State Route 374 (Death Valley Road) (Nye County)	v	3,400	B
0.3 kilometer (0.2 mile) north of State Route 373 (Nye County)	w	2,600	B

a. Source: DIRS 178749-NDOT [n.d.], all.
b. See Figure 3-235 for location of traffic counts.
c. NA = not available.

3.3.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes the affected environment for occupational and public health and safety related to construction and operation of a railroad along the Mina rail alignment. Section 3.3.10.1 describes the nonradiological, radiological, and transportation regions of influence; Section 3.3.10.2 describes the nonradiological health and safety environment; Section 3.3.10.3 describes the radiological health and safety environment; Section 3.3.10.4 describes ***background radiation*** in the vicinity of the Yucca Mountain Site; and Section 3.3.10.5 describes the nonradiological transportation health and safety environment.

The radiological health and safety environment discussion is related to the impact analyses of public and occupational ***exposure*** to ***radiation***. The nonradiological health and safety environment discussion is related to the occupational health and safety impact analysis, including occupational incidents affecting construction and operations workers resulting from workplace physical hazards, exposure to nonradiological ***hazardous chemicals***, and exposure to other nonradiological hazards (such as biological hazards). The nonradiological transportation health and safety environment discussion relates to the nonradiological transportation impact analysis, which includes impacts to workers and the public from roadway and railway transportation ***accidents*** other than accidents involving releases of ***radiation***.

3.3.10.1 Region of Influence

3.3.10.1.1 Nonradiological Region of Influence

The region of influence for occupational nonradiological impacts includes:

- The nominal width of the Mina rail alignment construction right-of-way between Wabuska and the Rail Equipment Maintenance Yard. There would be no new construction along the existing Union Pacific Branchline between Hazen and Wabuska; the region of influence for the existing rail line between Hazen and Wabuska applies only to the operations phase, not to the construction phase.
- The ***operations right-of-way*** of the existing Union Pacific Hazen Branchline between Hazen and Wabuska and the operations right-of-way of the Mina rail alignment between Wabuska and the Rail Equipment Maintenance Yard.
- Public roads in Washoe, Carson City, Douglas, Storey, Churchill, Mineral, Lyon, Nye, and Esmeralda Counties and the Walker River Paiute Reservation that the proposed railroad workforce would use during railroad construction and operations.
- The railroad construction and operations support facilities including access roads, water wells, and quarries where workers would perform construction, operations, or maintenance activities. Railroad operations support facilities within the region of influence include the following:
  - Staging Yard (including interchange tracks) at Hawthorne
  - Maintenance-of-Way Facility
  - Rail Equipment Maintenance Yard
  - Cask Maintenance Facility
  - ***Nevada Railroad Control Center*** and National Transportation Operations Center
- Construction support facilities include the following:
  - Quarries
  - Concrete batch plant
  - Construction camps
  - Water wells

The region of influence for occupational nonradiological impacts includes public roads upon which the proposed workforce would travel and the rail line right-of-way and construction and operations support facilities where the proposed workforce would work.

3.3.10.1.2 Radiological Region of Influence

The region of influence for radiological impacts to members of the public during ***incident-free transportation*** includes the area 0.8 kilometer (0.5 mile) on either side of the centerline of the Mina rail alignment, which, for purposes of analysis, includes operation of cask trains and other trains along the existing Union Pacific Railroad Hazen Branchline to the Staging Yard and operation of cask trains and repository construction and supplies trains from the Staging Yard to the Rail Equipment Maintenance Yard.

The region of influence for occupational radiological impacts during incident-free operation includes the physical boundaries of railroad operations support facilities, where workers would perform activities involving the transportation of ***spent nuclear fuel*** and ***high-level radioactive waste***. Railroad operations support facilities within the radiological region of influence include only the Staging Yard, the Rail Equipment Maintenance Yard, and the Cask Maintenance Facility because DOE anticipates that the potential for workers to be exposed to ***ionizing radiation*** from ***radioactive*** materials will occur only at those facilities. Radioactive materials would not be handled at the Nevada Railroad Control Center and National Transportation Operations Center, or the Maintenance-of-Way Facility.

For purposes of this Rail Alignment EIS, the affected environment for radiological impacts to members of the public in relation to incident-free transportation includes:

- Residents within the region of influence of the Mina rail alignment, including persons who live within 0.8 kilometer (0.5 mile) of either side of the centerline of the Union Pacific Railroad Hazen Branchline, from Hazen to the Rail Equipment Maintenance Yard. For the public radiological impact analysis, DOE evaluated four specific alignments: the alignment with the highest exposed population, the shortest alignment, the longest alignment, and the alignment with the lowest population (Table 3-146). Affected populations for the four alignments would include:
  - Populations of the public within 0.8 kilometer of either side of the centerline of the rail alignment. These populations are based on 2000 Census data.
  - Populations of Tribal members within 0.8 kilometer of either side of the centerline of the rail alignment. These populations are also based on 2000 Census data.
  - Populations within 0.8 kilometer of the Staging Yard. Based on the location of the Staging Yard at Hawthorne and 2000 Census data, DOE anticipates that there would be no members of the public within 0.8 kilometer of the Staging Yard footprint.
  - Individuals at locations such as residences or businesses located near the rail alignment.
  - Populations within the region of influence for radiological impacts for potential public exposure related to accidents and sabotage. This includes the area 80 kilometers (50 miles) on either side of the centerline of the rail line. These populations are based on 2000 Census data.

For radiological accidents and sabotage, the populations within the region of influence are based on the population within 80 kilometers (50 miles) on either side of the centerline of the proposed rail alignment. DOE based this region of influence on that described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 6-24).

Table 3-146. Mina rail alignments evaluated for radiological impacts to members of the public.[a]

Alignment with the largest population	Alignment with the smallest population	Longest alignment	Shortest alignment
941 people	878 people	901 people	904 people
339 miles	347 miles	354 miles	323 miles
Union Pacific Railroad Hazen Branchline[b]	Union Pacific Railroad Hazen Branchline[b]	Union Pacific Railroad Hazen Branchline[b]	Union Pacific Railroad Hazen Branchline[b]
Department of Defense Branchline North	Department of Defense Branchline North	Department of Defense Branchline North	Department of Defense Branchline North
Schurz alternative segment 5	Schurz alternative segment 4	Schurz alternative segment 6	Schurz alternative segment 1
Department of Defense Branchline South	Department of Defense Branchline South	Department of Defense Branchline South	Department of Defense Branchline South
Mina common segment 1	Mina common segment 1	Mina common segment 1	Mina common segment 1
Montezuma alternative segment 2	Montezuma alternative segment 3	Montezuma alternative segment 3	Montezuma alternative segment 1
Mina common segment 2	Mina common segment 2	Mina common segment 2	Mina common segment 2
Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 3	Bonnie Claire alternative segment 2	Bonnie Claire alternative segment 2
Common segment 5	Common segment 5	Common segment 5	Common segment 5
Oasis Valley alternative segment 3	Oasis Valley alternative segment 1	Oasis Valley alternative segment 3	Oasis Valley alternative segment 5
Common segment 6	Common segment 6	Common segment 6	Common segment 6

a. Populations based on 2000 Census data.
b. The Union Pacific Railroad Hazen Branchline is part of the region of influence only for the purposes of the radiological impact assessment; the Union Pacific Railroad Hazen Branchline is not part of the Mina rail alignment.

3.3.10.1.3 Transportation Region of Influence

The region of influence for transportation includes public roadways in the vicinity of the Mina rail alignment, as well as the Mina rail alignment itself. The region of influence for public nonradiological transportation impacts includes public roads and the rail line right-of-way in relation to potential roadway and railway nonradiological transportation accidents that could involve the public. The region of influence for transportation is primarily in remote and rural areas, and there are two operating railroads between Hazen and Thorne. The existing Union Pacific Hazen Branchline from Hazen to Wabuska, and the Department of Defense Branchline from Wabuska to Thorne both carry very low rail volumes, with an average of two trains per week on the Union Pacific Railroad Hazen Branchline and two trains per week on the Department of Defense Branchline. Although the existing Union Pacific Railroad Mainline that services west-central Nevada is used as a point of comparison in Section 4.3.10, this Rail Alignment EIS does not assess impacts to the Union Pacific Railroad Mainline.

During railroad construction, new access roads to construction camps, quarries, and water wells would originate from nearby intersections with existing public roadways. The Mina rail alignment would be within Nevada Department of Transportation Districts 1 and 2, and the rail alignment would cross Churchill, Lyon, Mineral, Nye, and Esmeralda Counties and the Walker River Paiute Reservation. The region of influence focuses on the vicinity of the Mina rail alignment, but also includes other roadways that DOE could use to supply materials, equipment, and workers during the construction phase. DOE recognizes that during construction, completed segments of the rail line could be used to transport goods and services to construction sites and camps.

3.3.10.2 Nonradiological Health and Safety Environment

Nonradiological occupational health and safety considers potential recordable incidents, lost-time accidents, and worker fatalities resulting from potential exposure of workers to physical hazards and nonradiological hazardous chemicals in their work environment during railroad construction and operations. The affected environment for nonradiological occupational health and safety also includes potential occupational health effects from exposure to exhaust emissions from vehicles and heavy equipment, including, for example, earth-moving equipment.

Nonradiological public health and safety addresses potential exposure of members of the public to nonradiological chemical hazards and vehicle emissions that would result from railroad construction and operations. Section 3.3.4, Air Quality and Climate, and Section 3.3.8, Noise and Vibration, describe the affected environments for potential public exposure to criteria and nonradiological ***hazardous air pollutants***, including vehicle emissions, and potential exposure to noise and vibration generated from construction and operation of the proposed railroad.

The types of potential nonradiological health and safety hazards to construction workers and operations and maintenance workers under the Proposed Action include:

- Incidents resulting from physical hazards, including occupational injuries and illnesses resulting in total ***recordable cases***, ***lost workday cases***, and fatalities. Fatalities could occur on or off the work site as a result of an incident or illness experienced on the work site. Physical hazards could include the potential for falls, excavation and confined-space entry hazards, mechanical hazards, electrical hazards, ergonomic hazards, and heavy construction equipment (not passenger vehicles) hazards, and illnesses related to workplace exposure to chemical hazards.
- Off-site vehicle emissions-related health effects, including health effects related to off-site vehicular emissions from transportation of construction workers, equipment, and materials and wastes to and from the construction sites.

- On-site vehicle and heavy equipment-related health effects, including effects related to diesel engine exhaust emissions from vehicles and heavy-equipment operated by construction workers on the construction sites. These health effects encompass workers who could be exposed to vehicular and heavy equipment emissions.
- Incidents resulting from other nonradiological chemical hazards, including occupational exposure to chemicals (such as solvents and lubricants), dust (such as silica dust), and other nonradiological substances from railroad construction and operations. The U.S. Department of Labor Bureau of Labor Statistics incident rates include occupational illnesses and fatalities that could result from nonradiological chemical exposure. However, the Bureau of Labor Statistics incident rates do not include a breakdown by incident type (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).
- Unexploded ordnance hazards, including potential encounters by rail line construction workers with unexploded ordnance. The U.S. Army has identified and mapped an area of potential unexploded ordnance along the existing Department of Defense Branchline right-of-way south of Schurz. This area is bordered by the southeastern shoreline of Walker Lake, the existing Department of Defense Branchline, and the Hawthorne Army Depot.
- Noise hazards, including short-term or long-term occupational exposure to noise that could impair hearing.
- Biological hazards that workers could encounter, such as venomous animals, West Nile Virus, Valley Fever, Hantavirus, and rabies.

3.3.10.3 Radiological Health and Safety Environment

Sources of Radiation Exposure

Nationwide, on average, members of the public are exposed to approximately 360 millirem per year from natural and manmade sources. The relative contributions by radiation source to people living in the United States are (DIRS 155970-DOE 2002, p. F-4):

- Radon in homes and buildings: 200 millirem per year
- Medical radiation: 53 millirem per year
- Internal radiation from food and water: 40 millirem per year
- Terrestrial (external radiation from rocks and soil): 28 millirem per year
- Cosmic (external radiation from outer space): 27 millirem per year
- Consumer products: 10 millirem per year
- Other sources: Less than 1 millirem per year

There are ambient levels of radiation in the vicinity of the Mina rail alignment, just as there are around the world. All people are inevitably exposed to the three sources of ionizing radiation: sources of natural origin unaffected by human activities, sources of natural origin but affected by human activities (called enhanced natural sources), and manmade sources. Natural sources (natural background radiation) include ***cosmic radiation*** from space, ***cosmogenic radionuclides*** produced when cosmic radiation interacts with matter in the atmosphere or ground, and naturally occurring, long-lived ***primordial radionuclides*** in the Earth's mantle. Enhanced natural sources include those that can increase exposure as a result of human actions, deliberate or otherwise. For example, a mill tailings pile from a uranium extraction process probably would contain concentrated levels of naturally occurring ***radionuclides***. A variety of radiation exposures, generally smaller than those caused by natural sources, result from manmade sources including nuclear medicine, medical X-rays, and consumer products.

Radiation: Radiation is energy traveling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. In this Rail Alignment EIS, the word "radiation" refers to ionizing radiation. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.

Cosmic radiation: A variety of high-energy particles including protons that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level where the Earth's atmosphere is most dense and provides the greatest protection.

Cosmogenic radionuclides: Radioactive nuclides generated when the upper atmosphere interacts with many of the cosmic radiations. Despite their short half-lives, they are found in nature because their supply is always being replenished.

Decay product: A nuclide resulting from the radioactive decay of a parent isotope or precursor nuclide. The decay product might be stable or it might decay to form a decay product of its own.

Decay series: The succession of elements initiated in the radioactive decay of a parent, as thorium or uranium, each of which decays into the next until a stable element, usually lead, is produced.

Effective dose equivalent: Often referred to simply as dose, it is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body.

Natural background radiation is the largest contributor to the average radiation dose of individuals. The natural occurrence of cosmic radiation, cosmogenic radionuclides, and primordial radionuclides varies throughout the world depending on such factors as altitude and geology. External radiation comes from all three of these natural sources, but cosmic radiation and radiation from primordial radionuclides are the largest contributors to dose. Cosmic radiation consists of charged particles (primarily protons from extraterrestrial sources) that have sufficiently high energies to generate secondary particles that have direct and indirect ionizing properties. The three main primordial radionuclide contributors to external terrestrial gamma radiation are potassium-40 and the members of the thorium and uranium ***decay series***. Most external terrestrial gamma radiation comes from the top 20 centimeters (8 inches) of soil, with a small contribution from airborne radon ***decay*** products.

Internal radiation dose from natural sources comes primarily from the primordial radionuclides and their ***decay products***. The largest individual source of internal dose comes from the inhalation of radon-222 and its decay products, which are all members of the uranium-238 decay series. This exposure comes mainly from inhalation of these radionuclides in indoor air, coming from the soil underneath buildings. All of the primordial radionuclides are in the body in various concentrations, incorporated by ingesting or inhaling these radionuclides in air, water, and all types of food products. Although of smaller importance to natural internal dose than the other mechanisms, four cosmogenic radionuclides, tritium (hydrogen-3), beryllium-7, sodium-22, and carbon-14, produce quantifiable internal doses.

Table 3-147 lists estimated radiation doses to individuals from natural sources in the region of influence and other locations in the United States. The radiation doses shown in the table are in terms of ***effective dose equivalent***, which is an expression of the radiation dose received by an individual from external radiation and from radionuclides internally deposited in the body. Effective dose equivalent has units of ***rem***.

Table 3-147. Radiation exposure from natural sources.

Source[b]	Annual dose in millirem (effective dose equivalent)							
	National	Tonopah	Las Vegas	Reno	Beatty	Amargosa Valley	Goldfield	Yucca Mountain
Cosmic and terrestrial	55	143	88[a]	131[a]	150[a]	107[a]	130[a]	160[a]
Radon in homes (inhaled)[c]	200	200	200	200	200	200	200	200
Naturally occurring radiation In body	39	39	39	39	39	39	39	39
Totals[d]	300	382	327	370	389	346	369	399

a. Combined cosmic and terrestrial radiation sources.
b. Sources: DIRS 100473-National Research Council 1990, Table 1-3, p. 18; DIRS 181387-University of Nevada-Reno 2006, p. B-8, Table B4-1; DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all.
c. Value for radon is an average for the United States.
d. Totals might differ from sums of values due to rounding.

Table 3-147 lists background radiation results for Tonopah, Las Vegas, Goldfield, Beatty, Reno, and Town of Amargosa Valley. DOE obtained cosmic and terrestrial background radiation for these Nevada locations based on radiological monitoring data from September 1999 through 2006 from the Desert Research Institute Community Environmental Monitoring Program (DIRS 179137-CEMP 2006, all; DIRS 179138-CEMP 2006, all; DIRS 179139-CEMP 2006, all; DIRS 179140-CEMP 2006, all; DIRS 179141-CEMP 2006, all; DIRS 179142-CEMP 2006, all). DOE obtained background radiation data for Reno from the Environmental Health and Safety University of Nevada, Reno 2006 Annual Report (DIRS 181387-University of Nevada, Reno 2006, Page B-8, Table B4-1). The average background radiation for the United States, including terrestrial and cosmic radiation, radon exposure, and natural radiation in the body, is 300 millirem per year, with radon exposure comprising 200 millirem per year, cosmic and terrestrial radiation comprising 55 millirem per year, and natural body radiation comprising 39 millirem per year (DIRS 100473-National Research Council 1990). The background radiation for Las Vegas (the closest large city to the Mina rail alignment region of influence) is 328 millirem per year, with cosmic and terrestrial radiation doses resulting in a slightly higher total annual dose than the average for the United States (DIRS 179142-CEMP 2006, all). The background radiation for the reported locations within the region of influence range from 328 millirem per year to 390 millirem per year. Background data include background radiation resulting from fallout.

3.3.10.4 Background Radiation at the Yucca Mountain Site

Ambient radiation levels from cosmic and terrestrial sources in the Yucca Mountain region are higher than the United States average. The higher elevation at Yucca Mountain results in higher levels of cosmic radiation because there is less ***shielding*** by the atmosphere. The United States average for cosmic and terrestrial radiation exposures is 55 millirem per year (DIRS 100473-National Research Council 1990, Table 1-3, p. 18). The exposures at the Yucca Mountain ridge and Yucca Mountain surface facilities are about 160 and 150 millirem per year, respectively. Moreover, there are higher amounts of naturally occurring radionuclides in the soil and parent rock of this region than in some other regions of the United States, which also results in higher radiation doses.

The Yucca Mountain FEIS includes a detailed discussion (DIRS 155970-DOE 2002, pp. 3-95 to 3-101) of the natural radiation levels, mineral-related radiation risks, and historical activities in the Yucca Mountain region that might have resulted in radiation effects to workers and the public.

3.3.10.5 Transportation Health and Safety Environment

3.3.10.5.1 Public Roadways

Because the region of influence includes public roads primarily located in remote and rural areas, the Mina rail alignment would cross areas with relatively low traffic volumes. The exception is the existing Union Pacific Railroad Hazen Branchline, which crosses public roads with moderate traffic (such as Alternate U.S. Highway 50 in Hazen, U.S. Highway 50 in Silver Springs, and Alternate U.S. Highway 95 in Churchill and Wabuska). Section 3.3.9, Socioeconomics, describes the public road infrastructure and ***baseline*** traffic conditions along the Mina rail alignment in more detail. In summary, the Mina rail alignment would cross paved highways with low to moderate traffic volumes and unpaved roads with low traffic volumes. While many of the unpaved roads are important to the daily activities of landowners and ranchers in the area, these unpaved roads are not heavily traveled.

Table 3-148 lists the paved highways and the Union Pacific Railroad Hazen Branchline the Mina rail alignment would cross. Figure 2-12 shows the locations of these crossings (DIRS 180872-Nevada Rail Partners 2007, Table C-1). Additionally, the primary paved highways in the project vicinity are Alternate U.S. Highway 50, U.S. Highways 50 and 95, and Alternate U.S. Highway 95 in the northern portion; State Routes 359, 360, and 361 and U.S. Highway 95 in the central portion; and U.S. Highways 6 and 95 and State Routes 265, 266, and 267 in the southern portion.

Overall highway safety statistics for Nevada show that the fatality rate per 100 million vehicle-miles traveled is approximately 1.28 (1.65 in rural areas). The national average is approximately 40 percent lower at 0.91 fatalities per 100 million vehicle-miles traveled (1.42 in rural areas) (DIRS 180484-FHWA 2005, p. 1, Section V, Tables FI-20 and VM-2).

Table 3-148. Potential rail line crossings of main highways.

Segment	Highway	County/Reservation
Union Pacific Railroad Hazen Branchline[a]	Alt.U.S. Highway 50	Churchill
Union Pacific Railroad Hazen Branchline[a]	Alt.U.S. Highway 50	Lyon
Union Pacific Railroad Hazen Branchline[a]	Alt. U.S. Highway 95 (at two locations)	Lyon
Schurz alternative segment 1	U.S. Highway 95	Walker River Paiute Reservation
Schurz alternative segment 4	U.S. Highway 95	Walker River Paiute Reservation
Schurz alternative segment 5	U.S. Highway 95	Walker River Paiute Reservation
Schurz alternative segment 6	U.S. Highway 95	Walker River Paiute Reservation
Mina common segment 1	State Route 361	Mineral
Mina common segment 1	U.S. Highway 6 / 95	Esmeralda
Montezuma alternative segment 1	U.S. Highway 95	Esmeralda
Montezuma alternative segment 2	U.S. Highway 95	Esmeralda
Montezuma alternative segment 3	U.S. Highway 95	Esmeralda

a. The Union Pacific Railroad Hazen Branchline is part of the region of influence for the purposes of the transportation impact assessment, but is not part of the Mina rail alignment.

3.3.10.5.2 Railroad Accidents

This section describes the general characteristics of railroad accidents in the United States and in the State of Nevada. DOE commissioned a railroad study – *The Nevada Railroad System: Physical, Operational, and Accident Characteristics* (the Nevada railroad study), which covers the period between 1979 and 1988 (DIRS 104735-YMP 1991, all). Because the number of annual rail-related accidents and incidents in Nevada is very small, it is difficult to draw conclusions about how the safety of rail operations in Nevada has changed since 1988. However, the study is the most comprehensive and relevant rail accident study to date regarding the State of Nevada and it provides some insights into the general characteristics of rail accidents in Nevada and the United States. The study presented information on types, causes, and frequency of railroad accidents; accident locations; and some of the more significant accidents from 1979 through 1988. The important findings of the Nevada railroad study were:

- Numbers and types of accidents. During the study period, the numbers of reported rail accidents in Nevada and the entire United States were 208 and 48,256, respectively. The most common accident types for Nevada and the rest of the United States were derailment and rail–highway crossing collision.
- Causes of rail accidents. Track/roadbed conditions caused proportionately more accidents in the rest of the United States than in Nevada, and mechanical/electrical failure caused proportionately more accidents in Nevada than in the rest of the United States. Nevada showed a higher proportion of its reported accidents in the higher speed ranges than did the rest of the Nation.
- Speeds at times of accidents. In general, most rail accidents happened at very low speeds. Approximately half of all reported accidents in Nevada occurred at speeds of 16 kilometers (10 miles) per hour or less, and 40 percent of all accidents in Nevada were at 8 kilometers (5 miles) per hour or less. Nationally, 73 percent of all accidents occurred at 16 kilometers per hour or less, and 53 percent of all rail accidents occurred at 8 kilometers per hour or less.
- Elapsed time on duty. The Nevada railroad study showed that about 45 percent of all accidents occurred within the first 4 hours on duty, approximately 41 percent occurred between 4 to 8 hours on duty, and approximately 14 percent occurred after 8 hours on duty.
- Weather and time of day. In Nevada, approximately 73 percent of all accidents reported occurred in clear weather, while approximately 9 percent occurred in cloudy weather. Rain, fog, and snow accounted for lower proportions. In Nevada, approximately half (49 percent) of all rail accidents occurred at night. Nationally, approximately 42 percent of all accidents occurred at night.
- Locations of accidents. The Nevada railroad study revealed that accidents occur at slightly higher rates at switchyard tracks.
- Rail–highway at-grade crossing accidents. Excluding the switching and handling incidents, rail accidents seemed to occur at random locations. The notable exception was rail–highway at-grade crossings. In the United States, rail–highway at-grade crossings in general were a higher accident location.
- Fatal rail accidents. Fewer accidents occurred at the higher speeds, but the chance that an accident, once it did occur, produced a fatality increased as speed increased. Comparing the total number of accidents at each speed interval to the total number of fatal accidents at each speed interval revealed that an accident occurring at above 97 kilometers (60 miles) per hour was 31 times more likely to cause a fatality than an accident occurring at 8 kilometers (5 miles) per hour or less.

With the exception of accident causes, the Nevada railroad study (DIRS 104735-YMP 1991, all) found that rail-accident characteristics in Nevada were not markedly different from rail-accident characteristics in the rest of the United States. The most apparent differences related to the relatively large proportion of Nevada rail lines that were in open country where higher operating speeds are maintained, compared to the United States as a whole. Most rail accidents, both in Nevada and in the rest of the United States, occurred at very low speeds. Nevada showed a slightly higher number of high-speed accidents compared to the national average. The Nevada railroad study also showed that Nevada had a larger percentage of accidents caused by equipment failure and human factors. The Nevada railroad study also found that for accidents involving only rail equipment, there were no classical "high" accident locations as there typically are with highway transport. Instead, minor accidents tended to occur in rail yards and during switching operations. More severe accidents, occurring at higher speeds on open track, seemed to happen at random.

Railroads are required by law to submit accident/incident reports within 30 days after the month to which they pertain. The Federal Railroad Administration annually publishes *Railroad Safety Statistics* which contains statistical data, tables, and charts based on railroad accident reporting requirements. In this publication, the terms "accidents" and "incidents" are used to describe the entire list of reportable events, which includes collisions, derailments, and other events involving the operation of on-track equipment and causing reportable damage above an established threshold; impacts between railroad on-track equipment and highway users at crossings; and all other incidents or exposures that cause a fatality or injury to any person, or an occupational illness to a railroad employee. As defined in *Railroad Safety Statistics*, accidents/incidents are divided into three major groups for reporting purposes:

- Train accident. A safety-related event involving on-track rail equipment (both standing and moving), causing monetary damage to the rail equipment and track above a prescribed amount.
- Highway–rail grade crossing incident. Any impact between a rail and highway user (both motor vehicles and other users of the crossing) at a designated crossing site, including walkways, sidewalks, etc., associated with the crossing.
- Other incident. Any death, injury, or occupational illness of a railroad employee that is not the result of a train accident or highway-rail incident.

Table 3-149 summarizes rail accident data from the *Railroad Safety Statistics – Annual Report 2004* for the five-year period 2000 through 2004 (DIRS 178016-DOT 2005, pp. 13 and 17). Accident and incidents rates are not available for Nevada because train mile data is only available on a nationwide basis.

The data listed in Table 3-149 reflect rail operations involving general freight service. ***Dedicated train*** service, which would be used to move cask railcars to the Yucca Mountain repository, would follow stringent safety regulations. Additionally, dedicated train service has increased control and command capabilities, because shorter trains allow better visual monitoring from the locomotive and the escort car. Therefore, accident and incident rates for dedicated train service are expected to be lower than the ones listed in Table 3-149.

3.3.10.5.3 Transportation of Munitions

The U.S. Army currently transports munitions to and from the Hawthorne Army Depot by rail. Munitions ***shipments*** pass to and from the Depot through the town of Schurz along the existing Department of Defense Branchline. The Army assesses hazards associated with transportation of munitions using a risk assessment code ***matrix*** evaluation of the potential accident probability and potential hazard severity, as illustrated in Table 3-150 (DIRS 181032-Dillingham 2007, all).

Table 3-149. Rail accidents in Nevada and the United States (2000 through 2004).[a]

	2000	2001	2002	2003	2004
Train accidents (excluding highway–rail crossing incidents – see below)					
Nevada	12	14	9	8	17
United States	2,983	3,023	2,738	2,997	3,296
Train accidents rate (accidents per train mile) (excluding highway–rail crossing incidents)					
Nevada	NA[b]	NA	NA	NA	NA
United States	4.1×10^{-06}	4.2×10^{-06}	3.8×10^{-06}	4.0×10^{-06}	4.3×10^{-06}
Total highway–rail incidents at public crossings[c]					
Nevada	1	2	1	1	2
United States	3,032	2,843	2,709	2,610	2,644
Total highway–rail incident rates (incidents per train mile) at public crossings[c]					
Nevada	NA	NA	NA	NA	NA
United States	4.2×10^{-06}	4.0×10^{-06}	3.7×10^{-06}	3.5×10^{-06}	3.4×10^{-06}

a. Source: DIRS 178016-DOT 2005, pp. 13 and 17.
b. NA = not applicable.
c. Any impact, regardless of severity, between railroad on-track equipment and any user of a public or private crossing site must be reported to the U.S. Department of Transportation, Federal Railroad Administration, on Form F 6180.57. The crossing site includes sidewalks and pathways at, or associated with, the crossing. Counts of fatalities and injuries include motor vehicle occupants, people not in vehicles or on the trains, and people on the train or railroad equipment.

Table 3-150. Risk assessment code matrix.[a]

	Accident probability				
Hazard severity	A	B	C	D	E
I	1	1	2	3	5
II	1	2	3	4	5
III	2	3	4	5	5
IV	3	4	5	5	5

a. Source: DIRS 181032-Dillingham 2007, all.

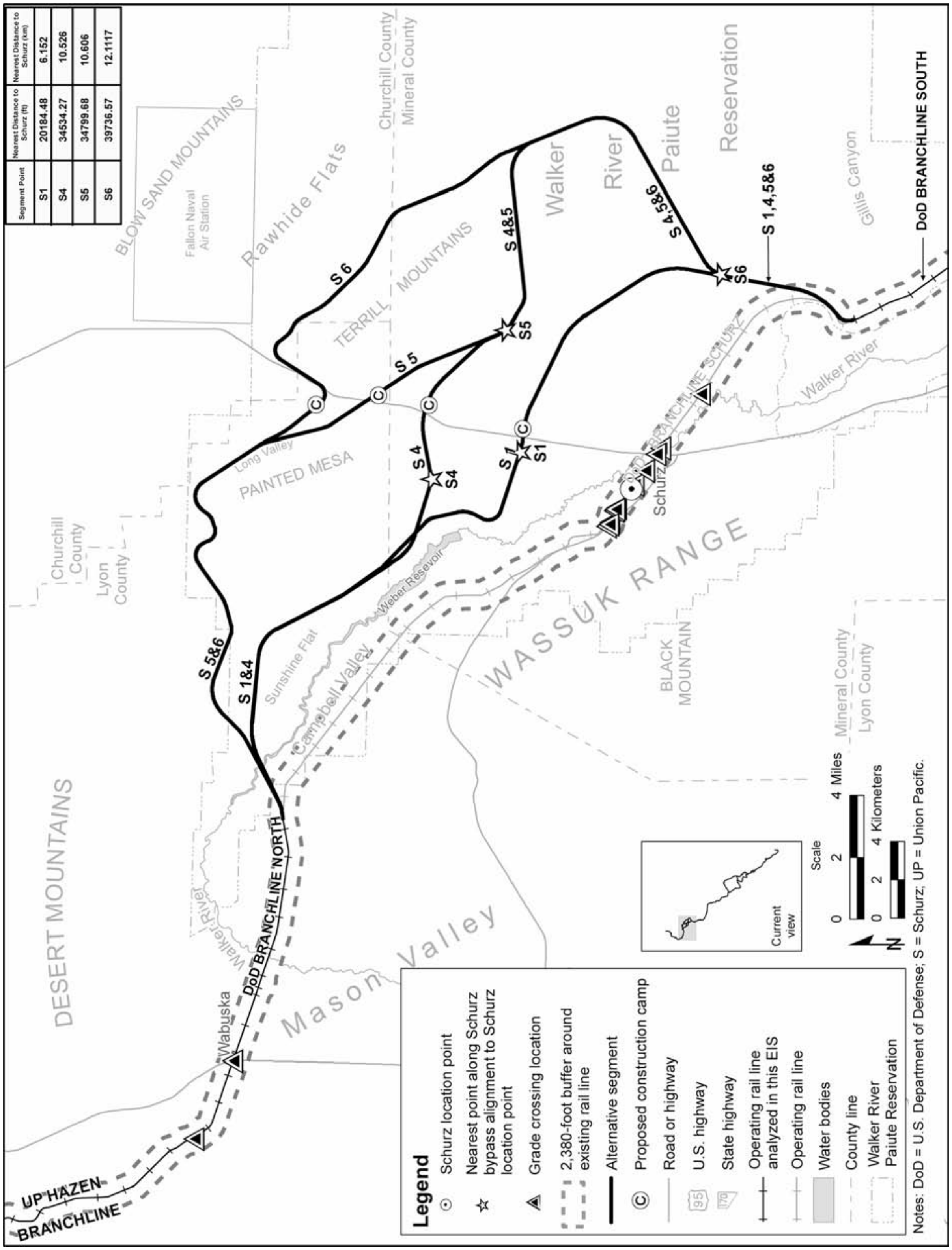
B-1. Hazard Severity: Category Description
I Catastrophic - Death or permanent disability or major property damage
II Critical - Permanent partial disability or extensive property damage
III Marginal - Lost workday due to injury or minor property damage
IV Negligible - First aid injury or minimal property damage

B-2. Accident Probability:
A Frequent - Occurs very often, continuously experienced
B Likely - Occurs several times
C Occasional - Occurs sporadically
D Seldom - Remotely possible; could occur at some time
E Unlikely - Can assume will not occur, but not impossible

The overall rating of a transportation route using the Army methodology is the combination of B-1 (Hazard Severity) and B-2 (Accident Probability) in the matrix. According to Department of Defense guidelines, a 1 rating or a 2 rating is not acceptable for shipment of munitions. A rating of 3 is acceptable for shipment of munitions only after higher-level review and approval from the military headquarters. Final ratings of 4 or 5, after controls are implemented, are acceptable for shipment of munitions. After application of controls, the Army has rated the existing ***rail route*** through the town of Schurz as 5 (corresponding to Risk Assessment Matrix Code 1-E) (DIRS 181032-Dillingham 2007, all).

The Army also uses quantity-distance calculations to provide an assessment of the Distance to Public Traffic Routes and Distance to Inhabited Buildings for storage or transportation of munitions. Public traffic route distances give consideration to the transient nature of the exposure and are calculated as 60 percent of the Inhabited Building Distance (DIRS 181032-Dillingham 2007, all).

According to Table 5-1 of Department of the Army Pamphlet 385-64, a Distance to Public Traffic Route of 725 meters (2,380 feet) or a Distance to Inhabited Building of 1,210 meters (3,970 feet) apply to munitions shipments of the types that may be made along the existing rail line. This methodology indicates that there should be an easement of at least 725 meters on either side of the tracks (no building) along the entire route. This is based on 60 percent of Inhabited Building Distance (IBD) of 1,210 meters (DIRS 181032-Dillingham 2007, p. 1). However, there are inhabited buildings within this distance for the existing Department of Defense Branchline through Schurz. Also, as shown in the Figure 3-236, there are nine grade crossings within the town of Schurz along the Department of Defense Branchline.



Segment Point	Nearest Distance to Schurz (ft)	Nearest Distance to Schurz (km)
S1	20184.48	6.152
S4	34534.27	10.526
S5	34799.68	10.606
S6	39736.57	12.1117

Figure 3-236. Inhabited building distance for existing Department of Defense Branchline.

3.3.11 UTILITIES, ENERGY, AND MATERIALS

This section describes the affected environment for public-service utilities (water, wastewater treatment, telecommunications, and electricity), energy (fossil fuels), and construction materials within the Mina rail alignment region of influence.

Section 3.3.11.1 describes the regions of influence for utilities, energy resources, and construction materials; Section 3.3.11.2 describes public-service utilities in the region of influence; Section 3.3.11.3 describes energy resources (not related to public-service utilities) in the region of influence; and Section 3.3.11.4 describes resources for construction materials in their regions of influence.

3.3.11.1 Regions of Influence

3.3.11.1.1 Regions of Influence for Utilities

The regions of influence for public water systems, wastewater treatment, telecommunications, and electricity differ and are described below.

- Public water systems: The region of influence for public water systems is Lyon, Mineral, Esmeralda, and Nye Counties, communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties.

- Wastewater treatment: The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lyon, Mineral, Esmeralda, and Nye Counties and communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties. (Note: For wastewater treated using other methods [for example, on-site portable wastewater-treatment facilities], treated wastewater would be recycled, and there is no associated region of influence.)

- Telecommunications: The region of influence for telephone and fiber-optic telecommunications is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Verizon.

- Electricity: The region of influence for electric-power resources includes areas serviced by the southern Nevada electrical grid operated by Nevada Power Company; Sierra Pacific Power Company; and Valley Electric Association, Inc.

3.3.11.1.2 Region of Influence for Energy Resources (Fossil Fuels)

The description of the affected environment for energy resources focuses on consumption of fossil fuels. For purposes of this analysis, the region of influence for fossil fuels is limited to regional suppliers within the State of Nevada.

3.3.11.1.3 Regions of Influence for Construction Materials

Construction materials include concrete, ballast, subballast, steel, steel rail, and general building materials. The region of influence for each material is defined by the distribution networks and suppliers of that material to the general project area.

The region of influence for cast-in-place concrete and subballast is limited to the State of Nevada. Subballast, sand, and gravel would be generated from available sources within the rail roadbed earthwork area, overburden at quarries, and borrow sites near the rail alignment. DOE forecasts that no surplus sand

and gravel would be available for roadbed construction from excavation cuts along the rail line. Therefore, DOE plans to obtain sand and gravel from gravel pits along the alignment or nearby U.S. Highway 95, using existing pits, new pits sited nearby, or elsewhere. DOE would determine the exact locations of gravel pits during final design and construction planning. DOE would use some of the natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 176034-Shannon & Wilson 2006, pp. 24 to 26).

DOE would obtain ballast rock from potential quarry sites close to the rail line construction right-of-way during the construction phase and from commercial quarry sites in southern Utah and in California during the operations phase. Therefore, the region of influence for obtaining ballast rock would encompass the State of Nevada during the construction phase, and Utah and California during the operations phase.

Other materials, including steel, steel rail, general building materials, concrete ties, and other precast concrete could be procured and shipped on a national level. Therefore, the region of influence for these materials is national.

Public water system: A water system that provides water for human consumption for an average of at least 25 persons per day (or 15 or more service connections) and is in use for at least 60 days each year.

Community water system: A public water system that serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

Non-transient, non-community water system: A public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.

Source: 40 CFR 141.2.

3.3.11.2 Utilities

3.3.11.2.1 Utility Corridors and Rights-of-Way

Section 3.3.2, Land Use and Ownership, describes the major utilities and utility corridor networks in the Mina rail alignment region of influence.

3.3.11.2.2 Public Water Systems

Figure 3-237 shows the locations of ***public water systems*** in Lyon, Mineral, Esmeralda, and Nye Counties and on the Walker River Paiute Reservation. There are 140 regulated public water systems in these counties and on the Walker River Paiute Reservation (which lies primarily in Mineral County) including the 46 ***community water systems*** listed in Table 3-151.

Within the Mina rail alignment region of influence, public water systems are generally located in or near Hawthorne, Mina, and the unincorporated towns of Beatty, Pahrump, and Town of Amargosa Valley. In addition, although not a community water system, the Yucca Mountain Site has a regulated public water system (NV0000867). This system is classified as a ***non-transient, non-community public water system***.

3.3.11.2.3 Wastewater-Treatment Facilities

DOE would treat wastewater using municipal wastewater-treatment facilities, on-site portable wastewater-treatment facilities (***package plants***), or a combination of the two.

Municipalities with wastewater-treatment facilities include Mason, Yerington, Hawthorne, Schurz, Goldfield, Beatty, Gabbs, Tonopah, and Round Mountain. Table 3-152 lists the capacity of each system and the existing load.

In Hawthorne in Mineral County, a future design capacity of 1,700,000 liters (450,000 gallons) per day is specified.

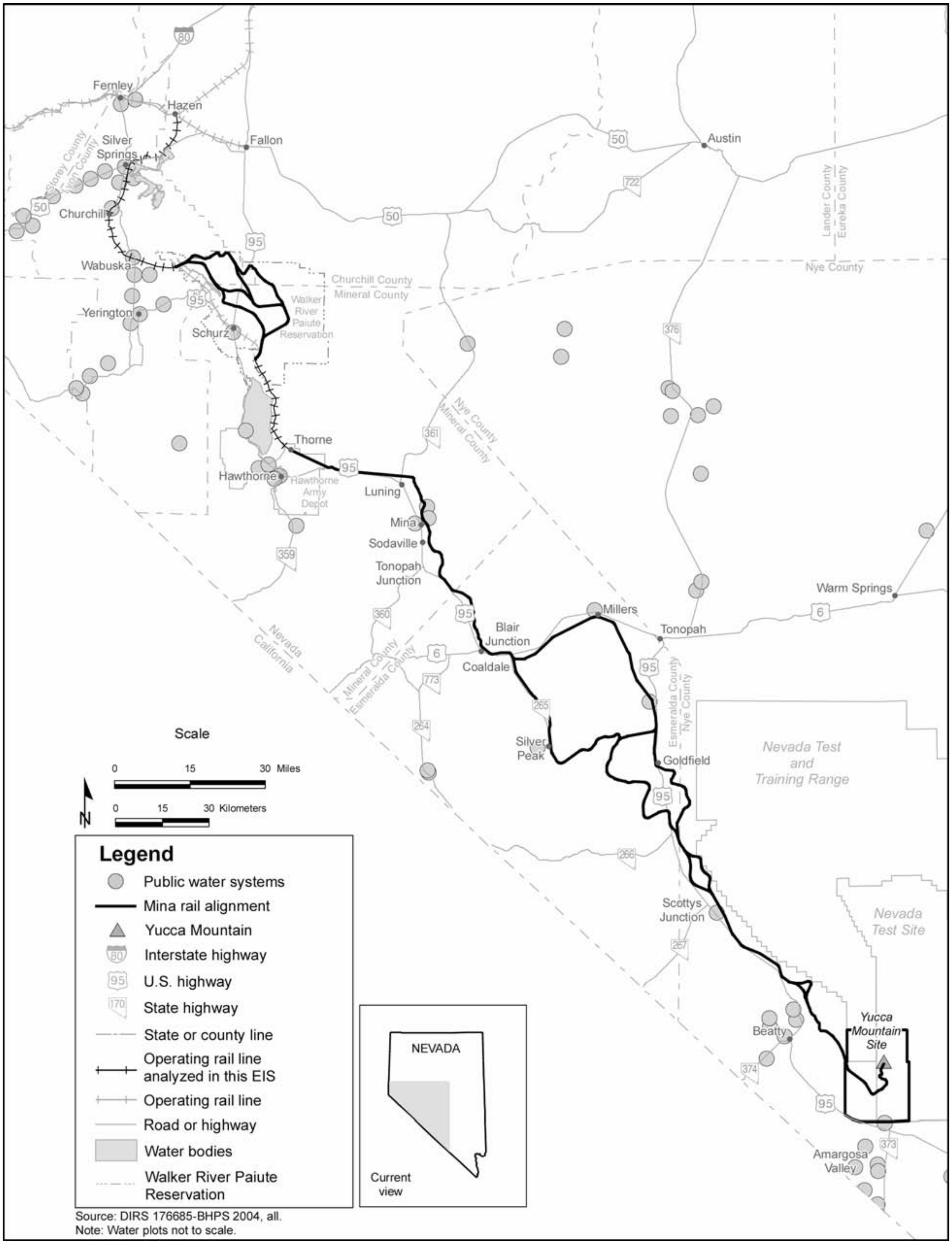


Figure 3-237. Public water systems in Lyon, Mineral, Esmeralda, and Nye Counties.

Table 3-151. Community water systems in Lyon, Mineral, Esmeralda, and Nye Counties[a] (page 1 of 2).

County	Public water supply identification number	Name
Lyon	NV0000813	Churchill Ranchos Estates
	NV0000361	Crystal Clear Water Company
	NV0000032	Dayton Town Utilities
	NV0000366	Dayton Valley Estates Water
	NV0000033	Dayton Valley Mobile Home Park
	NV0000062	Fernley Public Works
	NV0002516	Five Star Mobile Home Park
	NV0000838	Moundhouse Water System
	NV0000029	Rosepeak Water System
	NV0000267	Silver Springs Mobile Home Park
	NV0000223	Silver Springs Mutual Water Company
	NV0000224	Stagecoach General Improvement District
	NV0000242	Weed Heights Development
	NV0000256	Willowcreek General Improvement District
	NV0000255	Yerington, City of
Mineral	NV0000357	Hawthorne Army Depot
	NV0000073	Hawthorne Utilities
	NV0000074	Mina Luning Water System
	NV0000302	Walker Lake Apartments
	NV0000268	Walker Lake General Improvement District
Esmeralda	NV0000072	Goldfield Town Water
	NV0000363	Silver Peak Water System
Nye	NV0002558	Amargosa Valley Water Association
	NV0005033	Anchor Inn Mobile Home Park
	NV0000009	Beatty Water and Sanitation District
	NV0000362	Big Five Parks
	NV0000369	Big Valley Mobile Home Park
	NV0002538	C Valley Mobile Home Park
	NV0002589	Calvada North, Utilities Inc. of Central Nevada
	NV0000218	Carver's Smoky Valley Recreational Vehicle and Mobile Home Park
	NV0005032	Country View Estates, Utilities Inc. of Central Nevada
	NV0000831	Desert Mirage Home Owners Association

Table 3-151. Community water systems in Lyon, Mineral, Esmeralda, and Nye Counties[a] (page 2 of 2).

County	Public water supply identification number	Name
Nye (continued)	NV0000300	Desert Utilities
	NV0002552	Escapee Co-Op of Nevada
	NV0000063	Gabbs Water System
	NV0004074	Hadley Subdivision
	NV0000926	Hafen Ranch Estates
	NV0000175	Manhatten Town Water
	NV0000920	Mountain Falls Water System
	NV0005067	Mountain View Mobile Home Park, Utilities Inc. of Central Nevada
	NV0000183	Pahrump Mobile Home Park
	NV0005028	Shoshone Estates Water Company
	NV0000359	Shoshone Water Company
	NV0005066	Sunset Mobile Home Park
	NV0000237	Tonopah Public Utilities
	NV0000270	Utilities Inc. of Central Nevada

a. Source: DIRS 176686-BHPS 2004, all.

Table 3-152. Municipal wastewater-treatment facilities in the Mina rail alignment region of influence.

Location	Capacity (liters per day)[a]	Existing load (liters per day)
Mason, Lyon County	227,000[b]	189,000[b]
Yerington, Lyon County	2,040,000[b]	1,210,000[b]
Hawthorne, Mineral County	1,480,000[b]	1,550,000[b]
Schurz, Mineral County	189,000[b]	76,000[b]
Goldfield, Esmeralda County	170,000[b]	114,000[b]
Beatty, Nye County	570,000[b]	420,000[b]
Gabbs, Nye County	190,000[b]	190,000[b]
Tonopah, Nye County	3,800,000[b]	1,600,000[b]
Round Mountain (Hadley Subdivision), Nye County	610,000[c]	260,000[c]

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 178590-EPA 1999, all.
c. Source: DIRS 178697-Kaminski 2003, all.

In Esmeralda County, Goldfield's sewage collection system was built in the 1940s and 1950s, and some of the system's original terra-cotta pipes are deteriorating. There are two lagoons, each 4,000 square meters (1 acre) in area, and a rapid infiltration system 1.6 kilometers (1 mile) north of Goldfield. The community has recently been awarded a $3 million grant under the Water Resource Development Act of 2000 (114 Stat. 2472) to renovate and upgrade the system. These renovations will allow Esmeralda County to increase the number of users served by its sewer system (DIRS 174751-Arcaya 2005, all).

Most communities in southern Nye County rely primarily on individual dwelling or small communal wastewater-treatment systems, with the exception of Beatty, which has municipal sewer service. For example, Pahrump has no community-wide wastewater-treatment system. Several wastewater-treatment units serve parts of the town, such as the dairy and the jail, but most households have septic tank and drainage-field systems, which are likely to be typical of the small communities in southern Nye County.

3.3.11.2.4 Telecommunications Services

Local telephone service in the Mina rail alignment region of influence is provided by Verizon (Lyon County), Nevada Bell Telephone Company (AT&T Nevada) (Mineral County, part of Esmeralda County, and Nye County), and Citizens Telecommunications Company of Nevada (part of Esmeralda County) (DIRS 173401-Nevada Telecommunications Association 2005, all). One or more broadband providers (such as Comcast Cable and Bandwidth T1) serve Schurz, Mina, Silver Peak, Tonopah, Goldfield, and Town of Amargosa Valley (DIRS 176453-FCC 2005, pp. 348 to 350).

3.3.11.2.5 Electrical Services

Nevada Power Company is the electric utility serving most customers in Southern Nevada, covering a territory of 12,000 square kilometers (4,600 square miles). Its customer base includes approximately 630,000 residential and 84,000 commercial or industrial accounts (DIRS 172302-Nevada Power Company 2004, all). The utility has 2,200 megawatts of generating capacity and purchases additional power to meet peak load demands of 5,800 megawatts. Nevada Power Company forecasts a 1.8 percent average annual rate of growth in peak-load demand through 2020. Total electricity sales in 2005 were 19 million megawatt-hours (DIRS 173383-Nevada State Office of Energy 2005, p. 23).

Sierra Pacific Power Company serves 330,000 electricity customers in a 130,000-square-kilometer (50,000-square-mile) territory that encompasses Carson City, Reno, Winnemucca, Elko, and Tonopah in Nevada, as well as the Lake Tahoe area in northeastern California (DIRS 173382-Sierra Pacific Power 2005, all). The utility has 1,100 megawatts of generating capacity and purchases additional power to meet peak load demands of 1,900 megawatts. Sierra Pacific Power Company forecasts a 1.6 percent average annual rate of growth in peak-load demand through 2020. Total electricity sales in 2005 were 8.8 million megawatt-hours (DIRS 173383-Nevada State Office of Energy 2005, p. 9). Both Nevada Power Company and Sierra Pacific Power Company are wholly owned subsidiaries of Sierra Pacific Resources.

Valley Electric Association, Inc., distributes power to southern Nye County, including the Pahrump Valley, Amargosa Valley, Beatty, and the Nevada Test Site. The Western Area Power Administration allocates a portion of the lower-cost hydroelectric power from the Colorado River dams to Valley Electric Association, Inc. The private power market supplies the supplemental power necessary to meet the needs of the members. Valley Electric Association, Inc., sells about 400,000 megawatt-hours to more than 15,000 members (DIRS 173383-Nevada State Office of Energy 2005, p. 39).

Table 3-153. Sales of distillate fuel oils in Nevada, 1997 through 2004.

Year	Annual sales of distillate fuel oils (millions of liters)[a]
1997	1,640[b]
1998	1,530[b]
1999	1,580[c]
2000	1,620[c]
2001	1,550[d]
2002	1,580[d]
2003	1,510[e]
2004	1,810[e]

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 178588-EIA 1999, Table 4
c. Source: DIRS 178609-EIA 2001, Table 4.
d. Source: DIRS 173384-EIA 2003, Table 4.
e. Source: DIRS 176397-EIA 2005, Table 4.

3.3.11.3 Energy

Existing fossil-fuel supplies in the Mina rail alignment region of influence are available from nearby communities, mainly from relatively highly populated towns such as Hawthorne and Tonopah, and along the well-traveled U.S. Highway 95 connecting the metropolitan areas of Reno and Las Vegas. The regional supply system can respond flexibly to demand. Table 3-153 shows sales of distillate fuel oils (diesel fuel) in Nevada from 1997 through 2004. Fuel consumption remained fairly constant through 2003. The recent upward trend reflects current population growth in southern Nevada as a key determinant of total energy consumption closely linked to rising demand for housing, services, and travel.

3.3.11.4 Construction Materials

Most of the Mina rail alignment would be along the U.S. Highway 95 corridor and would be within the southern Nevada supply chain for construction materials.

The region of influence for cast-in-place concrete is the State of Nevada, where annual production in 2004 equaled approximately 16 million metric tons (18 million tons) (DIRS 173400-NRMCA 2004, p. 2).

Precast concrete is available nationally, and the annual national production in 2003 equaled approximately 15 million metric tons (17 million tons) (DIRS 173392-van Oss 2003, Table 15). Annual national production of pre-cast concrete railway ties was about 720,000 ties in 2004 and is projected to grow to about 1,180,000 ties by 2007 (DIRS 173573-Gauntt 2004, p. 17).

Ballast for rail roadbed construction is generally obtained locally because of the costs associated with transporting large volumes of these materials. Within the region of influence there are large areas of public lands that contain materials suitable for use as ballast. DOE has identified five potential quarry sites near the Mina rail alignment for use during the construction phase (see Chapter 2, Table 2-16). Following construction, the DOE-developed quarries would be closed. During the operations phase, DOE would obtain ballast for track maintenance commercially. The nearest active quarries to the region of influence are at Oroville, California, approximately 320 kilometers (200 miles) west-northwest of Mina, and at Milford, Utah, approximately 500 kilometers (310 miles) east of Mina. The Milford Quarry is on the Union Pacific Railroad route that travels from Salt Lake City, Utah, to Los Angeles, California, and processes much of the high-quality ballast for the Union Pacific Railroad lines throughout the southwest. Suitable sands and gravels would likely be available along cuts for the proposed rail line and from overburden at potential quarry rock and borrow sites. If needed, DOE could also establish sand and gravel borrow sites at various points along the Mina rail alignment, possibly adjacent to existing Nevada Department of Transportation gravel pits. Approximately 55 surplus pit locations are available adjacent to Nevada Department of Transportation materials sources and additional nearby sites could be developed (DIRS 180857-Nevada Rail Partners 2007, Section 3.1.2).

The steel market is worldwide in scope, but the region of influence DOE considered for steel supply is national. Raw production of carbon steel in the United States in 2003 equaled 86 million metric tons (95 million tons) (DIRS 173387-Fenton 2003, Table 1). Steel rail production equaled 540,000 metric tons (600,000 tons) in 2002 and 520,000 metric tons (570,000 tons) in 2003 (DIRS 173387-Fenton 2003, Table 3).

3.3.12 HAZARDOUS MATERIALS AND WASTE

This section describes existing facilities in Nevada that could receive and dispose of ***hazardous waste*** derived from hazardous materials, ***low-level radioactive wastes,*** and nonhazardous waste associated with constructing and operating the proposed railroad along the Mina rail alignment. Section 3.3.12.1 describes the region of influence for hazardous materials and wastes. Section 3.3.12.2 describes landfills for the disposal of nonhazardous, nonrecyclable, nonreusable wastes; Section 3.3.12.3 describes disposal facilities for hazardous wastes; and Section 3.3.12.4 describes the disposal of low-level radioactive wastes. Hazardous materials DOE might use during construction and operation of the proposed railroad are described throughout Section 4.3.12.

Hazardous waste: Waste designated as hazardous by U.S. Environmental Protection Agency or State of Nevada regulations. Hazardous waste, defined under the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*), is waste that poses a potential hazard to human health or the environment when improperly treated, stored, or disposed of. Hazardous wastes appear on special Environmental Protection Agency lists or possess at least one of the following characteristics: ignitability, corrosivity, toxicity, or reactivity.

Low-level radioactive waste: Radioactive waste that is not classified as high-level radioactive waste, transuranic waste, or byproduct tailings containing uranium or thorium from processed ore. Usually generated by hospitals, research laboratories, and certain industries (42 U.S.C. 108).

3.2.12.1 Region of Influence

The region of influence for the use of hazardous materials and the generation of hazardous and nonhazardous wastes includes the nominal width of the rail line construction right-of-way, and the locations of railroad construction and operations support facilities.

The region of influence for the disposal of hazardous wastes includes the entire continental United States because commercial hazardous waste disposal vendors could utilize facilities throughout the country.

The region of influence for the disposal of nonhazardous waste includes the disposal facilities in Mineral, Nye, Esmeralda, and Clark Counties in Nevada.

The region of influence for the disposal of low-level radioactive wastes includes DOE low-level waste disposal sites, sites in ***Agreement States***, and U.S. Nuclear Regulatory Commission-licensed sites.

3.3.12.2 Nonhazardous Waste Disposal

Industrial and special wastes: Construction debris and other ***solid waste***, such as tires, that have specific management requirements for permitted landfill disposal.

Solid waste: For purposes of this analysis, defined as nonhazardous general household waste.

DOE would dispose of nonhazardous, nonrecyclable, nonreusable wastes in municipal landfills in Nevada. Nevada has 24 operating municipal landfills that combined accept more than 12,700 metric tons (14,000 tons) of waste per day (DIRS 174663-State of Nevada 2005, Slide 5; DIRS 174664-State of Nevada 2005, all). According to the *Draft Solid Waste Management Plan* (DIRS 174041-State of Nevada 2004, p. 7), Nevada municipalities have ensured landfill capacity for decades into the future. Table 3-154 lists the capacities the Nevada Division of Environmental Protection reported in 2002 (DIRS 174041-State of Nevada 2004, Appendixes 2 and 3) for the active landfills in Mineral, Nye, Esmeralda, and Clark Counties. All of these landfills have permits to accept ***industrial and special wastes***.

DOE would utilize a contractor for the disposition of recyclable materials.

Table 3-154. Capacities of active landfills in Mineral, Nye, Esmeralda, and Clark Counties.[a]

County	Facility name[b]	Operator	Capacity (cubic meters)[c]	Per day disposal rate (metric tons)[d]	Projected closure (year)
Mineral	Hawthorne Class I	Mineral County	1,270,000	25	2041
Nye	Round Mountain Class I Expansion	Nye County	540,000	10	2028
	Tonopah Class II	Nye County	120,000	15	2011
Esmeralda	Goldfield Class I	Esmeralda County	210,000	4	2023
Clark	Apex Regional Classes I and III	Republic Silver State	61,900,000	8,000	2147
	Laughlin Class I	Silver State Services	4,600,000	85	2019
Totals			68,640,000	8,139	

a. Source: DIRS 174041-State of Nevada 2004, Appendixes 2 and 3.
b. Class I landfills receive 18 metric tons or more of waste per day; Class II landfills receive less than 18 metric tons of waste per day; and Class III landfills receive only industrial waste. Each of these landfills accepts solid and industrial and special wastes.
c. To convert cubic meters to cubic yards, multiply by 1.3079.
d. To convert metric tons to tons, multiply by 1.1023.

3.3.12.3 Hazardous Waste Disposal

The U.S. Ecology Treatment and Disposal Site in Beatty, Nevada, is a Nevada-permitted hazardous waste disposal site (DIRS 173918-American Ecology 2005, all). This facility treats and disposes of hazardous wastes and nonhazardous industrial wastes. Safety-Kleen Systems, Inc., operates a hazardous waste-permitted treatment, storage, and disposal facility in North Las Vegas, Nevada, and Philip Services Corporation operates a similar facility in Fernley, Nevada (DIRS 177662-NDEP 2006, all). Hazardous waste disposal capacity in western states has been estimated to be 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50).

3.3.12.4 Low-Level Radioactive Waste Disposal

Low-level radioactive wastes would be generated during operation of the Cask Maintenance Facility. DOE would control and dispose of site-generated low-level radioactive waste in a DOE low-level waste disposal site, a site in an Agreement State, or in a U.S. Nuclear Regulatory Commission-licensed site.

3.3.13 CULTURAL RESOURCES

Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470), as amended, requires federal agencies to take into account the effects of their undertakings on historic properties. The procedures established by the Advisory Council on Historic Preservation, described in 36 CFR Part 800, define how federal agencies meet these statutory responsibilities. The section 106 process seeks to accommodate historic preservation concerns with the needs of federal undertakings through consultation between the agency official and other parties with an interest in the effects of the undertaking on historic properties, commencing at the early stages of project planning. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties.

Identification of sites eligible for listing on the *National Register of Historic Places* is a primary component of historical preservation work. The evaluation of both historic and archeological sites, to determine eligibility for National Register listing, is accomplished through the application of eligibility criteria as identified in 36 CFR Part 60.4, as follows:

> The quality of significance in American history, architecture, archeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, material, workmanship, feeling and association and
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history; or
>
> (b) that are associated with the lives of persons significant in our past; or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history.

Prehistoric archaeological sites are most often found eligible under criterion (d), while archaeological sites containing historical deposits and some prehistoric sites are also often considered under other criteria. For example, ordinarily, cemeteries, birthplaces or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories: (a) a religious property deriving primary significance from architectural or artistic distinction or historical importance; (b) a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with an historic person or event; (c) a birthplace or grave of an historical figure of outstanding importance if there is no appropriate site or building directly associated with his productive life; (d) a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; (e) a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; (f) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or (g) a property achieving significance within the past 50 years if it is of exceptional importance.

Likewise, historic structures (as opposed to archaeological sites) are assessed under a variety of National Register criteria.

While nearly all sites have the potential to yield information useful in addressing a limited number of research questions, this limited potential is not considered sufficient to qualify a site for inclusion on the National Register under criterion (d). By establishing guidelines, agencies have clearly set the precedent that not all information is important, and thus, not all sites are important. Federal guidelines encourage the use of a set of research questions that are generally recognized as important research goals as a means of evaluating significance. If a site contains information that is demonstrably useful in answering such questions, it can be considered an important site. National Register evaluation guidelines state that a site must retain integrity to be considered eligible under one or more of the criteria.

The *National Register of Historic Places* describes historic resources as standing or collapsed buildings, structures, objects, sites, and districts that are at least 50 years old, or have achieved significance within the past 50 years. Archaeological resources are prehistoric or historic remains of human lifeways or activities that are at least 100 years old, and include artifact concentrations or scatters, whole or fragmentary tools, rock carvings or paintings, and buildings or structures. Resources that incorporate geographic areas, including both cultural and natural features, and that are associated with historic events or other cultural values include ***traditional cultural properties***, cultural landscapes (DIRS 174501-Birnbaum 1994, all), ***ethnographic landscapes*** (DIRS 155897-Parker and King 2002, all), rural historic landscapes (DIRS 155896-McClelland et al. 1990, all), and historic mining landscapes (DIRS 175489-Noble and Spude 1997, all).

For purposes of analysis in this Rail Alignment EIS, DOE has completed a sample inventory of the Mina rail alignment alternative segments and common segments, which provides a thorough characterization of the nature and distribution of resources along the rail alignment. The Department would perform an intensive cultural-resource inventory before starting construction of any specific alternative segment or common segment, and would compile a data recovery plan that would include prudent and feasible practices and measures to avoid or reduce potential adverse impacts to archaeological and historical resources.

This section focuses on cultural resources in the Mina rail alignment region of influence, including those associated with the American Indian culture. Section 3.4 further identifies and discusses American Indian interests in the region. This section summarizes information obtained through a review of available data from federal, state, and local agencies, and findings of data-gathering efforts and field investigations.

Section 3.3.13.1 describes the region of influence for cultural resources along the Mina rail alignment; Section 3.3.13.2 describes the methodology DOE used to identify such sources; Section 3.3.13.3 is a general description of the cultural resources setting and characteristics; Section 3.3.13.4 describes site-specific cultural resources; and Section 3.3.13.5 describes cultural resources for each Mina alternative segment and common segment, including those associated with American Indian culture.

3.3.13.1 Region of Influence

The region of influence for the cultural resources analysis includes two levels of coverage that incorporate areas where construction or other land disturbances could directly or indirectly affect cultural resources:

- Level I – The first level of coverage is the nominal width of the construction right-of-way, the area where ground disturbance could have direct or ***indirect impacts*** on cultural resources. Under Section 106 of the National Historic Preservation Act, the Level I region of influence would comprise the project's Area of Potential Effect.
- Level II – The second level of coverage is a 3.2-kilometer (2-mile)-wide area centered on the rail alignment, and includes the area of potential disturbances that could have indirect impacts on cultural resources. Unless otherwise noted, references in the text that follow refer to the Level II region of

influence. For example, impacts could extend beyond this area where railroad operations and maintenance activities could have an aesthetic, auditory, or visual impact on a potentially significant historic or ***ethnographic*** vista.

3.3.13.2 Methodology

DOE prepared cultural resource documents to support the description of the affected environment and the impacts assessments for the Mina rail alignment. For this analysis, the Department used the following methods to evaluate known and potential resources in the Mina rail alignment region of influence:

- ***Class I inventory***. Reviewing existing cultural resource files, examining the literature, and interviewing knowledgeable people to identify potentially significant resources within the Level II region of influence of the alternative segments and common segments. DOE compiled the results into an historic context baseline report on cultural resources (DIRS 174688-AGEISS 2005, all; DIRS 182774 Kellyard Stegner 2007, all) that establishes the basis for the analytical methodology and the results of the site-file and literature reviews. This report also lists all published and unpublished documents and archival sources DOE consulted during the analysis. The Desert Research Institute provided a supplementary Class I update in April 2007.
- ***Class II inventory***. Conducting a statistical sample field survey (DIRS 174691-BLM 1990, all) of the Level I region of influence for the common segments and alternative segments. The Class II inventory involved intensive inspection of 103 sample units that measured 120 meters (400 feet) by 800 meters (2,600 feet), centered on the rail alignment. This inventory was guided by a research design prepared in consultation with the BLM and State Historic Preservation Office and was designed to provide a 20-percent sample of the length of common segments and alternative segments. The results of this effort provide a predictive view of the possible types of cultural resources that might be expected to occur along the common segments and alternative segments and an evaluation of the possible significance of potential historic properties. The Class II survey report summarizes the results of this effort.
- Consultation with American Indians with regional ties. Interactions with American Indian tribes and organizations that have traditional ties to the region to identify traditional cultural places within the Level I and II regions of influence that are important to American Indian cultural and religious values and beliefs, and to identify other resources, such as plants and animals, that might have historic or current uses.

As previously noted, DOE prepared cultural resource reports to support the description of the affected environment and the impacts assessments for this Rail Alignment EIS. The reports include detailed information about the methods and investigative approaches DOE utilized and about evaluation of the findings. Preparation of the baseline resource reports involved consulting and citing a large number of published and unpublished sources, and contacting knowledgeable persons, institutions, and offices holding relevant data.

DOE is using a phased cultural-resource identification and evaluation approach, as described in 36 CFR 800.4(b)2, to identify specific cultural resources along a final alignment. Under this approach, DOE has completed Class I and Class II inventories of Mina rail alignment alternative and common segments. The Department would perform final field surveys (BLM Class III intensive inventories) of the actual right-of-way and centerline, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, p. 15). In the interim, 20-percent Class II inventories have provided information to characterize the nature and distribution of cultural resources along the Mina rail alignment common segments and alternative segments. Before starting any ground-disturbing activities that could affect cultural resources, the Department would perform the intensive ***Class III inventory*** of the selected segments, site evaluations, impacts assessments, and implement impact reduction or prevention measures, as appropriate.

3.3.13.3 General Environmental Setting and Characteristics

Sections 3.3.13.3.1 through 3.3.13.3.4 summarize the prehistoric, American Indian, and Euroamerican cultural history of southern Nevada. Additional detail, including sources and references, is presented in the historic context report prepared to support this Rail Alignment EIS. (DIRS 174688-AGEISS 2005, all; DIRS 182291-Desert Research Institute 2007, all; URS 2007, all)).

3.3.13.3.1 Prehistoric Period

Native people inhabited the region that encompasses the Mina rail alignment for thousands of years and left artifacts and traces of their settlement and subsistence patterns and religious beliefs. The prehistoric archaeological record in the vicinity of the Mina rail alignment is subdivided into the following three cultural periods:

- Pre-Archaic (11,500 to 7,500 years before present). The Pre-Archaic cultural period is marked by relatively few people, who traveled in small bands hunting game and gathering food. Archaeological sites dating to this period are commonly preserved on gravel bars and other landforms associated with ***pluvial lakes***, marshes, and riparian zones. These sites and their artifacts indicate a reliance on wetlands, with an emphasis on hunting large game. Isolated finds of distinctive fluted points associated with the Clovis and Folsom groups of people have a wide but sporadic distribution throughout the region.
- Early to Middle Archaic (7,500 to 1,500 years before present). During the Early to Middle Archaic cultural period, a shift occurred to a wider use of the environment, including sites near springs, perennial streams, caves, and rockshelters. A gradual increase in populations was marked by the use of plant seeds and nuts, along with hunting small game. Twelve rockshelters dating to this period and the Late Archaic period have been investigated in the vicinity of the Mina rail alignment.
- Late Archaic (1,500 to 150 years before present). Hallmarks of the Late Archaic cultural period include ceramics and small projectile points, along with the bow and arrow. Settlement patterns and subsistence practices continued from the earlier period, with sites in a variety of settings but clustered around permanent springs and riparian settings.

3.3.13.3.2 American Indian Historic Period

The Mina rail alignment would cross lands historically occupied by two indigenous ethnic groups, the Northern Paiute and the Western Shoshone. Other neighboring groups, such as the Owens Valley Paiute and Shoshones from adjacent regions, had strong kinship ties and occasionally visited the region.

Both the Northern Paiute and the Western Shoshone were characterized by local subgroups, defined by slight language or dialectical differences, traditional centers of residential occupation, more or less regular home ranges or districts, and closeness of kin ties. Local subgroups clustered around small oases scattered throughout the desert where springs and flowing streams could be found. Mountains and surrounding valleys were important resource collection areas, but seasonal changes in food availability prevented areas from being occupied year-round. Figure 3-238 shows areas occupied by these groups.

The Mina rail alignment would cross or be adjacent to the territories of several American Indian subgroups. Northern Shoshone areas include the *Agá idökadö* District north and east of Walker Lake and the *Pakwidökadö* District south of Walker Lake. Western Shoshone subgroups include bands based in the Lida-Goldfield area.

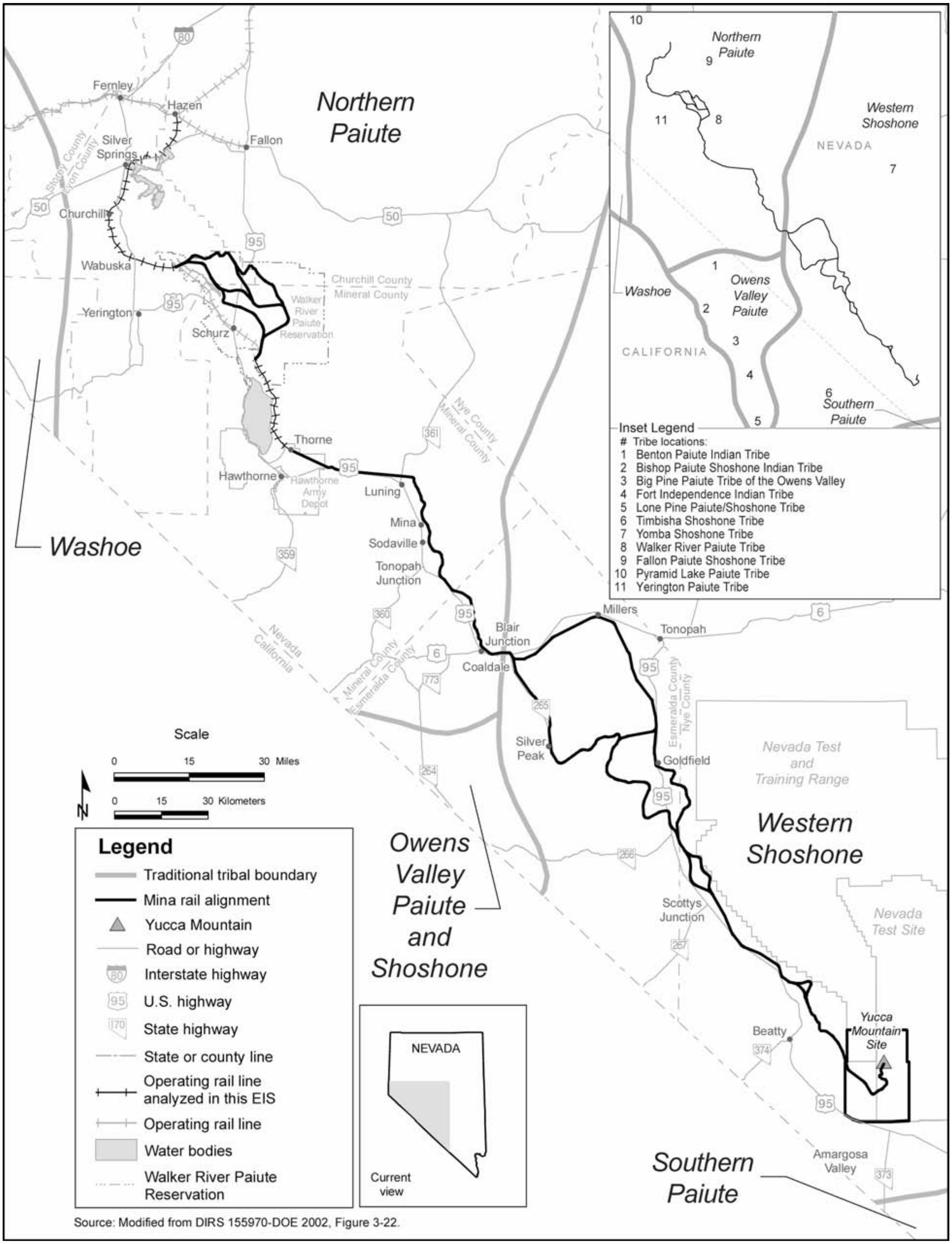


Figure 3-238. Traditional boundaries and locations of federally recognized tribes.

Following initial contact by European Americans in the early to middle 1800s, native people in central and southern Nevada began to adapt to changing conditions as settlement and development by miners, prospectors, and ranchers rapidly encroached on the landscape. As their essential resources were being lost to the Euroamerican expansion, both the Western Shoshone and the Northern Paiute were forced to confine their activities to selected reservations carved out of small portions of their traditional lands. Given the difficulties of making a living on these restricted areas, many responded by providing labor and other services to mining and ranching ventures, often living in mining towns or at ranches. In the vicinity of the region of influence, American Indian encampments are known to have been present at mining communities in the Goldfield and Tonopah areas.

3.3.13.3.3 Euroamerican Historic Period

Euroamerican incursion into the Great Basin was considerably slower than in other regions of North America. Consequently, American Indian groups in the intermontane West were able to survive early contact better than many other tribes and bands. During the first decades of contact, they were able to develop responses to the pressures exerted by Euroamericans on American Indian culture. By the reservation period of the 1860s, they had adopted means of resistance and acculturation that permitted the survival of much of their traditional lifeways.

Present-day Nevada remained largely unexplored by Euroamericans prior to 1826, at which time American and British trapping and trading parties began entering the Great Basin from the east and the northwest. Foremost among these was Peter Skene Ogden, who led a series of four expeditions into the northern Basin and Snake River plateau between 1826 and 1830, locating the Humboldt River and Humboldt Sink, as well as traveling south to Walker Lake and the Owens Valley. Specifically, on his 1829-1830 expedition, Ogden and his party retraced their steps of the previous year from the Columbia River to the Humboldt Sink, continued south to the Carson Sink and on to the Walker River which they followed down to Walker Lake. Continuing south and southwest past the location of present Hawthorne, Nevada, the party eventually reached the Owens River and Lake, following the Owens Valley south to the Mojave Desert. In 1833, an American party under the leadership of Joseph Reddeford Walker followed the Humboldt River and crossed the Sierra Nevada, returning the next year via the Owens Valley, Walker Lake, and the Walker River. On both trips, Walker and his men clashed with Northern Paiute in the vicinity of the Humboldt Sink.

The trails established by trappers and traders across the Great Basin eventually became heavily traveled overland routes to the Pacific coast. Explorers, migrants, and eventually the transcontinental railroad all made their way across the Basin. Two of the earliest groups, the Bidwell-Bartleson party of 1841 and the Walker-Chiles party of 1843, in part followed the trail established along the Walker River to the vicinity of Walker Lake before continuing on to California.

The surge of travelers along the Overland Trail corridor peaked after the discovery of gold in California in 1848, placing increasing pressure on resources along the Humboldt River, all of which were heavily relied upon by American Indian inhabitants. In the face of these destructive forces, many native inhabitants were forced to withdraw from former habitations along the river.

The United States officially acquired the territory of the Great Basin as a result of the Treaty of Guadalupe Hidalgo in 1848, which concluded the Mexican-American War. The first Euroamericans to settle in the Basin were the Mormons, who sought refuge in the Salt Lake Valley in 1847, then a remote part of Mexican territory. The Mormons were the first to arrive in the Great Basin with the intent of settlement and quickly established a number of missions throughout the territory. Among the first of these was Mormon Station, later renamed Genoa, located on the Humboldt River trail from Salt Lake City to Sacramento via Carson Pass, about 60 miles south of present-day Reno, settled in 1851.

Following in the footsteps of the Mormons, small farms and ranches began appearing in some of the more well-watered portions of the Great Basin. But it was the discovery of silver at the Comstock Lode that spurred major migration to western Nevada in the 1850s and 1860s.

As the population in the Virginia City and Carson Valley areas expanded, conflicts with native inhabitants also increased, as American Indian populations were forced out of traditional homelands and the already scarce resources upon which their livelihood depended were exhausted. Settlers demanded protection, and in 1860, the U.S. Army established Fort Churchill on the Carson River. Eventually, American Indian peoples were forced to confine their activities to selected reservations carved out of small portions of their traditional lands.

In addition to a military presence, the discovery and extraction of various ores and minerals in western Nevada, primarily gold and silver, necessitated the construction of new transportation operations. In 1880, the Carson and Colorado (C&C) Railroad Company was formed. Construction of the C&C rail line began in 1880 and ran from Carson City south along the east side of Walker Lake and extended south to Keeler, California, near the northern shore of Owens Lake. By 1900 the gold mining boom had waned in the Carson City area, but shortly thereafter gold deposits in Tonopah were discovered and the rail line continued to deliver supplies from Owens Valley to the Nevada mining operations.

To the north, in Nye, Lincoln, and Esmeralda Counties, mining remained the major economic interest. By 1870, a number of mining districts and communities were established throughout south-central Nevada. Precious metals were discovered in Tonopah in 1900 and Goldfield in 1902, and companies were formed to develop railroads and improve transportation to and from these economic centers. In 1905 a narrow gauge rail line was constructed to run from borax mines near Gold Center, Nevada, south through the Mojave Desert to Ludlow, California. The new railroad, operated under the name Tonopah and Tidewater Railroad Company, ran as both a passenger train and supply train from 1905 to 1940.

3.3.13.3.4 Cultural Landscapes

Based on the literature review of the cultural history of the region of influence, DOE identified several examples of potential cultural landscapes reflecting significant ethnographic, mining, and railroading activities within the Level II region of influence that might be eligible for listing on the *National Register of Historic Places* (DIRS 174688-AGEISS 2005, all). These include:

- Ethnographic historic period Northern Paiute settlements in the Walker River and Lake area, and Western Shoshone villages and surrounding use areas in Oasis Valley and the Goldfield area.
- Several historic mining districts, including the Santa Fe Mining District on the west slope of the Gabbs Valley Range east of Luning; the Mina or Silver Star Mining District in the Excelsior Mountains southwest of Mina; the Sodaville Mining District in the south end of the Pilot Range east of Sodaville; the Silver Peak Mining District in the Clayton Valley area; and the Goldfield area.
- Historic railroad activities in the Luning, Mina, Sodaville, Silver Peak, and Goldfield areas.

3.3.13.4 Site-Specific Cultural Resources

The corridor through which the rail alignment would pass demonstrates a history of diverse prehistoric and historic land-use patterns. Native peoples occupied this area for many thousands of years, as exhibited by the archaeological sites identified in the area. These sites include campsites, rockshelters, ***lithic scatters***, quarries, rock rings and alignments, and rock-art sites. Euroamerican presence in the area is largely limited to the past 150 years or so, and is characterized by diverse activities represented at a wide variety of site types. Recorded and anticipated sites include early transportation features such as wagon and stage roads; railroads and railroad camps and sidings; homesteads; and mines, mills, and mining camps (Figure 3-239). Isolated features and artifacts related to all of these activities can also be anticipated. This section presents data on both previously recorded cultural resources and known, but unrecorded, properties along the Mina rail alignment. This section first presents the results of the Class I site-file search of the Level II region of influence and the Class II inventory (field survey) of the Level I region of influence for the entire alignment, including alternative segments. The results are followed by a segment-by-segment discussion for each of the common segments and alternative segments. DOE based individual segment analyses on three data sources: (1) the known-site file search and literature review (DIRS 182290-Desert Research Institute 2007, all); (2) the Class II inventory and (3) information from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all). All references consulted or used in the different analyses can be found in those reports.

3.3.13.4.1 Previously Recorded Prehistoric Resources

A Class I site-file search for archaeological sites within the Level II region of influence identified 426 prehistoric recorded sites and ***isolates*** (Table 3-155). Of this total, 85 (20 percent) are isolated artifacts that were previously assigned archaeological site numbers. Although isolates are generally considered not eligible for listing on the *National Register of Historic Places*, they indicate, along with other types of sites, the presence of prehistoric people in the region of influence. In addition to the sites containing only prehistoric components, there are 42 multi-component sites containing both prehistoric and historic components; these are listed in Table 3-156. There are no prehistoric sites within the project area that are listed on the *National Register of Historic Places*. Resources that might be eligible for listing on the National Register have been identified as being either within or adjacent to the Mina rail alignment Level II region of influence. These include three toolstone procurement sites; 19 lithic scatters and/or camps; three sites characterized by rock art, including two ***petroglyph*** sites; and six rockshelter or cave habitation sites.

Table 3-155. Previously recorded prehistoric archaeological sites in the Level II region of influence[a].

Site type	Number of sites and isolates	Eligible[b]	Not eligible	Unevaluated
Rockshelters	13	4	0	9
Specialized activity areas (campsites)	9	6	0	3
Specialized activity areas (lithic scatters)	289	10	221	58
Rock-art sites	5	2	0	3
Toolstone sources and quarry sites	15	2	8	5
Isolates[c]	85	0	84	1
Other:				
Rock ring	4	0	3	1
Rock features	5	0	2	3
Tinaja (water storage feature)	1	0	1	0
Totals	426	24	319	83

a. Source: Data from a site-file search conducted by Desert Research Institute (DIRS 182290-Desert Research Institute 2007, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system. Isolates are generally considered ineligible for listing on the *National Register of Historic Places*.

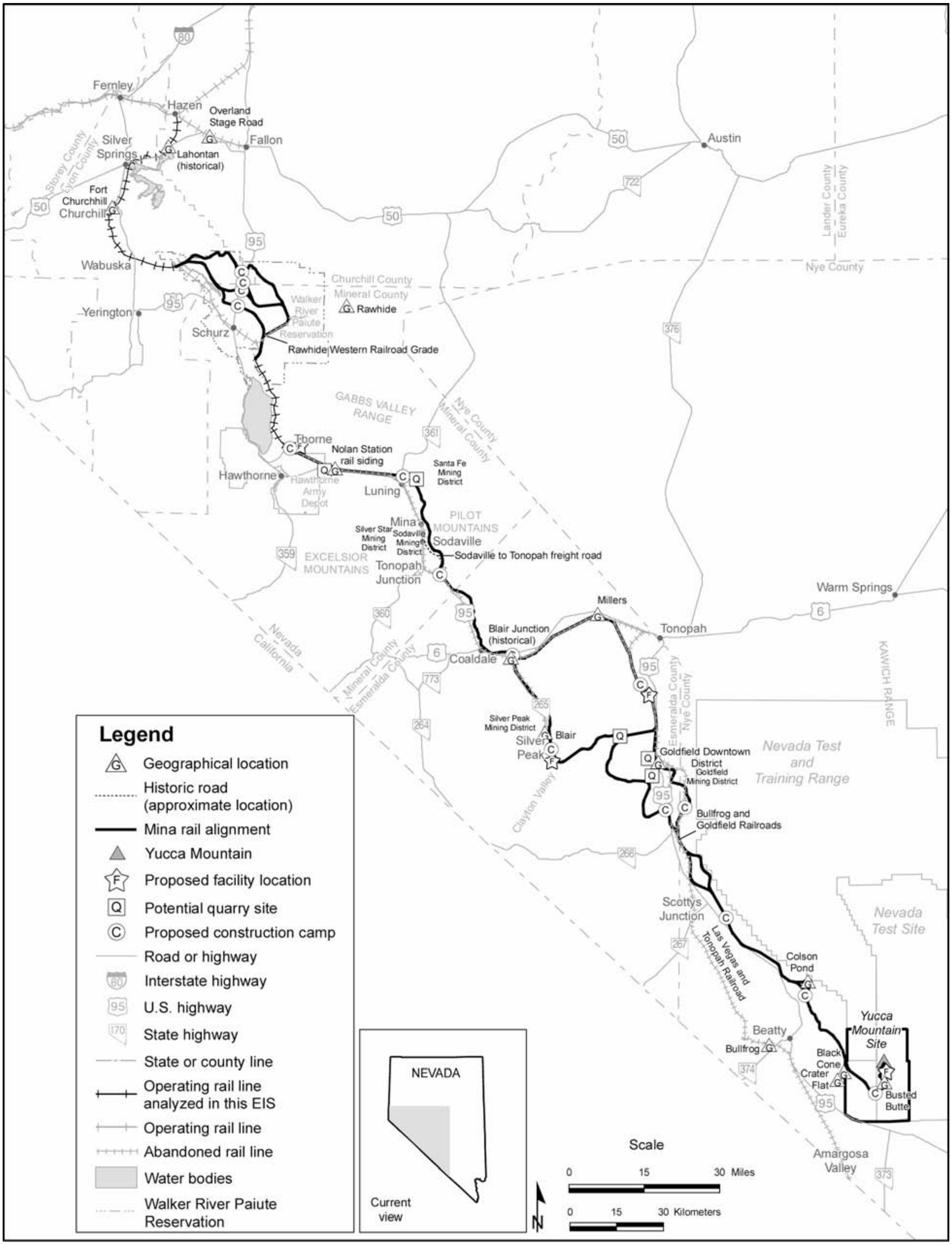


Figure 3-239. Major historic and geographical locations along the Mina rail alignment.

Table 3-156. Previously recorded historic Euroamerican sites in the Level II region of influence.[a]

Site type	Number of sites	Eligible[b]	Not eligible	Unevaluated
Historic ranching sites	0	0	0	0
Historic debris scatters (other)	46	2	40	4
Historic cemetery/graves	5	0	2	3
Historic railways	27	12	8	7
Campsite (mining or ranching, military, railroad)	3	2	1	0
Historic mining sites	31	8	15	8
Historic ranching sites (habitation)	1	1		0
Historic town sites	8	5 Goldfield downtown district listed on the *National Register of Historic Places*	1	2
Historic roads	4	1	0	3
Isolates[c]	7	0	6	1
Prehistoric/historic	42	5	28	9
Other	5	1	0	4
Unknown	2			2
Totals	181	37	101	43

a. Source: Data from site-file search conducted by Desert Research Institute (DIRS 182290-Desert Research Institute 2007, all).
b. Eligibility determinations taken from archaeological site forms on file, as evaluated against significance criteria for potential eligibility for the *National Register of Historic Places*.
c. Isolates include artifact occurrences that have been given a site number in the Nevada statewide archaeological recording system.

Site-type terminology reflects the site classification system employed in the BLM Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, Section 3.9).

3.3.13.4.2 Previously Recorded Historic Euroamerican Resources

A Class I site-file and literature search identified previously recorded historical Euroamerican sites within the Level II region of influence (see Table 3-156). One of these, the Goldfield downtown district, is listed on the *National Register of Historic Places*. Other historic resources that might be eligible for listing on the National Register have been identified as being either within or adjacent to the Mina rail alignment Level II region of influence. These resources include the following:

- Oasis Valley. Beatty Cattle Company Ranch and Colson Ranch, with associated Western Shoshone villages, both within the proposed rail alignment region of influence.

- Historic railroads, including segments of the Carson and Colorado, Las Vegas and Tonopah, Tonopah and Goldfield, and Southern Pacific railroads. The proposed rail line would follow various lengths of some of these lines between Hawthorne and Tonopah Junction, south toward Silver Peak, and intersect or follow many segments of the Las Vegas and Tonopah line along the 12 kilometers (7.2 miles) of Mina common segment 2, south of Goldfield. In these locations, DOE would refurbish the historic rail beds for use with the proposed rail line. Eligible or unevaluated resources associated with the railroads include stations, abandoned grades, construction-related features, and workers' encampments, and resources associated with Luning, Mina, Coaldale, and other towns established along the rail lines.

- Goldfield. The downtown district of Goldfield is listed on the *National Register of Historic Places*. The town dump and a cemetery (evaluated as eligible for listing on the National Register) would be within the Montezuma alternative segment 2 region of influence. There are also potential contributing features and sites within the region of influence for this alternative segment.
- Historic roads. Segments of the Sodaville to Tonopah freight road and of the Overland Stage Road have been identified.

3.3.13.4.3 Known American Indian Resources

Previous American Indian studies and consultations associated with the Yucca Mountain Project, the Nevada Test Site, the Nevada Test and Training Range, and other projects have yielded significant information on the concerns of modern-day American Indians regarding traditional and cultural values. These concerns include evidence of their ancestors' occupation and use of traditional homelands, and their feelings about natural resources and geologic formations in the region, such as plants, animals, and natural landforms that mark important locations. Opportunities for the identification of traditional cultural properties and additional places of concern to American Indians will remain open through the consultation process. Based on past studies and research for this Rail Alignment EIS, DOE has obtained information regarding the following potentially eligible historic properties that could be of cultural value for American Indians:

- Medicine rock sites, Walker River Paiute Reservation.
- Rabbit Spring rockshelter camp near Goldfield. Within the Level II region of influence.
- Winter village, probable site of a Western Shoshone village named Matsum in the Willow Springs vicinity. Within the Level II region of influence.
- Beatty area petroglyphs. Within the Level II region of influence.
- Western Shoshone Ogwe'pi District, a cluster of winter villages along the upper Oasis Valley and the headwaters of the Amargosa River, including two probable villages. Within the Level II region of influence.
- Black Cone site, a place of religious significance near Crater Flat. Within the Level II region of influence.
- Significant crossroad where numerous traditional American Indian trails came together near Fortymile Wash. Within the Yucca Mountain Site boundary.
- Rock art near Busted Butte. Within the ***Yucca Mountain Site boundary***.

3.3.13.5 Cultural Resources by Alternative Segments and Common Segments

Sections 3.3.13.5.1 through 3.3.13.5.11 describe the cultural resources for each of the Mina rail alignment common segments and alternative segments, including data from the previously recorded Class I site-file and literature search (DIRS 182290-Desert Research Institute 2007, all), the results of the Class II inventory, and associated American Indian consultations (DIRS 174205-Kane et al. 2005, all).

3.3.13.5.1 Union Pacific Railroad Hazen Branchline

The Class I site-file search revealed that 21 cultural resources have been recorded within the Level I region of influence of the existing Union Pacific Railroad Hazen Branchline. These resources include seven prehistoric sites, 10 historic sites, one site with both prehistoric and historic components, and three unknown site types. Six of the cultural properties are considered eligible or potentially eligible for the *National Register of Historic Places*, including several that are part of the National Register-listed Lahontan Dam historic district (DIRS 182290-Desert Research Institute 2007, all). Eligible or potentially eligible resources include a large prehistoric residential base camp, a portion of the Overland Stage Road, the Newlands Waterworks at Lahontan City, a Lahontan City construction townsite and railroad station, a railroad ***berm*** and debris scatter, and a multi-component site with eligible historic elements including a telephone line and debris scatter. In addition, the existing rail line passes through Fort Churchill State Historic Park, site of an important 1860-1869 U.S. Army post.

3.3.13.5.2 Department of Defense Branchline North

Department of Defense Branchline North is an existing rail line that begins east of Wabuska. It trends east through a valley just south of Parker Butte and north of the Mason Valley Wildlife Management Area. In total, Department of Defense Branchline North is about 8 kilometers (5 miles) long.

The Class I site-file search did not identify any cultural resources recorded within the Level I region of influence. No Class II inventory has been conducted.

3.3.13.5.3 Schurz Alternative Segments

At present, the Department of Defense operates a branch rail line that runs south from the end of the Union Pacific Railroad Hazen Branchline at Wabuska, directly through Schurz on the Walker River Paiute Reservation, to the Hawthorne Army Depot. DOE is considering four alternative segments to bypass Schurz to the east and connect the proposed rail line to existing Department of Defense Branchline North east of Wabuska. These four alternative segments are referred to as Schurz 1, 4, 5, and 6.

Schurz alternative segment 1 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would trend east and then southeast, roughly parallel to the Walker River for approximately 10 kilometers (6 miles). From the Walker River, Schurz alternative segment 1 would continue in a southeasterly and then easterly direction for approximately 6 kilometers (4 miles). It would trend to the south through Sunshine Flat for approximately 19 kilometers (12 miles). After crossing U.S. Highway 95 with a grade-separated crossing, the rail line would pass south of the Calico Hills. Schurz alternative segment 1 would continue south for another 6 kilometers before joining the existing Department of Defense Branchline South. Schurz alternative segment 1 would be about 52 kilometers (32 miles) long.

The Class I site-file search revealed that five cultural resources have been recorded along Schurz alternative segment 1, including two within the Level I region of influence and three within the Level II region of influence. Previously recorded sites include one prehistoric site, three historic sites, and one multi-component prehistoric and historic site. None of the five resources has been evaluated for eligibility to the *National Register of Historic Places*.

DOE surveyed 15 sample units during the Class II effort, a total of 12 kilometers (7.5 miles). Eight resources were recorded, including five prehistoric sites, all characterized by lithic scatters, and three historic sites, including two railroads and one trash deposit. One prehistoric lithic scatter and one historic railroad are potentially eligible for listing on the *National Register of Historic Places*. The other six resources appear ineligible for listing.

Schurz alternative segment 4 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would trend east and then southeast, roughly parallel to the Walker River for approximately 10 kilometers (6 miles). From the Walker River, the rail line would trend generally southeast and east for about approximately 12 kilometers (7.5 miles) and would cross U.S. Highway 95 with a grade-separated crossing. Between the Terrill Mountains and Calico Hills, it would run due east for about 11 kilometers (7 miles). It would then trend southwest for approximately 16 kilometers (10 miles) and would continue in a roughly southern direction for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 4 would be about 64 kilometers (40 miles) long.

The Class I site-file search revealed that one historic cultural resource, the Rawhide Western Railroad grade, has been recorded along Schurz alternative segment 4, within the Level I region of influence. National Register-eligibility of this resource has not been determined.

DOE surveyed four sample units during the Class II effort, totaling 3.2 kilometers (2 miles). Eight prehistoric resources were recorded, including lithic and groundstone scatters, and a quarry. Three of the sites are considered potentially eligible for listing on the *National Register of Historic Places*, two are considered not eligible, and three of the sites have not been evaluated.

Schurz alternative segment 5 would begin at the end of the existing Department of Defense Branchline North, would cross the Walker River, and would run east for approximately 14 kilometers (9 miles). This alternative segment would briefly cross into Churchill County before turning southeast and traveling through Long Valley across U.S. Highway 95 with a grade-separated crossing. Between the Terrill Mountains and Calico Hills, it would run due east for about 11 kilometers (7 miles). It would then trend southwest for approximately 16 kilometers (10 miles). It would continue in a roughly southern direction for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 5 would be about 71 kilometers (44 miles) long.

The Class I site-file search revealed that four cultural resources have been recorded along Schurz alternative segment 5, including two within the Level I region of influence and two within the Level II region of influence. These include three historic sites and one multi-component prehistoric and historic site. The multi-component site, Double Spring, is considered eligible for listing on the *National Register of Historic Places* and is located in the Level II region of influence; the historic sites have not been evaluated.

DOE surveyed 10 sample units during the Class II effort, totaling 8 kilometers (5 miles). Four resources were recorded, including three prehistoric lithic scatters, all unevaluated for eligibility, and one historic site, a trash deposit that is recommended not eligible for listing on the National Register.

Schurz alternative segment 6 would begin at the end of existing Department of Defense Branchline North, cross the Walker River, and would run east for approximately 14 kilometers (9 miles). This alternative segment would briefly cross into Churchill County before turning southeast and traveling through Long Valley before turning sharply northeast and crossing U.S. Highway 95. After following U.S. Highway 95 for about 4 kilometers (2.5 miles), the rail line would then turn southeast and run along the eastern edge of the Terrill Mountains for approximately 16 kilometers (10 miles). It would then trend southwest for approximately 16 kilometers. The rail line would continue south for about 6 kilometers (4 miles) before joining the existing Department of Defense Branchline South. Schurz alternative segment 6 would be about 72 kilometers (45 miles) long.

The Class I site-file search revealed that nine cultural resources have been recorded along Schurz alternative segment 6, including five within the Level I region of influence and four within the Level II region of influence. Of these nine, seven are prehistoric or have a prehistoric component, and two are historic resources. Prehistoric resources include one isolate, two lithic scatters, one rock alignment with possible burials, one petroglyph site, and one site considered eligible for listing on the National Register that has a medicine rock, cairns, hunting blinds, and petroglyphs. The isolate and one of the lithic scatters are considered not eligible; eligibility status of the remaining prehistoric sites has not been determined. The sites within the Level I region of influence include a lithic scatter, the isolate, and the rock alignment. The two historic sites falling along Schurz alternative segment 6 are found within the Level I region of influence and include the Rawhide Western Railroad grade and the Reese River Road stage route. Eligibility status of these resources has not been determined.

DOE surveyed two sample units during the Class II effort, totaling 1.6 kilometers (1 mile). One resource, a prehistoric lithic scatter, was recorded. This site has not been evaluated for listing on the *National Register of Historic Places*.

3.3.13.5.4 Department of Defense Branchline South

Department of Defense Branchline South is existing track that starts where the Schurz alternative segments would end, about 13 kilometers (8 miles) south of Schurz. The rail line trends generally south for 10 kilometer (6 miles) before leaving the Walker River Paiute Reservation, and continues generally south for another 24 kilometers (15 miles) on the east side of Walker Lake. Department of Defense Branchline South ends near Hawthorne, where it would join Mina common segment 1. Department of Defense Branchline South is approximately 35 kilometers (22 miles) long.

The Class I site-file search revealed that three cultural resources have been recorded within 0.15 kilometer (500 feet) of the existing rail line, including an historic pier piling, the historic Nolan Station rail siding, and a boulder containing cupule-style rock art (DIRS 182290-Desert Research Institute 2007, all). The historic pier piling is considered not eligible, and the other two sites have not been evaluated for eligibility. Because this line passes through or is adjacent to the Hawthorne Army Depot, first established as a U.S. Navy ammunition storage facility in 1928, historic structures associated with the depot might lie within the region of influence. No such structures were identified during Class I or Class II inventories. Any structures identified within the Level I region of influence during future studies, however, would require recordation and evaluation.

3.3.13.5.5 Mina Common Segment 1 (Soda Spring Valley Area)

Mina common segment 1 would begin north of the city of Hawthorne and would trend southeast before turning east at U.S. Highway 95. It would trend east along U.S. Highway 95 through Soda Springs Valley for approximately 40 kilometers (25 miles). Continuing to parallel U.S. Highway 95, the rail line would cross State Route 391 and turn south for approximately 64 kilometers (40 miles). It would pass the communities of Luning and Mina, which are along U.S. Highway 95 and would be approximately 1.5 to 3 kilometers (1 to 2 miles) to the east of the rail alignment. The rail line would then turn east before crossing U.S. Highway 95 with a grade-separated crossing in the area of Blair Junction and continuing for about 1.5 kilometers (1 mile) before joining the selected Montezuma alternative segment. Mina common segment 1 would be approximately 120 kilometers (72 miles) long.

The Class I site-file search revealed that 56 cultural resources have been recorded along Mina common segment 1, including 18 within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include two prehistoric lithic scatters (one site is considered not eligible, one site has not been evaluated), 14 historic sites (five sites are considered eligible, two sites are considered not eligible, and seven sites have not been evaluated), and two multi-component sites (one site is not eligible, one site has not been evaluated). Types of eligible resources falling within the Level I region of influence include the Sodaville to Tonopah Freight Road, railroad workers' camps, and a railroad grade. Within the Level II region of influence, there are 24 prehistoric sites (15 sites are considered not eligible, and nine have not been evaluated), and 14 historic sites (four are considered eligible, six are considered not eligible, and four have not been evaluated). The prehistoric sites consist of a rockshelter, lithic scatters, and isolates. Most of the historic sites are associated with railroad construction and operation, including camps, stations, and grades. Mining sites and the townsites of Redlich and Mina also fall within the region of influence of Mina common segment 1.

DOE surveyed 29 sample units during the Class II effort, totaling 23.3 kilometers (14.5 miles). A total of 19 resources were recorded, including 14 prehistoric sites (13 lithic scatters and one quarry), three historic trash deposits, and two historic railroads. One historic railroad and the prehistoric quarry site are both considered eligible for listing on the *National Register of Historic Places*. Seven of the prehistoric lithic scatters are considered not eligible, and six have not been evaluated for eligibility. The three historic trash deposits and the additional historic railroad are considered not eligible.

3.3.13.5.6 Montezuma Alternative Segments

DOE is considering three alternative segments in the Montezuma area, referred to as Montezuma alternative segments 1, 2 and 3. Montezuma alternative segment 1 would depart Mina common segment 1 just southeast of Blair Junction. It would trend roughly southeast along State Route 265 through part of the Big Smoky Valley and west of the Weepah Hills for approximately 37 kilometers (23 miles), passing to the east of the Silver Peak in Clayton Valley. It would then turn to the northwest through Clayton Valley and run through a pass between Clayton Ridge and Paymaster Ridge close to Silver Peak Road. It would then trend south for the next 11 kilometers (7 miles) between Clayton Ridge on the west and Montezuma Peak on the east before turning east for about the next 13 kilometers (8 miles), passing to the south of Montezuma Peak. The rail alignment would again turn roughly south for approximately 11 kilometers, traveling to the west of the Goldfield Hills. It would then travel northwest, cross U.S. Highway 95, and turn south before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 1 would be approximately 120 kilometers (73 miles) long.

3.3.13.5.6.1 Montezuma Alternative Segment 1. The Class I site-file search revealed that 43 cultural resources have been recorded along Montezuma alternative segment 1, including five within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, two prehistoric sites, including a quarry site of unknown eligibility status and a small lithic scatter that is considered not eligible, and three historic sites (two sites, a railroad grade and telephone line, are considered eligible and one site, a trash dump, has not been evaluated) are present.

Within the Level II region of influence, previously recorded resources include 27 prehistoric sites (one site is considered eligible, 17 sites are considered not eligible, and nine have not been evaluated), 10 historic sites (three are considered eligible, four are considered not eligible, and three have not been evaluated), and one multi-component site that is considered not eligible. The majority of the prehistoric sites consist of lithic scatters and isolates, though cave and quarry sites are also present; historic sites include railroad grades, a dump, a wagon road, mining sites, and the townsite of Blair.

DOE surveyed 25 sample units during the Class II effort, totaling 20.1 kilometers (12.5 miles). Twenty resources were recorded, including 17 prehistoric lithic scatters, two historic trash deposits, and one historic mining site. One lithic scatter is considered eligible for listing on the *National Register of Historic Places*; three scatters are considered not eligible, and the remaining 13 prehistoric sites have not been evaluated for eligibility. Of the historic sites, one trash deposit and the mining site are considered not eligible; the other trash deposit has not been evaluated.

3.3.13.5.6.2 Montezuma Alternative Segment 2. Montezuma alternative segment 2 would depart Mina common segment 1 just southeast of Blair Junction. It would trend northeast for about 35 kilometers (22 miles) just south of U.S. Highway 95. Northeast of Lone Mountain, it would turn south into Montezuma Valley and run south for 49 kilometers (31 miles) before turning east and crossing U.S. Highway 95 south of Goldfield. It would then trend south for about 37 kilometers (23 miles) before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 2 would be approximately 120 kilometers (74 miles) long.

The Class I site-file search revealed that 226 cultural resources have been recorded along Montezuma alternative segment 2, including 39 within the Level I region of influence and 187 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include 11 prehistoric sites (10 are considered not eligible, one has not been evaluated), 17 historic sites (one site, the townsite of Goldfield, is listed on the *National Register of Historic Places*, nine sites are considered eligible, and seven are considered not eligible), and 11 multi-component sites (one site is considered eligible, nine are considered not eligible, and one has not been evaluated). Eligible site types include railroad grades, Millers townsite, a mining camp and miner's cabin, the Goldfield Junction Station and Goldfield Dump, a feed lot with corrals, and a multi-component site with mining structures and rock art. An unrecorded American Indian settlement is also reported within the Montezuma alternative segment 2.

Within the Level II region of influence, recorded resources include 112 prehistoric sites (four sites are considered eligible, 73 are considered not eligible, and 35 have not been evaluated), 58 historic sites (14 sites are considered eligible, 42 are considered not eligible, and two have not been evaluated), and 17 multi-component sites (14 are considered not eligible, and three have not been evaluated). The majority of the prehistoric sites consist of small lithic scatters and isolates; a variety of historic sites is found, primarily associated with mining and railroad activities. Historic sites also include the townsite of Millers, cemeteries, historic dumps, and military encampments, as well as sites and features potentially contributing to the National Register-listed Goldfield townsite.

DOE surveyed 24 sample units during the Class II effort, totaling 19 kilometers (12 miles). A total of 39 resources were recorded, including 28 prehistoric lithic scatters and one quarry, four historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and seven are considered not eligible; 19 lithic scatters and the quarry have not been evaluated for eligibility. The four historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated.

3.3.13.5.6.3 Montezuma Alternative Segment 3. Montezuma alternative segment 3 would depart Mina common segment 1 just southeast of Blair Junction. It would trend northeast for about 35 kilometers (22 miles) just south of U.S. Highway 95. Northeast of Lone Mountain, it would turn south into Montezuma Valley and trend south for 37 kilometers (23 miles). North of Goldfield, it would turn west and trend along the northern portion of the Montezuma Range for 12 kilometers (7.5 miles). It would then trend south for the next 11 kilometers (7 miles) between Clayton Ridge on the west and Montezuma Peak on the east before turning east for about the next 13 kilometers (8 miles), passing to the south of Montezuma Peak. The rail alignment would again turn roughly south for approximately 11 kilometers, traveling to the west of the Goldfield Hills. It would then travel northwest, cross U.S. Highway 95, and turn south before joining Mina common segment 2 near Lida Junction. Montezuma alternative segment 3 would be approximately 140 kilometers (88 miles) long.

The Class I site-file search revealed that 84 cultural resources have been recorded along Montezuma alternative segment 3, including eight within the Level I region of influence and 76 within the Level II region of influence. Within the Level I region of influence, there is one prehistoric site (considered not eligible) and seven historic sites (six are considered eligible, and one is considered not eligible). The eligible resources include two railroad grades, Millers townsite, the Goldfield Junction Station, a mining camp, and a feed lot with corrals.

Within the Level II region of influence, previously recorded resources include 55 prehistoric sites (35 sites are considered not eligible, and 20 have not been evaluated), 18 historic sites (four sites are considered eligible, 12 are considered not eligible, and two have not been evaluated), and three multi-component sites that are considered not eligible. The majority of the prehistoric sites consist of small lithic scatters and isolates; a rockshelter is also present. Historic sites are primarily associated with mining and railroad activities, and include camps, dumps, mining features, and railroad grades and stations.

DOE surveyed 30 sample units during the Class II effort, totaling 24 kilometers (15 miles). A total of 46 resources were recorded, including 36 prehistoric lithic scatters and one quarry, three historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and eight are considered not eligible; 26 lithic scatters and the quarry have not been evaluated for eligibility. The three historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated.

3.3.13.5.7 Mina Common Segment 2 (Lida Junction Area)

Mina common segment 2 would begin at the end of the Montezuma alternative segments and run roughly southeast for about 3.4 kilometers (2.1 miles) before joining one of the Bonnie Claire alternative segments.

The Class I site-file search revealed that one prehistoric cultural resource, the Twin Buttes Rockshelters, is recorded along Mina common segment 2 within the Level II region of influence. This site has not been formally evaluated for eligibility, but is likely to be considered eligible. No cultural resources have been previously identified within the Level I region of influence.

No Class II effort has been conducted along this short segment.

3.3.13.5.8 Bonnie Claire Alternative Segments

DOE is considering two alternative segments in the area north of Scottys Junction – Bonnie Claire alternative segments 2 and 3.

3.3.13.5.8.1 Bonnie Claire Alternative Segment 2. Bonnie Claire alternative segment 2 would depart Mina common segment 2 as the easternmost alternative segment where it skirts the western border of the Nevada Test and Training Range. The Class I site-file search identified one cultural resource along Bonnie Claire alternative segment 2. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II survey examined five sample units, a total of 4 kilometers (2.5 miles). Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and ground stone scatter, evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

3.3.13.5.8.2 Bonnie Claire Alternative Segment 3. Bonnie Claire alternative segment 3 would run west of Bonnie Claire alternative segment 2, closer to U.S. Highway 95, and generally follow an abandoned rail line grade for part of its length. The Class I site-file search revealed four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences. The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles). One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

3.3.13.5.9 Common Segment 5 (Sarcobatus Flat Area)

Common segment 5 would begin 4 kilometers (2.5 miles) north of Scottys Junction and trend generally southeast through the Sarcobatus Flat area, approximately 100 meters (330 feet) east of U.S. Highway 95 at its closest point. Common segment 5 would end approximately 6 kilometers (4 miles) north of Springdale, where it would connect to one of the Oasis Valley alternative segments. Common segment 5 would be about 40 kilometers (25 miles) long (DIRS 176165-Nevada Rail Partners 2006, p. E-13).

The Class I site-file search identified 33 cultural resources within common segment 5. These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for listing on the *National Register of Historic Places*; 11 are not eligible, and 14 remain unevaluated.

DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles). Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places*, and the tree lithic scatters are not eligible.

3.3.13.5.10 Oasis Valley Alternative Segments

The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3. These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places)* and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

3.3.13.5.10.1 Oasis Valley Alternative Segment 1. The Class II survey looked at three sample units along Oasis Valley 1, totaling 2.4 kilometers (1.5 miles). Two prehistoric sites (lithic scatters) and one historic mine site were recorded.

Oasis Valley alternative segment 1 would pass to the east of the historic ranch known today as the Beatty Cattle Company Ranch. In addition to being an unrecorded historic ranch, the area adjacent to the ranch is known to be the location of an early historic Western Shoshone winter camp. This camp has been partially recorded but has not been evaluated.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated with and supplied labor for the ranches.

3.3.13.5.10.2 Oasis Valley Alternative Segment 3. Oasis Valley alternative segment 3 would cross Oasis Valley farther to the east than Oasis Valley 1, but because of proximity, much of the discussion for Oasis Valley 1 applies to this alternative segment. During the Class II survey, DOE inspected four sample units, a total of 3.2 kilometers (2 miles); five sites and 28 isolates were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 would also be near a historic ranch (noted as the Colson Ranch or Indian Camp on some maps). Similar to the Beatty Cattle Company Ranch, the Colson Ranch is an unrecorded historic property that has been identified as a Western Shoshone winter camp.

3.3.13.5.11 Common Segment 6 (Yucca Mountain Approach)

The Yucca Mountain area has been heavily analyzed in conjunction with repository site characterization studies. Intensive cultural resource studies related to the development of the repository site have been completed; consequently, a large number of archaeological sites are known to exist along common segment 6. This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified a total of 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, 3 historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected thirteen sample units, a total of 11 kilometers (7 miles). Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6, Desert Research Institute conducted a supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary. This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that had not been previously surveyed during repository site characterization activities. Desert Research Institute identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this segment. Several of these fall within the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty Wash rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

3.3.14 PALEONTOLOGICAL RESOURCES

Paleontology is a science that uses ***fossil*** remains to study life in past geological periods. DOE, the BLM, and other federal agencies recognize paleontological resources as a fragile and nonrenewable scientific record of the history of life on earth and consider them a critical component of America's natural heritage. Once such resources are damaged, destroyed, or improperly collected, their scientific and educational value could be greatly reduced or forever lost.

> **Fossil**: Fossils include the body remains, traces, and imprints of plants or animals that have been preserved in the Earth's crust since some past geologic or prehistoric time. Generally, to be considered a fossil, the remains must be older than recent in age (older than 10,000 years). Fossils are found in ***sedimentary rock***.
>
> **Sedimentary rock**: Rock formed from material deposited by water, wind, or glaciers.

The BLM manages and protects paleontological resources under the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq.*), and in accordance with 43 CFR 8365 and 43 CFR 3622. The BLM has developed policies and management actions to protect and manage paleontological resource areas of high scientific value consistent with the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all) and the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), while allowing casual and academic collecting of invertebrate (animals without backbones) fossils within the regulatory framework. Because of their relative rarity and scientific importance, vertebrate (animals with backbones) fossils may only be collected with a BLM permit and remain the property of all Americans in museums or other public institutions (DIRS 180122-BLM [n.d.], all).

Section 3.3.14.1 describes the region of influence for paleontological resources along the Mina rail alignment; and Section 3.3.14.2 describes the paleontological resources within the region of influence, including the identification of previously recorded important fossil resources and the approaches for managing those resources.

3.3.14.1 Region of Influence

The region of influence for paleontological resources along the Mina rail alignment is the nominal width of the rail line construction right-of-way, and the footprints of railroad construction and operations support facilities.

3.3.14.2 Affected Environment

The BLM has established a classification system to rank areas according to their potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils (*Paleontological Resource Management* and *General Procedural Guidance for Paleontological Resource Management*). The BLM uses these rankings (called ***Condition 1***, ***Condition 2***, and ***Condition 3***) in land-use planning and to identify areas that might warrant special management or special designation (DIRS 176085-BLM 1998, all; DIRS 176084-BLM 1998, all).

> BLM ranking of areas for their potential to contain paleontological resources (DIRS 176084-BLM 1998, pp. II-2 and II-3):
>
> **Condition 1** - Areas that are known to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.
>
> **Condition 2** - Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.
>
> **Condition 3** - Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

To determine the affected environment for paleontological resources along the Mina rail alignment, DOE consulted the BLM and reviewed existing documentation of paleontological resources, including applicable BLM resource management plans and the National Science Foundation's website *The Paleontology Portal*.

The Mina rail alignment would cross large areas of volcanic rock and granite, alternating with basins filled with deposits from erosion of the mountains. North of the Montezuma Range, there are some exposures of sedimentary rock in alluvial fans and playa areas. Fossils are likely found in sedimentary rock; however, there are no known occurrences of paleontological resources within the Mina rail alignment region of influence.

Although the proposed rail alignment would not cross any known fossil-rich rock outcrops, the possibility exists that beds containing fossils could be uncovered during construction of the proposed railroad.

3.3.15 ENVIRONMENTAL JUSTICE

To support the assessment of the potential for ***disproportionately high and adverse impacts*** on ***minority*** and ***low-income*** communities, this section provides the information on minority and low-income ***populations*** and communities in the Mina rail alignment region of influence. Section 3.2.15.1 describes the region of influence, Section 3.2.15.2 describes the methodology DOE used to determine population groups, and Section 3.2.15.3 describes regional population characteristics for environmental justice considerations.

> **Minority** individuals are members of the following population groups: American Indian or Alaskan Native, Asian or Pacific Islander, Black, and Hispanic.
>
> A **low-income** household is one for which the household income is below the U.S. Census Bureau poverty thresholds.
>
> Source: DIRS 155970-DOE 2002, Section 3.1.13.1.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to make achieving environmental justice part of their missions by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations, and provide access to public information on, and an opportunity for public participation in, matters relating to human health or the environment. Executive Order 12898 also directs agencies to provide opportunities for public input on the incorporation of environmental justice principles into federal agency programs or policies. Executive Order 12898, and associated implementing guidance, establishes the framework for characterizing existing conditions related to environmental justice. For this analysis, DOE uses the terms minority and low-income in the context of environmental justice as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13.1) and *Poverty Thresholds* (DIRS 174625-Census Bureau 2005, all).

3.3.15.1 Region of Influence

The Mina rail alignment region of influence for environmental justice encompasses the regions of influence for all other resource areas because impacts in other resource areas could result in environmental justice impacts. Section 3.3 describes the regions of influence for the ***environmental resource areas*** analyzed in this Rail Alignment EIS. For some resource areas, the relevant region of influence is an area extending a given distance from the centerline of the rail alignment. For others, the relevant region of influence is not so precisely definable, but generally includes the landscape the rail line would cross. However, the most inclusive region of influence is that defined for hazardous materials and waste (see Section 3.3.12), which considers a nationwide region of influence.

In addition to the regions of influence delineated via direct physical proximity to the Mina rail alignment, the environmental justice region of influence includes populations that could be affected by the project that have cultural or religious ties in the area, even though the population may not have a physical presence. For a discussion of American Indian populations, and resulting cultural region of influence, see Section 3.4, American Indian Interests.

3.3.15.2 Methodology

Following the Council on Environmental Quality guidance (DIRS 103162-Council on Environmental Quality 1997, all) and the approach used in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 3.1.13), DOE considered that a minority population exists where either: (a) the minority population of the affected area exceeds 50 percent; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis (DOE used both the United States and the State of Nevada minority populations).

> A **census block** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block is the smallest geographic unit for which the Census Bureau tabulates 100-percent data.
>
> A **census county division (CCD)** is a subdivision of a county that is a relatively permanent statistical area established cooperatively by the Census Bureau and state and local government authorities. It is used for presenting decennial census statistics in those states that do not have well-defined and stable minor civil divisions that serve as local governments.
>
> A **census block group** is a subdivision of a census tract (or, prior to 2000, a block numbering area). A block group is the smallest geographic unit for which the Census Bureau tabulates sample data. A block group consists of all the blocks within a census tract with the same beginning number.
>
> A **census tract** is a small, relatively permanent statistical subdivision of a county delineated by a local committee of census data users for the purpose of presenting data. Designed to be relatively homogeneous units with respect to population characteristics, economic status, and living conditions at the time of establishment, census tracts average about 4,000 inhabitants.
>
> Sources: DIRS 181904-U.S. Census Bureau 2007; DIRS 181905-U.S. Census Bureau [n.d].

DOE used the Council on Environmental Quality definition of low-income and the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is meaningfully greater than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE applied the U.S. Nuclear Regulatory Commission guidance of a 20-percent threshold above the state average of 11 percent (that is, 31 percent) for low-income populations (69 *FR* 52040).

To identify low-income populations, DOE used U.S. Census Bureau data for census block groups. The census block group, which typically consists of between 600 and 3,000 people with an optimum size of 1,500 people, is the smallest census unit for which the Census Bureau releases income data (to protect confidentiality). Block groups on American Indian reservations, off reservation trust lands, and special places must contain a minimum of 300 people. (Special places include correctional institutions, military installations, college campuses, workers' dormitories, hospitals, nursing homes, and group homes.) To identify minority populations, DOE used U.S. Census Bureau data for ***census blocks***. The census block is the smallest census unit for which the Census Bureau collects 100-percent data. The Department assessed the population within 3 kilometers (1.8 miles) on either side of the centerline of the Mina rail alignment, to be consistent with the Yucca Mountain FEIS.

DOE developed these analyses by creating Geographic Information System (GIS) representations of the Mina rail alignment alternative segments and common segments and creating a computer program to extract specific census data based on the 3-kilometer buffer distance. The specific census data required to develop the analyses included:

- Total population and number of minority persons by census block
- Total population and number of individuals below the poverty level by census block group

For Census 2000, the Census Bureau used two forms, one short and one long. The Bureau sent the short form to every household, and sent the long form, containing the seven 100-percent questions plus the sample questions, to only a limited number of households. Generally, about one in every six households nationwide received the long form. The rate varied from one in two households in some smaller areas, to one in eight households for more densely populated areas. The long form requests information on the numbers and ages of members of each household and income received during the previous full year. From this information, the Bureau makes a determination of the poverty status of the individuals living in the household. The Census Bureau additionally uses school districts, child protective services, and social services to supplement the census data to develop estimates that more fully represent actual poverty status among all populations.

3.3.15.3 Regional Characteristics

3.3.15.3.1 Minority and Low-Income Populations

The Mina rail alignment would affect portions of five counties in Nevada (Churchill, Lyon, Mineral, Esmeralda, and Nye). Table 3-157 summarizes Census 2000 data on minority and low-income populations within these general areas. The table includes specific county subdivisions and small population centers within or near the Mina rail alignment. For comparison, the table includes statewide and countywide minority and poverty data.

Based on the data in Table 3-157, seven of the county subdivisions and small population centers that would encompass the Mina rail alignment have a higher proportion of minority residents than the associated countywide proportion of minority residents. The Schurz population center and the Walker River ***Census County Division***, both in Mineral County, are the two extreme cases with the widest percentage difference of 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in Section 3.3.15.2.

As shown in Table 3-157, poverty rates in the affected county subdivisions tend to be higher than the associated countywide poverty percentages, except in the following county subdivisions:

- Hawthorne subdivision, where the poverty rate is lower than the Mineral County percentage
- Goldfield subdivision, where the poverty rate is lower than the Esmeralda County percentage (DIRS 176856-U.S. Census Bureau 2003)

In all cases, poverty rates in the county subdivisions are higher than the statewide figure of 11 percent.

Population centers are often assessed in relation to the county in which they are located. As shown in Table 3-157, compared to Nye County, Beatty has a lower minority population rate but a higher poverty rate. With 89 percent, Schurz has a higher minority population rate than the established 50-percent threshold and a higher poverty rate (26 percent), although it is below the established threshold of 20 percent above the state average (11 percent), which combined is a threshold of 31 percent.

To illustrate minority concentrations, Figure 3-240 shows the distribution of census block groups with minority population percentages that are more than 50 percent. It also includes federally recognized American Indian lands, because American Indians are included in the definition of minority populations. Based on Census 2000 estimates, the population living within 3 kilometers (1.8 miles) on either side of the Mina rail alignment is 5,907 (DIRS 174625-Census Bureau 2005, all). Of that population, approximately 1,100 (19 percent) are minority populations. Two block groups in Lyon County, block groups 1 and 2 of census tract 9602, comprise approximately half of the minority populations in the region of influence for environmental justice.

To illustrate low-income concentrations, Figure 3-241 shows the distribution of census block groups with low-income rates that are more than 20 percentage points above the state average of 11 percent. Based on

Census 2000 estimates, the population within 3 kilometers (1.8 miles) on either side of the centerline of the Mina rail alignment for whom poverty status is determined is 3,600. Of these, 530, or 15 percent, are living below the poverty level. This percentage is higher than the percent of the population living in poverty for the State of Nevada as a whole (11 percent) and is generally similar to the population living in poverty in the counties along the Mina rail alignment (8.6 percent to 15 percent) (see Table 3-157). There is one census county division with a poverty rate of more than 20 percent above the state average of 11, the Walker River Census County Division, with a 32-percent poverty rate.

3.3.15.3.2 American Indian Perspectives

Section 3.4 describes American Indian perspectives related to the Proposed Action, including environmental justice concerns.

Table 3-157. Minority and low-income populations in the jurisdictions potentially affected by construction and operation of the proposed rail line – Mina rail alignment.[a]

Areas	Population	Percent minority	Percent low-income
State of Nevada	2,000,000[b]	35	11
Counties			
Churchill County	24,000	18	9
Lyon County	32,500	13	10
Mineral County	5,070	30	15
Nye County	33,000	15	11
Esmeralda County	970	19	15
County subdivisions			
Silver Springs Census County Division, Lyon County, Nevada	6,700	8	13
Hawthorne Census County Division, Mineral County, Nevada	4,000	16	11
Mina Census County Division, Mineral County, Nevada	240	0.1	22
Walker River Census County Division, Mineral County, Nevada[c]	870	80	32
Amargosa Valley Census County Division, Nye County, Nevada	1,100	28	15
Beatty Census County Division, Nye County, Nevada	1,090	11	13
Tonopah Census County Division, Nye County, Nevada	2,900	18	11
Goldfield Census County Division, Esmeralda County, Nevada	450	3	12
Silverpeak Census County Division, Esmeralda County, Nevada	520	22	18
Small population centers			
Schurz (Mineral County)[c]	710	89	26
Beatty (Nye County)	1,090	11	13

a. Source: DIRS 176856-U.S. Census Bureau 2003, all.
b. The state population was rounded to 2 million for consistent analysis.
c. Encompasses the Walker River Paiute Tribe.

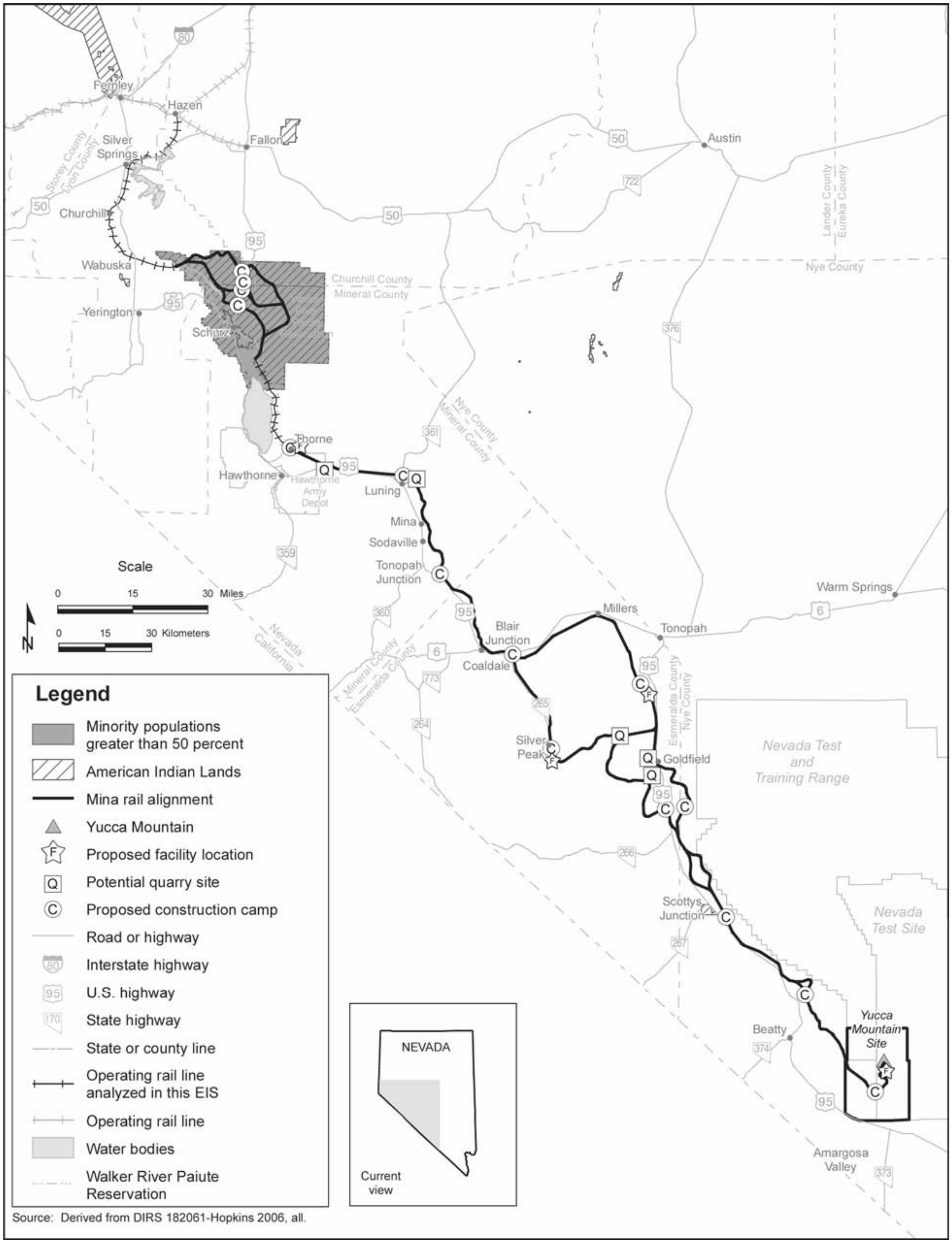


Figure 3-240. Minority populations greater than 50 percent along the Mina rail alignment.

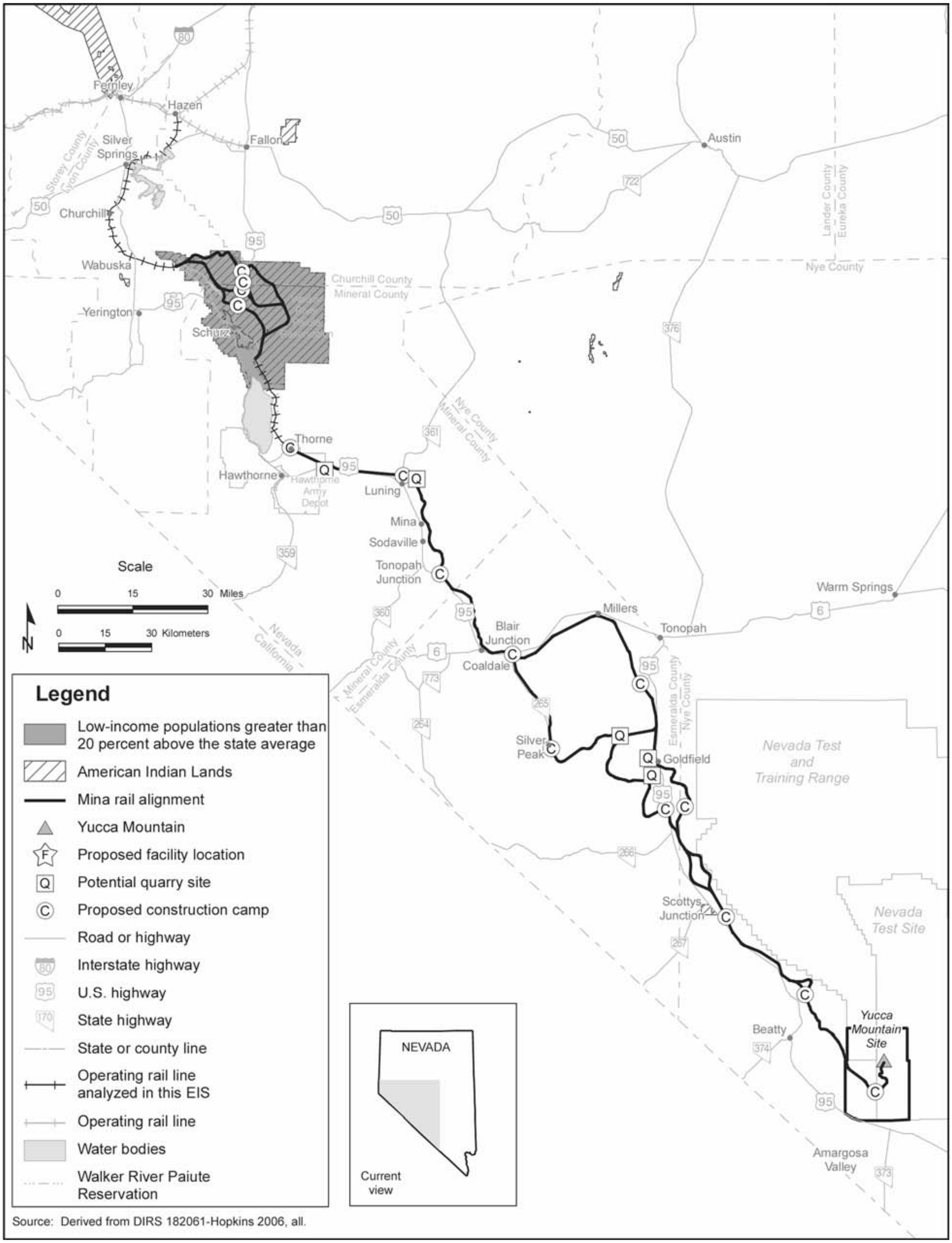


Figure 3-241. Low-income populations greater than 20 percent above the state average along the Mina rail alignment.

3.4 American Indian Interests in the Proposed Action

This section summarizes the interests and concerns expressed by various American Indian tribes and organizations within or near the Caliente and Mina rail alignment regions of influence. Sections 3.2.13 and 3.3.13, Cultural Resources, provide additional information on American Indian cultural resources.

American Indian interests regarding environmental resources are not limited to archaeological or historical sites, but include natural resources and geological formations present throughout the region. Natural resources constitute critical components of American Indian daily life and religious beliefs, while plants and animals are sources of food, raw materials, and medicines, and are components of ritual practices. Natural landforms mark locations that are significant for keeping the historic memory of American Indian people alive and for teaching children about their culture and history (DIRS 174205-Kane et al. 2005, p. 9).

In 1987, DOE initiated the Native American Interaction Program to solicit input from tribes and organizations on the characterization of the Yucca Mountain Site and the possible construction and operation of a repository for spent nuclear fuel and high-level radioactive waste. These tribes and organizations – Southern Paiute; Western Shoshone; and Owens Valley Paiute and Shoshone people from Arizona, California, Nevada, and Utah – have declared traditional ties to the Yucca Mountain area and to portions of the larger region that includes the Caliente and Mina rail alignments. As part of the scoping process for this Rail Alignment EIS, DOE held a Yucca Mountain tribal interactions meeting in June 2004 to take comments from tribal representatives about the proposed rail line along the Caliente rail alignment. In October 2004, a small group of designated tribal representatives participated in a field reconnaissance trip along the alignment, followed by a meeting of the larger consolidated group in late November 2004. Based on these efforts, the American Indian Writers Subgroup prepared a resource document, *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all), that provides insight into American Indian interests along the Caliente rail alignment.

At the time of these discussions, the Mina rail alignment was not under consideration as an ***implementing alternative***, and Northern Paiute peoples who traditionally occupied lands north of Goldfield and Tonopah did not participate in preparation of the American Indian Resource Document. As a consequence, the document does not present an American Indian perspective on the area from Blair Junction north to Hazen, along the Mina rail alignment. DOE obtained some information on Northern Paiute views during discussions with the Walker River Paiute Tribe, including a meeting with the Tribe in November 2006 to discuss the Mina rail alignment, but the Tribe did not complete the full environmental review process. Therefore, this section of this Rail Alignment EIS is based largely on the American Indian Resource Document prepared for the Caliente rail alignment.

The DOE Native American Interaction Program concentrates on the protection of cultural resources at Yucca Mountain and contributes to government-to-government interactions with the American Indian tribes and organizations. The program helps DOE comply with various federal laws and regulations, including the American Indian Religious Freedom Act (42 United States Code [U.S.C.] 1996 *et seq.*); the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa *et seq.*); the National Historic Preservation Act (16 U.S.C. 470 *et seq*.); the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq*.); DOE Order 1230.2, *American Indian Tribal Government Policy*; Executive Order 13007, *Indian Sacred Sites*; Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*; and the *DOE Office of Congressional Affairs, American Indian and Alaska Natives Tribal Government Policy, January 2006* (DIRS 176994-Bodman 2006, all). These laws and Executive Orders, and the DOE policy mandate the protection of archaeological sites and cultural items and require agencies to include American Indians and federally recognized tribes in discussions and interactions on major federal actions. Additional guidance is provided in DOE information brief DOE/EH-41-0019/1204, *Consultation with Native Americans.*

Of the 17 tribal groups who participate in the Native American Interaction Program, 15 are federally recognized. The Pahrump Paiute Indian Tribe, which consists of a group of Southern Paiutes living in Pahrump, Nevada, is not a federally recognized tribe. In addition, the Las Vegas Indian Center is also not a federally recognized tribe, but DOE has included it in the Native American Interaction Program because the Center represents the urban American Indian population of the City of Las Vegas and of Clark County, Nevada (DIRS 103465-Stoffle et al. 1990, p. 7).

The 17 tribes and organizations have formed the Consolidated Group of Tribes and Organizations, which is a forum consisting of tribally approved representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. The Consolidated Group of Tribes and Organizations has provided DOE with valuable insights into American Indian cultural and religious values and beliefs. These interactions have produced several reports that record the history of American Indian people and the interpretation of American Indian cultural resources in the Yucca Mountain region (DIRS 104958-DOE 1989, pp. 30 to 74; DIRS 103465-Stoffle et al. 1990, pp. 11 to 25; DIRS 104959-DOE 1990, pp. 23 to 49). DOE is committed to continued interaction and consultation with the tribes and organizations throughout the environmental review process.

3.4.1 REGION OF INFLUENCE

The region of influence for American Indian interests along the Caliente and Mina rail alignments is the area to which American Indians have historic ties.

Initial DOE studies of the region identified three tribal groups – the Southern Paiute, the Western Shoshone, and the Owens Valley Paiute and Shoshone – whose cultural heritage includes the Yucca Mountain region. Additional ethnographic efforts eventually identified 17 American Indian tribes and organizations with tribal resources in the region. Figures 3-242 and 3-243 show the traditional boundaries and locations of federally recognized tribes and their relationships to the Caliente and Mina rail alignments.

3.4.2 AMERICAN INDIAN VIEWS ON THE AFFECTED ENVIRONMENT

American Indians believe that they have inhabited their traditional homelands since the beginning of time. Archaeological surveys have found evidence that American Indians used the lands through which the Caliente rail alignment would pass on a temporary or seasonal basis (DIRS 103465-Stoffle et al. 1990, p. 29). American Indians emphasize that a lack of abundant artifacts and archaeological remains does not mean that their people did not use an area or that the land is not an integral part of their cultural ecosystem. American Indians assign meanings to places involved with their creation as a people, with religious stories, burials, and important secular events. The traditional stories of the Southern Paiute, Western Shoshone, and Owens Valley Paiute and Shoshone peoples identify such places.

The following paragraphs, excerpted from the American Indian Resource Document (DIRS 174205-Kane et al. 2005, pp. 9 and 10), are representative of the American Indian interests in and attachment to the area that would be affected by construction and operation of the proposed railroad along the Caliente rail alignment:

> For many centuries the YMP [Yucca Mountain Project] study area and the proposed rail corridor lands have been important to the lives of American Indians. These lands contain traditional gathering, ceremonial, and recreational areas for Indian people. From antiquity to contemporary

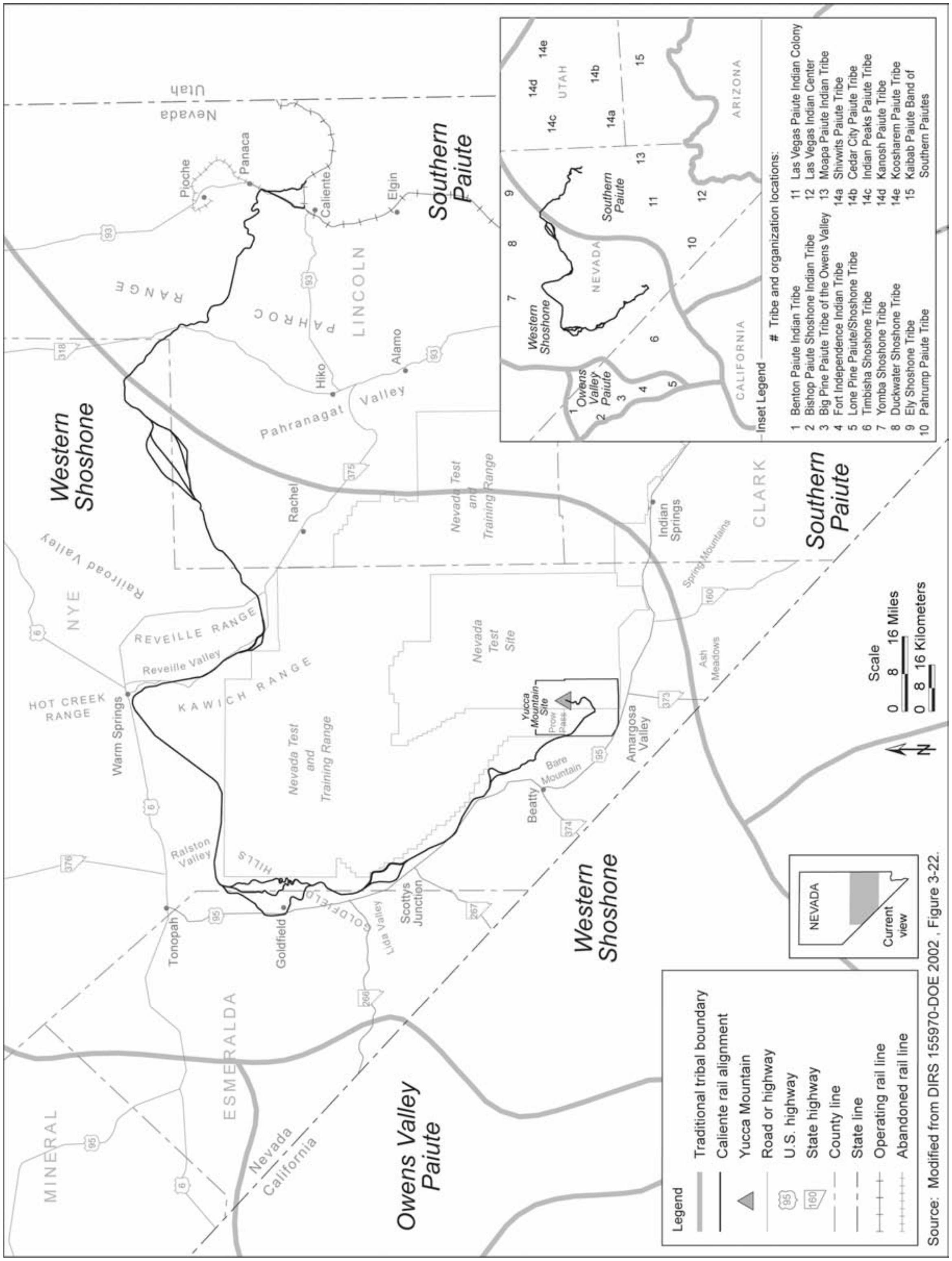


Figure 3-242. Traditional boundaries and locations of federally recognized tribes in the Caliente rail alignment region of influence.

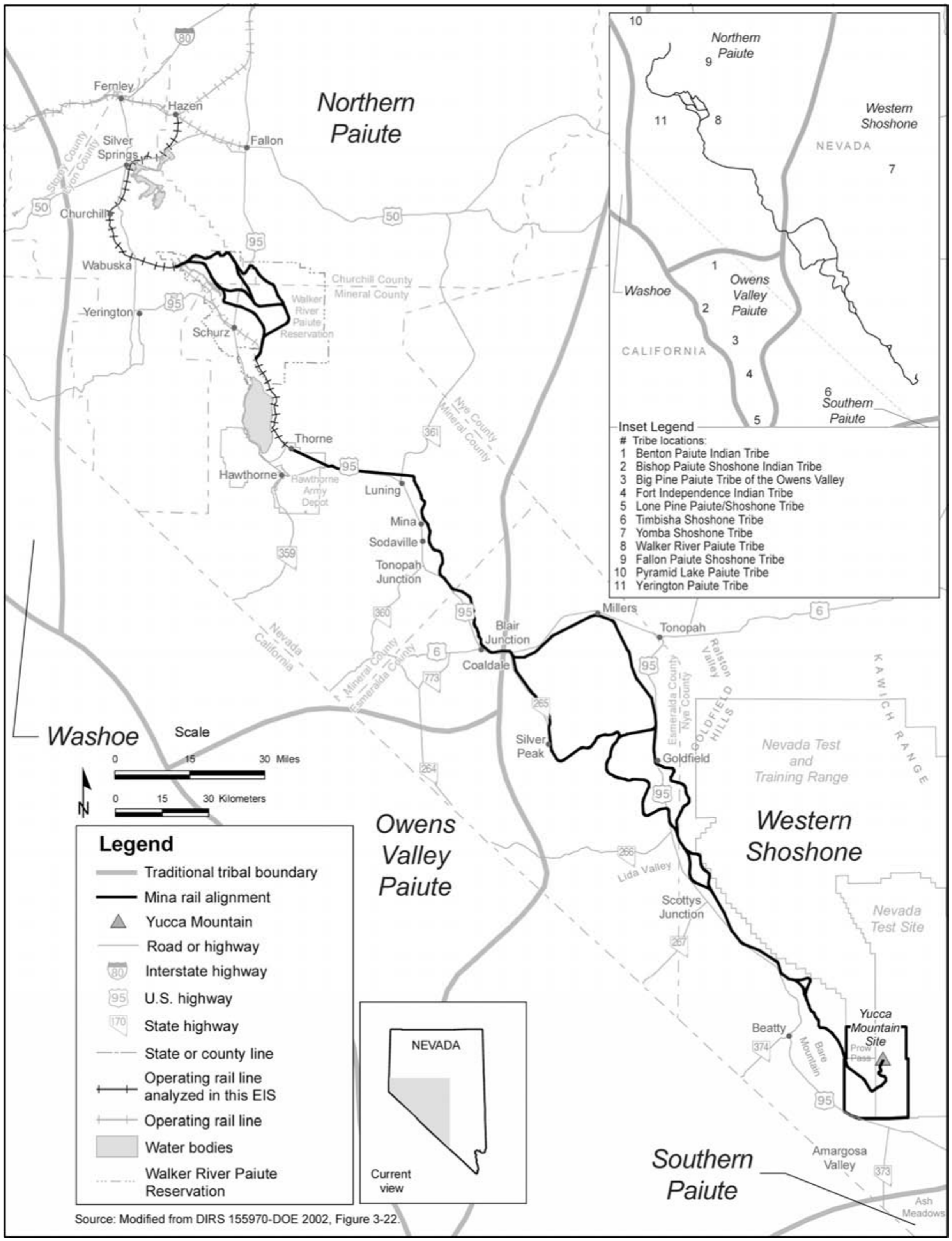


Figure 3-243. Traditional boundaries and locations of federally recognized tribes in the Mina rail alignment region of influence.

> times, this area has been used continuously by many tribes. It contains numerous ceremonial resources and power places that are crucial for the continuation of American Indian culture, religion, and society. Until the mid-1900s, traditional festivals involving religious and secular activities attracted Indian people to the area from as far away as San Bernardino, California. Similarly, groups came to the area from a broad region during the hunting season and used animal and plant resources that were crucial for their survival and cultural practices. Many non-Indian people hold a different view of these lands. For example, the federal government has maintained the perception that the YMP is located in a remote area with a very low population density and other characteristics that make it ideal for the siting of a potential repository to be accessed by a newly constructed rail system. Because of this 'wasteland perception,' YMP lands were withdrawn by the federal government for the Atomic Energy Commission's nuclear testing site. The federal agency was renamed the DOE who named the land the NTS [Nevada Test Site]; a portion of the land was later designated for the YMP and the potential repository site.
>
> Despite the loss of some traditional lands to destruction and reduced access, Indian people have neither lost their ancestral ties to, nor have forgotten the abundant cultural resources in the YMP area, or along the proposed rail corridor. Indian people have cared for the resources in these areas and will continue to do so. These strong beliefs and the presence of resources confirm the continuity in the American Indian use of and broad cultural ties to the YMP and the proposed rail alignment area.
>
> Indian people believe that the proposed rail alignment falls within a cultural landscape and corresponding viewshed that extends many miles in all directions. Because this land is a part and not the whole, it is essential that determinations of cultural affiliation, ancestral ties, and impacts from YMP actions and programs on traditional Indian culture, religion, and society be made according to the broad regional use of lands linked around Yucca Mountain.
>
> The extensive information compiled through long-term research involving the CGTO [Consolidated Group of Tribes and Organizations] demonstrates that American Indian cultural resources are not limited to archaeological or historical remains of native ancestors, but include all natural resources, as well as geological formations contained throughout the region. Natural resources constitute critical components of American Indian daily life and religious beliefs. Plants and animals are a source of food, raw materials, and medicine. Ritual practices cannot be properly carried out without plants and animals. Similarly, natural landforms mark locations that are significant for keeping the historic memory of American Indian people alive and for teaching children about their culture and history.
>
> This land and its resources are well-known by American Indian people, who consider the YMP and the proposed rail corridor areas as central parts of their cultural landscape. This knowledge has allowed them to be self-sufficient and to transfer all their cultural values and practices to future generations to this day.

Based on the collective knowledge of American Indian culture and previous American Indian studies in the region, the American Indian Resource Document identifies a number of resources that are important to historical and traditional use in the region through which the proposed rail line would pass. These include several categories of resources, including biological (both plant and animal), geological, hydrological, and what non-American Indian investigators commonly refer to as archaeological and historical sites (DIRS 174205-Kane et al. 2005, p. 13).

> American Indians believe that they have the responsibility to protect with care, and teach the young, the relationship of the existence of a non-destructive life on Mother Earth. This belief is the foundation of our holistic view of cultural resources, i.e., water, animals, plants, air, geology, sacred sites, TCPs [traditional cultural properties], and artifacts. Everything is considered to be interrelated and dependent on each other to sustain existence. Indian people believe that through proper respect and understanding, this complex relationship can be better understood and allow for existing and future generations to be better prepared for the care of these things.

Sections 3.4.2.1 through 3.4.2.4 briefly describe American Indian views on some of the existing resources; for more detailed information refer to the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) and *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement* (DIRS 102043-AIWS 1998, all).

3.4.2.1 Plants and Animals

Past studies by American Indians have identified about 107 plants, 46 species of mammals, and 35 species of birds that occur in the region and have either traditional use or importance. *Native Plants of Southern Nevada: An Ethnobotany* presents a detailed discussion of plants important to American Indian inhabitants of southern Nevada.

3.4.2.2 Water Resources

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 11) observes that American Indians are concerned about all water sources along the proposed rail alignment. Surface water exists in areas along the rail alignment (see Sections 3.2.5.1 and 3.3.5.1) and is found at springs, seeps, the Amargosa River (an ephemeral stream), and in temporary collection basins ("Pohs" or "tinajas"), which are important for storing water for everyday or ceremonial use (see sections 3.2.5 and 3.3.5, Surface-Water Resources). Other locations, known as hydrological areas, contain a wide range of important cultural resources including plants, animals, archaeological sites, minerals, traditional cultural places such as "power places," sacred sites, and intellectual properties. The American Indian perspective is that water sources, including those along the proposed rail alignment, are the homes of supernatural beings who live in the area and protect the springs and water resources.

3.4.2.3 Archaeological and Historical Places

Although not considered all-inclusive, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies 24 known locations of archaeological resources that fall within or near one or more of the Caliente and Mina rail alignments alternative segments and common segments. Four of these, however, including Bare Mountain, Prow Pass, Ash Meadows, and the Spring Mountains, are well outside the Caliente and Mina rail alignments regions of influence. Section 3.2.13, Cultural Resources, describes the others.

3.4.2.4 Environmental Justice

American Indians have identified environmental justice issues in the vicinity of Yucca Mountain, and in association with development of both the Yucca Mountain Repository and the proposed railroad. In 2005, the American Indian Writers Subgroup expressed the following concerns (DIRS 174205-Kane et al. 2005, pp. 29 and 30):

> ***Holy Land Violations***
>
> American Indian people that belong to the CGTO [Consolidated Group of Tribes and Organizations] consider that much of the land along the proposed rail corridor to be as central in their lives today as these lands have been since the creation of these people. The proposed impact area(s) are a part of the traditional holy lands of Western Shoshone, Southern Paiute and Owens Valley Paiute and Shoshone peoples. These holy lands and their resources have been subjected to exorbitant amounts of damage by long-term nuclear testing activities involving the NTS [Nevada Test Site] and site characterization activities associated with the YMP [Yucca Mountain Project]. The CGTO believes that the past, present, and future pollution of these holy lands constitutes both

Environmental Justice and equity violations. No other people have had their holy lands impacted by YMP-related activities.

Cultural Survival-Access Violations

One of the most detrimental consequences of YMP operations on the survival of American Indian culture, religion, and society has been the denial of free access to their traditional lands and resources. Loss of access to traditional foodstuffs and medicine has greatly contributed to undermining the cultural well being of Indian people. These Indian people have experienced, and will continue to experience, breakdowns in the process of cultural transmission due to lack of access to YMP lands and resources. The construction and use of the proposed rail corridor will add to such impacts to the land and the perpetuation of Indian culture. No other people have experienced or been subjected to similar cultural survival impacts attributed to access limitations within the YMP area.

3.4.3 AMERICAN INDIAN TREATY ISSUE

Of special concern to the Western Shoshone people is the Ruby Valley Treaty of 1863. The Western Shoshone people maintain that the treaty gives them rights to 97,000 square kilometers (24 million acres) in Nevada, including the Yucca Mountain region (DIRS 102216-*Western Shoshone National Council v. United States of America*, 1998, all). The legal dispute over the land began in 1946 when the Indian Claims Commission Act (60 Stat. 1049) gave tribes the right to sue the Federal Government for treaty promises that are not kept. If a tribe were to win a claim against the government, the Indian Claims Commission Act specifies that the tribe could receive only a monetary award and not land or other remunerations.

The Western Shoshone people filed a claim in the early 1950s alleging that the government had taken their land. The Indian Claims Commission found that Western Shoshone title to the Nevada lands had gradually been extinguished and set a monetary award as payment for the land. In 1976, the Commission entered its final award to the Western Shoshone people, who dispute the findings of the Commission and have not accepted the monetary award for the lands in question (the U.S. Treasury has been holding these monies in an interest-bearing account). The Western Shoshone people maintain that a settlement has not been reached. In 1985, the U.S. Supreme Court ruled that even though the money has not been distributed, the United States has met its obligations with the Commission's final award and, as a consequence, the aboriginal title to the land had been extinguished (DIRS 148197-*United States v. Dann et al.*, 1985, all).

On February 6, 2003, the Western Shoshone National Council sent a letter to members of the U.S. House of Representatives Resources Committee and the Senate Indian Affairs Committee, expressing opposition to any attempt to re-introduce legislation aimed at forcing a distribution of monies from Docket 326-K of the Indian Claims Commission to the Western Shoshone. The Council letter enclosed a report, *Failure of the United States Indian Claims Commission to File a Report with Congress in the Western Shoshone Case* (Docket 326-K), prepared by the Indigenous Law Institute on behalf of the Council, which asserted that the U.S. Indian Claims Commission never completed its action in Docket 326-K. The Council therefore asserted that there is no legal basis for a distribution bill and reiterated its position that negotiations between the Western Shoshone and the United States are the preferred way to resolve this ongoing conflict. On February 25, 2003, Representative Jim Gibbons (Nevada) introduced H.R. 884, a bill "to provide for the use and distribution of the funds awarded to the Western Shoshone identifiable group under Indian Claims Commission Docket Numbers 326-A-1, 326-A-3, and 326-K, and for other purposes." The bill became Public Law 108-270 in July 2004.

On March 4, 2005, the Western Shoshone National Council filed a lawsuit against the United States, DOE, and the U.S. Department of the Interior in federal district court in Las Vegas, Nevada. The complaint sought an injunction to stop federal plans for the use of Yucca Mountain as a repository based on the five established uses of the land within the boundaries of the 1863 Ruby Valley Treaty. On May 17, 2005, the U.S. District Court rejected a request from the Western Shoshone National Council for a preliminary injunction to stop DOE from applying for a license for the Yucca Mountain Project.

In 2006, a contingent of Western Shoshones sued Union Pacific Railroad, BNSF Railroad Company, Newmont Gold Company, Barrick Goldstrike Mines Inc., Glamis Gold Inc., Nevada Land Resource Company, Sierra Pacific Power Company, and Idaho Power Company in federal court in Reno, Nevada. The lawsuit claims that the companies violated the Ruby Valley Treaty by possessing land transferred from the U.S. Government.

Although this American Indian treaty issue involves land along the Caliente and Mina rail alignments, none of the alternative segments or common segments would encroach on federally recognized American Indian lands.

3.4.4 AMERICAN INDIAN VIEWS ON CONSTRUCTING AND OPERATING THE PROPOSED RAILROAD

Previous studies (DIRS 102043-AIWS 1998, all; DIRS 174205-Kane et al. 2005, all; DIRS 103465-Stoffle et al. 1990, all) have delineated American Indian sites, areas, resources, and other interests within or adjacent to the Caliente rail alignment region of influence (DIRS 102043-AIWS 1998, Chapter 2; DIRS 174205-Kane et al. 2005, Chapter 2). Comparable studies have not been completed for the Mina rail alignment region of influence, but similar views can be anticipated. The Consolidated Group of Tribes and Organizations has consistently opposed the siting and operation of a repository at Yucca Mountain and transportation of spent nuclear fuel and high-level radioactive waste to such a repository. *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the Native American Resource Document) (DIRS 174205-Kane et al. 2005, pp. 33 and 34) summarizes the views and concerns of the Consolidated Group of Tribes and Organizations. The "*CGTO has continually stated its opposition to the siting and transportation of spent nuclear fuel and high-level waste to a repository at Yucca Mountain*" and strongly believes that "*any disturbance to cultural, biological, botanical, geological, and hydrological resources, including viewscapes, songscapes, storyscapes, and traditional cultural properties will cause adverse impacts*" (DIRS 174205-Kane et al. 2005, p. 33). Some of the American Indian views expressed in the American Indian Resource Document regarding potential impacts under the Proposed Action include the following (DIRS 174205-Kane et al. 2005, p. 9):

> Despite the loss of some traditional lands to destruction and reduced access, Indian people have neither lost their ancestral ties to, nor have forgotten the abundant cultural resources in the YMP [Yucca Mountain Project] area, or along the proposed rail corridor. Indian people have cared for the resources in these areas and will continue to do so. These strong beliefs and the presence of resources confirm the continuity in the American Indian use of and broad cultural ties to the YMP and the proposed rail alignment area.
>
> Indian people believe that the proposed rail alignment falls within a cultural landscape and corresponding viewshed that extends many miles in all directions. Because this land is a part and not the whole, it is essential that determinations of cultural affiliation, ancestral ties, and impacts from YMP actions and programs on traditional Indian culture, religion, and society be made according to the broad regional use of lands linked around Yucca Mountain.

The Consolidated Group of Tribes and Organizations has stated that no systematic evaluations of traditional sacred sites or places along the Caliente rail alignment have been made by American Indian people that allowed for an opportunity for all members of the American Indian Writers Subgroup to fully evaluate the proposed rail alignment. Without proper studies and consultation, no specific statements about impacts to particular locations can be provided by the tribal representatives. Furthermore, establishment of the Yucca Mountain protected area boundaries and construction of the proposed repository and rail line would continue to restrict the free access of American Indians to these areas (DIRS 174205-Kane et al. 2005, p. 30).

There would be a potential for indirect impacts to American Indian interests from construction activities and the presence of additional workers, particularly impacts to the physical evidence of past use of the cultural landscape (artifacts, cultural features, archaeological sites, etc.) important to American Indian people.

Shared-Use Options would involve ground-disturbing activities for the construction of commercial access sidings for access to the rail line. In all likelihood, any shared-use projects would result in potential impacts to American Indian interests similar to those under the Proposed Action without shared-use. American Indians would also view the operation of a shared-use rail line as having adverse effects on American Indian interests and tribal resources.

3.4.5 SUMMARY

Perceptions about the types and magnitudes of potential impacts along the Caliente and Mina rail alignments vary among the various stakeholders with interests in the proposed railroad because of different beliefs, goals, responsibilities, and values. American Indians are concerned that the proposed railroad could cause substantial and high adverse impacts to a number of American Indian interests within and adjacent to the Caliente and Mina rail alignment regions of influence.

The Proposed Action includes best management practices that would avoid, minimize, or otherwise reduce impacts to American Indian interests to the greatest extent practicable. DOE would also consider mitigation measures for any remaining impacts to American Indian interests. Relevant best management practices and potential measures to mitigate impacts, if they occur, include:

- Continue to solicit input from American Indians to identify the potential to impact American Indian cultural resources, discuss potential solutions, and avoid adverse impacts.
- Comply with all regulatory requirements that protect American Indian interests (Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*).
- Consult with American Indian tribes and protect their access to public lands that contain American Indian cultural resources (American Indian Religious Freedom Act of 1978; Executive Order 13007, *Indian Sacred Sites*).

Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor
DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada
DOE/EIS-0369D

Volume III

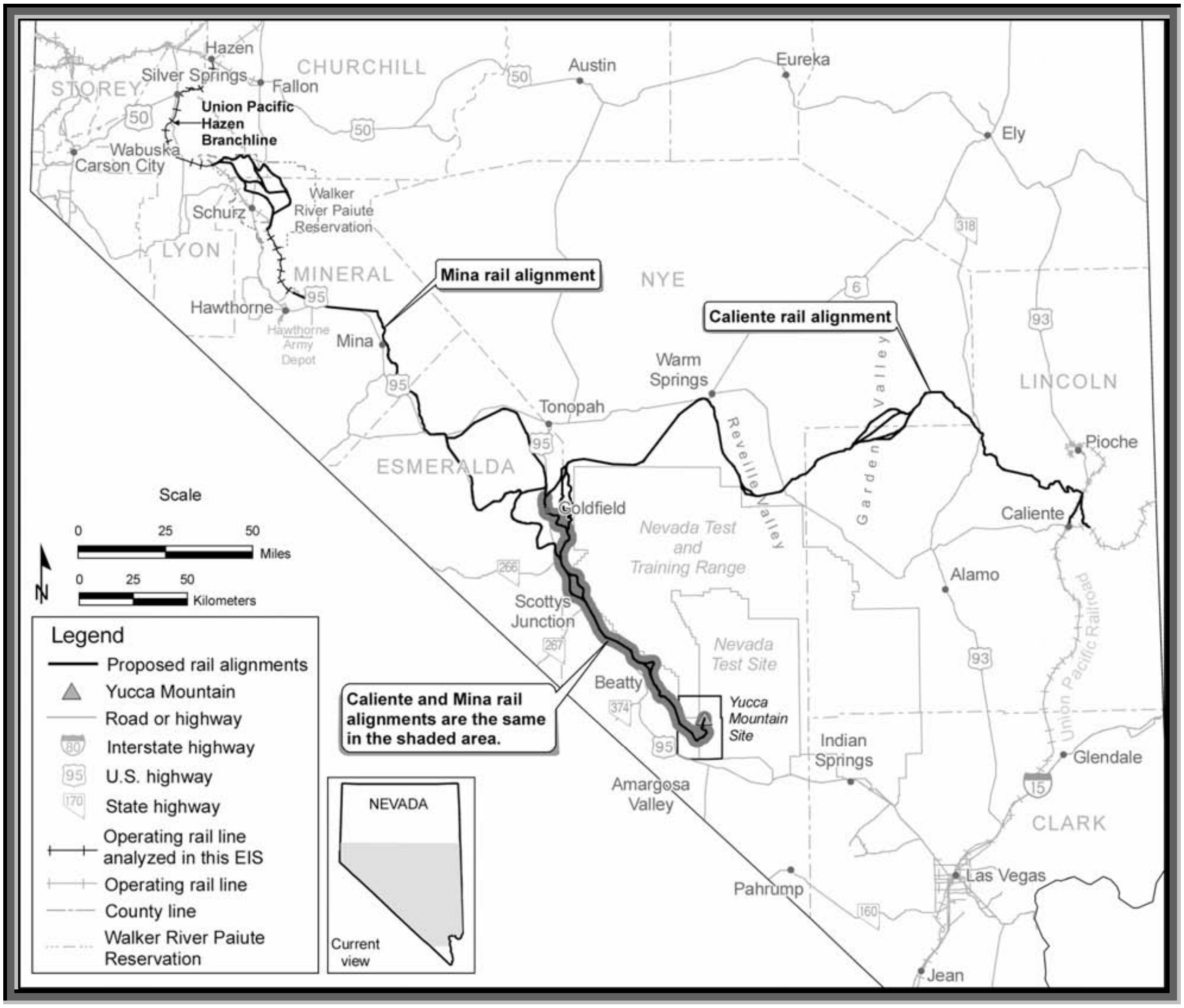
U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

4. ENVIRONMENTAL IMPACTS

This chapter describes the potential environmental impacts of constructing and operating a railroad along the Caliente rail alignment or the Mina rail alignment. An impact would be any change, positive or negative, from the existing (baseline) conditions described in Chapter 3 for each environmental resource area. The No-Action Alternative represents a continuation of baseline conditions.

Glossary terms are shown in ***bold italics***.



4.1 Introduction

This chapter begins with a description of ***impacts*** associated with the ***No-Action Alternative*** (Section 4.1.1). As described in Section 2.3, under the No-Action Alternative, the U.S. Department of Energy (DOE or the Department) would not select a ***rail alignment*** or build a ***railroad*** within the Caliente ***rail corridor*** or the Mina rail corridor and would relinquish public lands withdrawn or segregated from surface and mineral entry. The description of impacts associated with the No-Action Alternative applies to both rail corridors and all ***rail line alternative segments*** and ***common segments***. Section 4.1.2 introduces descriptions of impacts associated with the ***Proposed Action.***

Sections 4.2 and 4.3 describe potential impacts associated with construction and operation of the proposed railroad along the Caliente rail alignment and the Mina rail alignment under the Proposed Action, including a ***Shared-Use Option***.

Proposed Action: To determine a rail alignment within a rail corridor in which to construct and operate a railroad to transport spent nuclear fuel, high-level radioactive waste, and other materials from an existing railroad in Nevada to a repository at Yucca Mountain, Nye County, Nevada. The Proposed Action includes the construction of railroad construction and operations support facilities.

This Rail Alignment EIS analyzes two alternatives that would implement the Proposed Action: the Caliente rail alignment and the Mina rail alignment.

This Rail Alignment EIS also analyzes a Shared-Use Option for each implementing alternative, under which DOE would allow commercial shippers to use the rail line for transportation of general freight.

No-Action Alternative: DOE would not implement the Proposed Action within the Caliente rail corridor or the Mina rail corridor.

4.1.1 IMPACTS ASSOCIATED WITH THE NO-ACTION ALTERNATIVE

The No-Action Alternative establishes a baseline for comparison with the Proposed Action to determine potential impacts of constructing and operating the proposed railroad.

Under the No-Action Alternative, DOE would not implement the Proposed Action within the Caliente rail corridor or the Mina rail corridor and would relinquish public lands withdrawn from surface and mineral entry (see Section 1.5.1). Under the No-Action Alternative, there would be no impacts to natural, human-health, social, economic, or cultural resources from construction and operation of a railroad in Nevada for shipments of ***spent nuclear fuel***, ***high-level radioactive waste***, and ***other materials*** from an existing railroad to a ***geologic repository*** at Yucca Mountain.

Under the No-Action Alternative, DOE would not cause changes in current public land uses such as grazing and recreation; uses of public land would remain subject to Bureau of Land Management (BLM) administration under applicable resource management plans. The BLM would continue to manage resources, such as biological and cultural resources and scenic values. Under the No-Action Alternative, DOE would not cause changes to existing conditions on the Walker River Paiute Reservation or at the Hawthorne Army Depot.

The location and extent of new mining claims and the associated development of mineral commodities, although not known with any certainty, would no longer be limited by the Public Land Orders described in Section 1.5.1.

4.1.2 IMPACTS ASSOCIATED WITH THE PROPOSED ACTION

Chapter 3 describes the ***affected environment*** for 16 environmental resource areas that could be affected if DOE were to construct and operate the proposed railroad along the Caliente rail alignment or the Mina rail alignment under the Proposed Action.

The description of potential environmental impacts focuses on environmental resources within and adjacent to the Caliente rail alignment (Section 4.2) and the Mina rail alignment (Section 4.3), and the locations of railroad ***construction and operations support facilities*** outside the ***nominal*** width of the rail line ***construction right-of-way***.

This chapter describes potential impacts by environmental resource area and identifies potential impacts as either ***direct*** or ***indirect***, and either ***short-term*** or ***long-term***.

The chapter is organized as follows:

- Physical setting (Sections 4.2.1 and 4.3.1)
- Land use and ownership (Sections 4.2.2 and 4.3.2)
- Aesthetic resources (Sections 4.2.3 and 4.3.3)
- Air quality and climate (Sections 4.2.4 and 4.3.4)
- Surface-water resources (Sections 4.2.5 and 4.3.5)
- Groundwater resources (Sections 4.2.6 and 4.3.6)
- Biological resources (Sections 4.2.7 and 4.3.7)
- Noise and vibration (Sections 4.2.8 and 4.3.8)
- Socioeconomics (Sections 4.2.9 and 4.3.9)
- Occupational and public health and safety (Sections 4.2.10 and 4.3.10)
- Utilities, energy, and materials (Sections 4.2.11 and 4.3.11)
- Hazardous materials and waste (Sections 4.2.12 and 4.3.12)
- Cultural resources (Sections 4.2.13 and 4.3.13)
- Paleontological resources (Sections 4.2.14 and 4.3.14)
- Environmental justice (Sections 4.2.15 and 4.3.15)

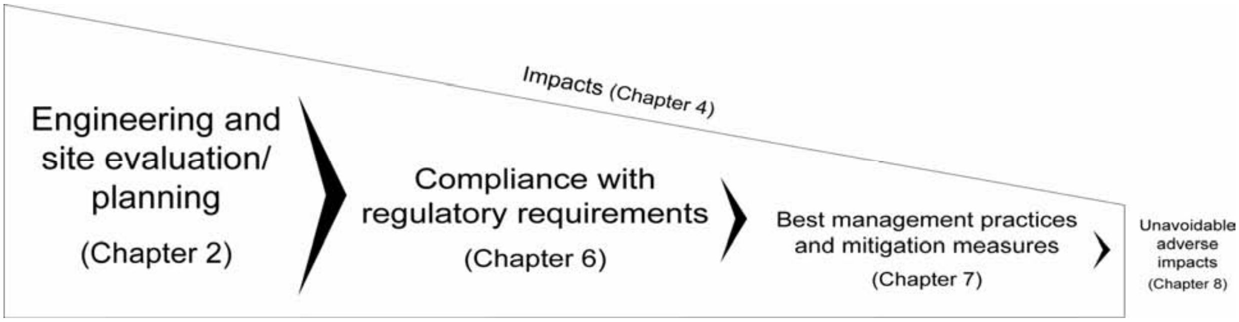
Direct impact: An effect that results solely from the construction or operation of a proposed action without intermediate steps or processes. Examples include habitat destruction, soil disturbance, air emissions, and water use.

Indirect impact: An effect that is related to but removed from a proposed action by an intermediate step or process. Examples include surface-water quality changes resulting from soil erosion at construction sites, and reductions in productivity resulting from changes in soil temperature.

Short-term impacts: In this Rail Alignment EIS, impacts limited to the construction phase (4 to 10 years).

Long-term impacts: In this Rail Alignment EIS, impacts that could occur throughout and beyond the life of the railroad operations phase (up to 50 years).

During the engineering and site evaluation and planning phase for the proposed railroad, DOE considered many factors to avoid or minimize potential environmental impacts (see Chapter 2), and would continue to consider these factors during the final design phase. As part of the Proposed Action, DOE would meet all applicable regulatory requirements during construction and operation of the proposed railroad (see Chapter 6), and would implement best management practices to ensure compliance with requirements (see Chapter 7). DOE could also implement measures to mitigate (see Chapter 7) any impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices. The impacts analyses in this chapter considered the foregoing to arrive at predictions of potential impacts, as illustrated in the following graphic. Each phase shown in the graphic reduces impacts. Ultimately, there could be unavoidable impacts (see Chapter 8).



Where possible, DOE has quantified potential impacts. For example, for the air quality analysis DOE used emissions inventories to determine existing air quality at the county level, and performed air quality simulations to determine potential changes in air-pollutant concentrations at specific receptor locations. Thus, the Department is able to provide a numerical assessment of potential impacts.

In other cases (such as the analysis of impacts to aesthetic resources), it is not possible to quantify impacts and DOE provides a ***qualitative*** assessment of potential impacts. The Department has used the following descriptors to qualitatively characterize impacts where quantification of impacts was not practical:

- **Small** - For the issue, environmental effects would not be detectable or would be so minor that they would neither destabilize nor noticeably alter any important attribute of the resource.
- **Moderate** - For the issue, environmental effects would be sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
- **Large** - For the issue, environmental effects would be clearly noticeable and would be sufficient to destabilize important attributes of the resource.

Unless otherwise noted, potential impacts described in this and other chapters would be adverse.

Each environmental resource section in this chapter describes the methodology DOE used to assess potential impacts for that resource. Each section provides a ***quantitative*** or qualitative description of potential impacts, and, where appropriate, tables summarize and compare the identified impacts for alternative segments, common segments, and construction and operations support facilities for each rail alignment.

4.1.3 PERCEIVED RISK AND STIGMA

Perceived risk and stigma: DOE uses the term risk perception to mean how an individual perceives the amount of risk from a certain activity. Studies show that perceived risk varies with certain factors, such as whether the exposure to the activity is voluntary, the individual's degree of control over the activity, the severity of the exposure, and the timing of the consequences of the exposure. DOE uses stigma to mean an undesirable attribute that blemishes or taints an area or locale.

In the *Final Environmental Impact Statement for* a *Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (Yucca Mountain FEIS; DIRS 155970-DOE 2002, Section 2.5.4), DOE evaluated ***perceived risk and stigma*** associated with construction and operation of a repository at Yucca Mountain and from the transportation of spent nuclear fuel and high-level radioactive waste. As stated in the Yucca Mountain FEIS, DOE recognizes that nuclear facilities can be perceived to be either positive or negative, depending on the underlying value systems of the individual forming the perception. Thus, perception-based impacts would not necessarily depend on the actual physical impacts or risk of repository operations, including transportation. A further complication is that people do not consistently act in accordance with negative perceptions; thus, the connection between public perception of risk and future behavior would be uncertain or speculative at best.

DOE concluded that, although public perception regarding the proposed geologic repository and transportation of spent nuclear fuel and high-level radioactive waste could be measured, there is no valid method to translate these perceptions into quantifiable economic impacts. Researchers in the social sciences have not found a way to reliably forecast linkages between perceptions or attitudes reported in surveys and actual future behavior. At best, only a qualitative assessment is possible about what broad outcomes seem most likely. The Yucca Mountain FEIS did identify some studies that report, at least temporarily, a small relative decline in residential property values might result from the designation of transportation corridors in urban areas.

The Yucca Mountain FEIS presents the following conclusions regarding perceived risk and stigma:

- While in some instances risk perceptions could result in adverse impacts on portions of a local economy, there are no reliable methods whereby such impacts could be quantified with any degree of certainty.
- Much of the uncertainty is irreducible.
- Based on a qualitative analysis, adverse impacts from perceptions of risk would be unlikely or relatively small.

The more detailed discussion of perceived risk and stigma related to the Yucca Mountain FEIS Proposed Action is incorporated into this Rail Alignment EIS by reference (DIRS 155970-DOE 2002, pp. 2-95 and 2-96).

An independent economic impact study (DIRS 172307-Riddel, Boyett, and Schwer 2003, all) conducted since DOE completed the Yucca Mountain FEIS examined, among other things, the social costs of perceived risk to Nevada households living near transportation routes. The study developed such an estimate in terms of households having a willingness to accept compensation for different levels of perceived risk and a willingness to pay to avoid risk. The results of the study indicated that during the first year of transport, net job losses (and associated drop in residential real estate demand and decreases in gross state product) in relation to the baseline would occur in response to people moving to protect themselves from transport risk. However, the initial impact would be offset rapidly, as the population shifted to a more risk-tolerant base. The results of this study are similar to the studies identified in the Yucca Mountain FEIS.

Other conclusions of this study are that the public and DOE have widely divergent risk beliefs and that the public is very uncertain about the risks they face. At the same time, more than 40 percent of the respondents in a public survey conducted as part of this study felt that DOE information is reliable or very reliable, while another 40 percent felt that DOE information is somewhat reliable. These results suggest social costs could be mitigated by reducing the risk people perceive from transport through information and education programs that are well researched and effectively presented.

While stigmatization of southern Nevada can be envisioned under some scenarios, it is not inevitable or numerically predictable. Any such stigmatization would likely be an aftereffect of unpredictable future events, such as serious accidents, which might not occur. Therefore, DOE did not attempt to quantify any potential for impacts from risk perceptions or stigma in this Rail Alignment EIS.

4.2 Caliente Rail Alignment

4.2.1 PHYSICAL SETTING

This section describes potential impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.1.1 describes the methodology DOE used to assess potential impacts to physical setting; Section 4.2.1.2 describes potential impacts of constructing the railroad; Section 4.2.1.3 describes potential impacts of operating the railroad; Section 4.2.1.4 describes potential impacts under the Shared-Use Option; and Section 4.2.1.5 summarizes potential impacts to physical setting.

As described in Section 3.2.1, physical setting includes physiography, geology, and soils. Section 3.2.1.1 describes the ***region of influence*** for physical setting along the Caliente rail alignment.

4.2.1.1 Impact Assessment Methodology

To assess potential impacts to physical setting along the Caliente rail alignment, DOE considered whether railroad construction and operations would:

- Result in soil erosion or loss of topsoil
- Result in the direct conversion of ***prime farmland*** to nonagricultural uses
- Result in the loss of availability of a known mineral resource that would be of value to the region or residents of Nevada
- Generate unstable slope conditions that could result in an on-site or off-site landslide, or collapse
- Expose construction workers, DOE personnel, and structures to amplified or unique adverse effects from ***seismic*** activity

If possible, DOE quantified impacts using data from Nevada soils surveys, geological maps, ***earthquake fault*** maps and records, and the total area of disturbance that would result from constructing and operating the proposed railroad.

The total area of disturbance would be the sum of disturbed areas within the nominal width of the ***rail line*** construction right-of-way and areas outside the nominal width of the construction right-of-way (railroad operations support facilities, quarry sites, some water-well sites, and access roads). The nominal width of the construction right-of-way would encompass the rail line, alignment access roads, some wells, ***construction camps***, and ***cuts*** and ***fills*** required to attain an appropriate ***grade***. While the nominal width of the construction right-of-way would be 300 meters (1,000 feet) across BLM lands, the width could vary in certain locations along the rail alignment. For example, it could be wider to accommodate additional earthwork, or narrower to avoid a sensitive environmental resource. Section 4.2.1.2.3 describes potential impacts from constructing the railroad operations support facilities; the number and size of those facilities would not vary among alternative segments.

Some potential impacts to physical setting along the Caliente alignment are more specifically addressed under other ***environmental resource areas***. Section 4.2.2, Land Use and Ownership, describes potential impacts to ***mining districts*** and mineral and energy resources; Section 4.2.4, Air Quality and Climate, describes soil loss from ***fugitive dust*** emissions; Section 4.2.5, Surface-Water Resources, describes potential erosion due to surface-water flow; and Section 4.2.10, Occupational and Public Health and Safety, describes impacts to worker safety from geologic hazards.

4.2.1.2 Construction Impacts

Direct impacts to physical setting along the Caliente rail alignment would occur primarily during the construction phase. Section 4.2.1.2.1 describes potential construction impacts common to the entire rail alignment. Section 4.2.1.2.2 describes impacts specific to alternative segments and common segments. Tables in Section 4.4.1.2.2 list the key information DOE used to analyze potential impacts to physical setting for the common and alternative segments.

4.2.1.2.1 Construction Impacts Common to the Entire Caliente Rail Alignment

4.2.1.2.1.1 Physiography. To the extent practicable, the Caliente alignment would avoid uneven topography and rugged terrain by following valleys and skirting mountain ranges, as described in Section 3.2.1.2.1 and illustrated in Figure 3-1. Where it is necessary to cross mountain ranges, the rail line would be located in gaps and passes. The rugged natural terrain surrounding the mountain ranges would, however, contribute to the potential for impacts to topography and soils. The ruggedness of an area is represented by the "rise and fall" calculation, which is the absolute elevation change measured at a fixed distance along the alignment. The rise and fall calculation provides a context for determining the amount of disturbance that would be required to establish the appropriate grades.

Depending on the combination of alternative segments and common segments along the Caliente rail alignment, the total area that would be disturbed during the construction phase would range from approximately 55 to 61 square kilometers (14,000 to 15,000 acres) (DIRS 176170-Nevada Rail Partners 2006, p. B-3). Construction impacts to physical setting would be centered along the rail alignment and would decrease with distance from the alignment.

Cuts and fills would be required to level steep slopes and provide a suitable grade for the rail ***roadbed***. The estimated volume of cuts along the Caliente rail alignment is 22.7 to 26.3 million cubic meters (29.7 to 34.4 million cubic yards), and the estimated volume of fill is 16.5 to 20.8 million cubic meters (21.6 to 27.2 million cubic yards) (DIRS 176165-Nevada Rail Partners 2006, Appendix E). Cut and fill activities would occur within the construction right-of-way. DOE would use the material excavated from the cuts to supply the required fill. Any excess cut material not used as fill would be used to smooth topography disturbed by construction and in reclamation efforts. Most of the earthwork would be along Caliente common segment 1 (see Section 4.2.1.2.2.2) and the selected Goldfield alternative segment (see Section 4.2.1.2.2.7). There would also be major cut, fill, and other earthwork processes around Bennett Pass, the Goldfield Hills, Beatty, and Yucca Mountain.

DOE would build up to 12 construction camps along the rail alignment. Each camp would include housing, support facilities, office space, utilities, contractor work areas, roadways, and parking, and would disturb approximately 0.10 square kilometer (25 acres) inside the nominal width of the construction right-of-way (DIRS 176172-Nevada Rail Partners 2006, p. 4-1).

There are six potential quarry sites along the Caliente rail alignment, and DOE would develop up to four of these sites. Each site would be expected to disturb an area from 1.3 to 3.8 square kilometers (320 to 930 acres) outside the nominal width of the construction right-of-way (DIRS 176172-Nevada Rail Partners 2006, pp. 3-1 and 3-2).

Construction of the ***Interchange Yard*** along the Caliente alternative segment could disturb 0.061 square kilometer (15 acres); the Interchange Yard along the Eccles alternative segment would disturb 0.12 square kilometer (30 acres). Construction of the ***Staging Yard*** would disturb 0.2 square kilometer (50 acres). Construction of the Maintenance-of-Way Trackside Facility would disturb 0.061 square kilometer and the

Rail Equipment Maintenance Yard would disturb the largest area (0.41 square kilometer [100 acres]) (DIRS 176170-Nevada Rail Partners 2006, p. A-5).

Construction activities that would disturb topsoil include, but are not limited to, cut excavation; quarry-pit excavation and borrow-pit stockpiles; placement of compacted fill, ***ballast***, and ***subballast***; road development and grading; and building facility foundations. During the construction phase, the soil column would be disturbed and topsoil would be removed. The areas with disturbed soils would have an increased potential for erosion by wind and water. DOE would implement best management practices (see Chapter 7) to control erosion, minimize soil loss, and conserve topsoil for grading after construction was completed. After construction was completed, disturbed areas away from the rail line would be leveled to a grade that would blend with the terrain, covered with reserved topsoil, and to the extent practicable, revegetated.

4.2.1.2.1.2 Geology.

Faulting and Seismic Activity Seismic-related hazards in the project area include ground shaking, rock falls and landslides, soil liquefaction, and fault displacement. The potential for humans or structures to be exposed to seismic hazards is generally uniform across the entire rail alignment and consistent with the rest of southern Nevada, as shown on Figure 3-4. Construction activities would not induce earthquakes or reactivate any faults. The general east-west configuration of the Caliente rail alignment would minimize the contact between the rail alignment and the linear range-bounding faults, which have the greatest potential for reactivation. At a minimum, DOE would design and operate the proposed railroad to be consistent with American Railway Engineering and Maintenance-of-Way Association seismic guidelines (DIRS 162040-AREMA 2001, Chapter 9) and could decide to implement additional, more stringent standards.

During the construction and operations phases, DOE would monitor earthquake activity using U.S. Department of the Interior, Geological Survey, and Yucca Mountain seismic networks. The response level of the maintenance-of-way authority would depend on the earthquake magnitude and distance to the rail line (see Table 4-1). DOE would develop an inspection protocol that would outline the procedures that would be used to inspect the track, rail roadbed, bridges, and other structures along the rail line. If required after a seismic event, construction would halt, trains would run at reduced speeds, and qualified inspectors would verify the safety of the track.

The rail line and transportation casks would be constructed to be consistent with the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. The inspection protocol and acceptance of the seismic guidelines would ensure that the risks associated with operating in a seismically active area would be minimized. Section 4.2.10, Occupational and Public Health and Safety, describes potential impacts to transportation safety and worker and public health and safety from seismic hazards.

Rock-Slope Hazards Several sections of the Caliente rail alignment would pass through steep and rugged terrain where unstable rock slopes would be a hazard (DIRS 176184-Shannon & Wilson 2006, pp. 41 to 43). Rock-slope failures typically occur where rock discontinuities (such as joints, bedding, foliation, and faults) are adversely oriented in relation to natural or constructed slope faces. Slope stability could be further reduced by natural weathering processes, which contribute to the mechanical breakdown of the rock mass within the rock ***matrix*** and along the discontinuities (DIRS 176184-Shannon & Wilson 2006, p. 42).

Rail line construction activities such as blasting and other cut procedures would have the potential to induce rock falls and landslides. Blasting could be required to excavate bedrock and would occur in strict compliance with existing regulations. Impacts resulting from construction and construction-related blasting are expected to be small, due to safety measures DOE would employ during blasting activities.

Table 4-1. Railways Engineering and Maintenance-of-Way Association seismic guidelines.[a]

Earthquake magnitude (Richter scale)	Response radii (kilometers)[b]	Response level[c]	Response protocol
0.0-4.9	d	I	Resume maximum operating speed. The need for the continuation of inspections will be determined by the proper maintenance-of-way authority.
5.0-5.9	160	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
6.0-6.9	320	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority.
	480	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
7.0 or greater	As directed, but not less than for 6.0 to 6.9	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.
		II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.

a. Source: DIRS 162040-AREMA 2001, Table 9-1.1 and p. 9-1.5.
b. To convert kilometers to miles, multiply by 0.62137.
c. Response level as defined by America Railway Engineering and Maintenance-of-Way Association.
d. Radii not applicable.

Debris Flows Debris flows are rapidly moving mixtures of water, soil, rock, and organic material. A debris flow can begin during or after heavy precipitation, and is especially dangerous if the debris dams a stream channel. If the dam fails, the saturated debris can travel downslope for several miles in a confined channel. Debris flows lose their energy and begin to deposit material when the stream gradient flattens or when the channel widens (DIRS 176184-Shannon & Wilson 2006, pp. 45 and 46).

There would be a potential for debris flows along portions of the rail alignment during the construction and operations phases. Such flows would be most common in areas where there is evidence of prior activity (DIRS 176184-Shannon & Wilson 2006, pp. 46 and 47). Debris flows could bury the rail line in sediment, destroy portions of the line, or weaken bridge pylons as a result of excessive erosion. It would not be possible to completely avoid debris flows in the area around the rail alignment.

Mineral and Energy Resources The rail line could cross surface or subsurface mineral or energy resources not part of identified mining districts or mineral leases. During construction, previously unknown resources could be identified in areas with large cuts. In 2005, the BLM generated a Mineral Potential Report for the Caliente rail corridor, using degrees to estimate areas with geologic favorability for particular mineral and energy resources (DIRS 182762-Shannon & Wilson, 2005, all). The report graded each Caliente rail alignment alternative segment and common segment on the potential for metallic and nonmetallic minerals, geothermal resources, and oil and gas resources in the area surrounding the rail alignment. The report rated each segment with high, medium, low, or no potential for each mineral resource type. However, a rating of high potential is only used as a guide in this impact analysis, and does not indicate the actual locations of commercial minerals.

During the construction phase, some minerals could be rendered inaccessible because they would be within the construction right-of-way. However, the ***operations right-of-way*** would be smaller than the construction right-of-way, so these restricted areas would become available during the operations phase. The Caliente rail alignment would not cross any known mineral deposits unique to the region. Therefore, any impacts related to restricted access to local mineral resources would be temporary and limited to the construction phase. Sections 4.2.1.2.2.1 through 4.2.1.2.2.12 provide more segment-specific information on the potential impacts to individual mineral and energy resources along alternative segments and common segments. Section 4.2.2, Land Use and Ownership, describes potential impacts to local mining districts.

Local Sources of Construction Materials Construction of a rail line along the Caliente rail alignment would require from 3.12 to 3.19 million metric tons (3.44 to 3.52 million tons) of crushed-rock ballast and from 2.72 to 2.81 million metric tons (3 to 3.1 million tons) of subballast for rail roadbed construction (DIRS 176172-Nevada Rail Partners 2006, p. 3-1). Soil and rock excavated from construction cuts would not be suitable for ballast; DOE would use this material for subballast and embankment fill (DIRS 176034-Shannon & Wilson 2006, pp. 15, 19, and 20). All of the subballast requirements would be met using excavated materials from construction cuts supplemented with bedrock extracted from the ballast quarries and if needed, alluvial ***borrow sites***.

DOE has identified six potential sites for ballast quarries along the Caliente rail alignment in the Caliente, Reveille Valley, and Goldfield areas (DIRS 176182-Shannon & Wilson 2006, p. 53). Of these potential locations, DOE would develop up to four sites to supply rock for ballast and subballast during the construction phase. Each quarry pit would be approximately 24 meters (80 feet) deep, with an anticipated ***footprint*** of approximately 0.04 square kilometer (10 acres). However, depending on the number of open quarries and the quality of the mineral materials, a quarry pit footprint could be as large as 2.1 square kilometers (530 acres). A waste-rock pile at each quarry site would disturb approximately 0.06 square kilometer (14 acres). ***Overburden*** material and rock not suitable for ballast or subballast gravel would be stored at this location until the end of quarry operations. A railroad ***siding*** to accommodate the ballast cars would be included in the total quarry disturbance area (DIRS 176172-Nevada Rail Partners 2006, pp. 3-1 and 3-2). When adding all of the maximum areas of the quarry site that could be disturbed during the construction phase (quarry pit, production plant, ballast storage, and waste pile), and including a temporary construction buffer area, a quarry site could disturb between 1.3 and 3.8 square kilometers (320 to 930 acres). These quarry-site values are considered to be maximum calculations, in the event of irregular topography and poor quality excavated mineral materials. Section 4.2.1.2.4 describes potential impacts from the quarry facilities in more detail.

The quarries would remain open through the construction phase. Afterward, DOE would reclaim disturbed areas in accordance with the post-construction and maintenance best management practices described in Chapter 7. Such practices would include grading the disturbed area, reshaping quarry-pit walls to stabilized slopes, replacing reserved topsoil, and revegetating.

DOE could use other local materials for rail line construction. Subballast would be generated from excavated cuts, crushed quarry rock, and if needed, borrow sites on certain ***alluvial fans***. Blasted bedrock from slope excavations and excess ballast rock would also be suitable for use to protect rail roadbed embankments from erosion. Some natural sand and gravel excavated from cuts and crushed rock from the quarries could be used to make concrete aggregate (DIRS 176034-Shannon & Wilson 2006, pp. 24 to 26). DOE would determine the prime sand and gravel deposits to be used before beginning construction.

Using local materials for ballast, subballast, embankment fill, and concrete aggregate would result in the consumption of construction resources (such as rock, sand, and gravel) often used for other construction projects in the area. However, alluvial deposits are plentiful in the region, and their use to construct the rail line would not substantially reduce the area supply of these resources. Because the potential impact to sand and gravel resources would be small along the entire alignment, this resource is not discussed further in Sections 4.2.1.2.2.1 through 4.2.1.2.2.12. Section 4.2.11, Utilities, Energy, and Materials, describes impacts to regional supply chains for other construction materials.

4.2.1.2.1.3 Soils. This section describes potential impacts to soils, including the removal of prime farmland from productive use. Rock excavation and land clearing would cause soil loss, surface erosion, and disruption of soil structure on previously undisturbed land.

During the construction phase, most soils would be excavated using conventional earthmoving equipment such as bulldozers, scrapers, rubber-tired backhoes, and track-mounted excavators. Solid rock encountered along the rail alignment would require drilling and blasting (DIRS 176184-Shannon & Wilson 2006, p. 48).

Soil Loss and Erosion There would be soil loss and erosion at all places where construction activities disturbed the ground surface. The severity of soil loss would depend on the extent of the disturbance, the erodibility of the soil, and the steepness of the terrain.

Land disturbed along the rail alignment would be most susceptible to soil loss and erosion during heavy rains and high winds. Areas where fine-textured soil and sand (such as on alluvial fans, lake-bed terraces, valleys, and flats) and where soils exhibited the ***erodes easily*** or ***blowing soil*** characteristics would be most susceptible to erosion. The Caliente rail alignment would be in an area with an ***arid*** climate that does not normally experience prolonged rainfall. Rainfall is typically brief, but can be very intense and form washouts in low-lying areas. Elevated water velocities during heavy rainfalls would increase erosion and scouring in areas where there is no vegetation, in areas dominated by sandy soils on steep slopes, along channel banks, and at bridge crossings (DIRS 176184-Shannon & Wilson 2006, p. 51). Construction of the proposed railroad would result in the loss of some topsoil and soil erosion. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. In areas of temporary surface disturbance, the topsoil would be reserved and replaced, where practicable.

Disturbed soils would also be susceptible to wind erosion, because wind speeds greater than 19 kilometers (12 miles) per hour are sufficient to move sand grains (DIRS 176184-Shannon & Wilson 2006, p. 53). Disturbed soils with the blowing soil characteristic tend to generate sand dunes, increase fugitive dust in the air, and contribute to the loss of topsoil. Wind and water erosion could also impact ***air quality***, surface-water quality, and biological resources, as discussed in Sections 4.2.4, 4.2.5, and 4.2.7, respectively.

Prime Farmland The Farmland Protection Policy Act (7 United States Code [U.S.C.] 4201 *et seq.*) seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses. As discussed in Section 3.2.1.2.3, less than 1 percent of soils along the Caliente rail alignment are classified as prime farmlands. The Caliente and Eccles alternative segments, Caliente common segment 1, and Garden Valley alternative segments 1, 2, and 8 would cross prime farmland soils (see Figures 3-8 and 3-9). DOE calculated the amount of potentially disturbed prime farmland soils by multiplying the total area of disturbance by the calculated percentage of prime farmland that would be within the rail line construction right-of-way. In Lincoln County, there is 0.16 square kilometer (40 acres) of prime farmland soils along the Caliente alternative segment and 0.1 square kilometer (24 acres) of prime farmland along the Eccles alternative segment.

Along these alternative segments, DOE would limit disturbance within the construction right-of-way to minimize potential impacts to private lands and thus minimize impacts to farmland. The 1.2 square kilometer (200 acres) of prime farmland soils along Caliente common segment 1 is in relatively isolated areas in Lincoln and Nye Counties (see DIRS 182843-ICF 2007, all, plates 55 to 60, 79, and 107 to 109), and at present is not being used for agricultural production. The Garden Valley alternative segments would disturb between 0 square kilometer (0 acre) along Garden Valley alternative segment 3 up to 0.4 square kilometer (99 acres) along Garden Valley alternative segment 2. Construction of the proposed railroad along the Caliente rail alignment would result in the loss of a total of 1.8 square kilometer (440 acres) of prime farmland soils. Lincoln and Nye Counties contain approximately 2,200 square kilometers (540,000 acres) of prime farmland soils; thus, the proposed railroad would remove less than 0.1 percent of the prime farmland soils from productive use. Esmeralda County does not contain prime farmland soils.

In addition to using the Nevada soil survey database classification, DOE also requested assistance from the Nevada Natural Resources Conservation Service office to identify prime, unique statewide, or locally important farmland along the Caliente rail alignment (DIRS 181388-Arcaya 2007, all). The Conservation Service office identified two segments that would potentially cross farmland, centered around the junction between the end of the Caliente and Eccles alternative segments and the beginning of Caliente common segment 1. About 2 to 2.4 kilometers (1.2 to 1.5 miles) of the northern portion of the Eccles alternative segment would cross private land with the potential to be farmed. There are historical traces of irrigation north of the origin of Caliente common segment 1 (DIRS 181388-Arcaya 2007, all).

Soil Stability Excavation and grading activities would disturb the natural structure of the soil by breaking plant roots and natural mineral cements that bind soils. Soils disturbed along cut slopes would have a higher risk of becoming unstable and creating mudflows or landslides in steep topography because water-bearing properties would have changed, and the soil structure would have been altered. However, DOE would revegetate or otherwise stabilize these areas and would reclaim them to the extent practicable, which would reduce the potential for increased erosion (see Chapter 7).

DOE would erect up to 12 construction camps along the rail alignment to house workers. Although the camps would be temporary and used only during the construction phase, soil could become compacted at these sites. After construction was complete, DOE would grade the terrain and revegetate these areas with ***native plant species*** (see Chapter 7), which would minimize the effects of soil compaction.

Studies have shown that, if left to natural ***soil recovery***, the return of soil to pre-disturbed conditions and natural succession of vegetation in the Yucca Mountain area could take decades or more, creating an increased potential for erosion, landslides, and mudslides (DIRS 104837-DOE 1989, p. 17). Impacts due to soil disruption would be large within the construction right-of-way and immediate region of influence until new vegetation was established and the natural succession was reestablished. DOE would reduce the impacts related to the increased potential for erosion, landslides, and mudslides through the implementation of best management practices, such as revegetating disturbed sites, establishing proper roadbed grades, and using stormwater erosion control measures (see Chapter 7).

4.2.1.2.2 Construction Impacts along Alternative Segments and Common Segments

4.2.1.2.2.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline. The Caliente and Eccles alternative segments would gradually increase in elevation as they traveled northward. The Caliente alternative segment would have a total rise and fall of approximately 87 meters (290 feet) over 18 kilometers (11 miles). The Eccles alternative segment would have a rise of 190 meters (630 feet) over 19 kilometers (12 miles) (DIRS 176165-Nevada Rail Partners 2006,Appendix E).

Table 4-2 summarizes the key information DOE considered to assess construction impacts to physical setting along the Caliente and Eccles alternative segments.

Table 4-2. Summary of key information for assessing impacts from constructing the Caliente or Eccles alternative segment.

Attribute	Caliente alternative segment	Eccles alternative segment
Length (kilometers)[a,b]	18	19
Rise and fall (meters)[a,c]	87	190
Earthwork cut quantities (cubic meters)[a,d]	0.48 million	1.83 million
Earthwork fill quantities (cubic meters)[a,d]	0.17 million	0.99 million
Construction[e]	Cuts and fills up to 24 meters high	Cuts up to 24 meters and fills up to 15 meters high
Number of construction camps[f]	1 (no. 1)	1 (no. 1)
Number of well sites outside nominal width of construction right-of-way[f]	1 (no. 3)	3 (nos. 1, 2, 3)
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	1.5	1.9
• Quarries[f]	1.6 (CA-8B)	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	0.0058	0.017
• Access roads to construction camps/well sites/quarries[f]	0.0073 (to well site 3)	0.015 (to well sites 1, 2, and 3)
Total disturbed area (square kilometers)[f,i]	3.1	2.1
Percent soil characteristics[j]	74 erodes easily 0 blowing soils 5.2 prime farmland	71 erodes easily 0 blowing soils 4.8 prime farmland
Soil characteristic area (square kilometers)[k]	2.3 erodes easily 0 blowing soils 0.164 prime farmland	1.5 erodes easily 0 blowing soils 0.1 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

The Caliente and Eccles alternative segments would result in the disturbance of approximately 3.1 square kilometers (770 acres) and 2.1 square kilometers (520 acres), respectively. More extensive cuts and fills would be required for the Eccles alternative segment, which would result in more permanent changes to the topography than for the Caliente alternative segment. Soil disturbance from construction activities along either alternative segment would result in localized impacts from the loss of topsoil and an increase in the potential for erosion. However, these impacts would be temporary and would be reduced through a combination of erosion control measures (see Chapter 7).

There is a high probability for perlite (a volcanic glass commercially mined south of the City of Caliente) deposits in the area around the Caliente and Eccles alternative segments. When heated very quickly, the grains of perlite expand into cellular particles, which can be incorporated into insulation, light-weight concrete, and acoustical tiles. There would be no depletion or removal of perlite; however, excavation could preclude mining of the deposits within the construction right-of-way. Because of the width of the rail line construction right-of-way in relation to the presence of this mineral resource, impacts to the perlite deposits would be small. There are some hot heat-flow wells in use around the City of Caliente; construction activities would not affect these geothermal resources because the rail alignment would not come close to the wells.

Approximately 0.16 square kilometer (40 acres) and 0.1 square kilometer (24 acres) of prime farmland would be disturbed along the Caliente or Eccles alternative segment, respectively (see Table 4-2). Disturbance of these soils, particularly if fill were added, would change their prime farmland soil classification and remove them from agricultural use. Along the Caliente alternative segment, a portion of the prime farmland soils are within the Caliente city limits, primarily on private land. A review of the prime, unique statewide, or locally important farmland by the Natural Resources Conservation Service identified land that is currently idle, but with a potential to produce alfalfa as a crop (DIRS 181388-Arcaya 2007, p. 1). The Eccles alternative segment could disturb approximately 0.2 square kilometer (50 acres) of prime farmland. Along the alternative segments, DOE would limit the area of disturbance within the construction right-of-way to minimize potential impacts to private lands. Because the Caliente alternative segment would primarily travel along the ***berm*** of an abandoned rail line, the Natural Resources Conservation Service did not identify any prime or ***unique farmland*** along that portion of the alternative segment.

More than 70 percent of soils along both the Caliente and the Eccles alternative segments have the erodes easily characteristic. Disturbance from construction along the rail alignment would disrupt the soil structure and increase the potential for erosion. DOE would implement best management practices (such as stockpiling topsoil and revegetating the area) to reduce the potential for additional soil loss due to erosion (see Chapter 7).

4.2.1.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross four major mountain ranges and three valleys. To maintain a rail grade of less than 2 percent, DOE would excavate and level high points along the alignment and, to the extent practicable, use this material to raise the low points. Table 4-3 lists the anticipated cut and fill requirements and other important information used in the impact analysis for Caliente common segment 1. The grading procedures would be greatest through Bennett Pass and around the North Pahroc Mountains. A total of 12 square kilometers (3,000 acres) of land would be disturbed during construction of the rail line (rail roadbed, alignment access roads, and a construction camp, water wells, and their access roads). These activities would cause topsoil loss and local erosion. Caliente common segment 1 would also travel through badland topography, erodible land created by excessive erosion. Sections of the rail alignment requiring large cuts could also increase the potential for rock falls or landslides. DOE would use erosion control measures (see Chapter 7) to control excessive loss of topsoil and local erosion along the segment, particularly in these areas. Sections of the rail alignment requiring large cuts could also increase the potential for rock falls or landslides. To minimize the chance of landslides, DOE would vary cut slope dimensions, depending on the strength and stability of the bedrock.

Limestone bedrock occurs widely along Caliente common segment 1 (DIRS 182762-Shannon & Wilson 2005, Figure E2). Limestone is found in the Burnt Springs, Highland, and North Pahroc Ranges, and might extend under the rail alignment in those areas. Rail line construction would have a small impact on the availability of limestone because this resource is widely available in mountain ranges throughout the region. There is one warm spring in the vicinity of Bennett Pass, approximately 1.6 kilometers (1 mile) from the construction right-of-way. Construction activities would not affect this spring. There is also a high potential for additional geothermal resources around the eastern portion of Caliente common segment 1. Rail line construction would not affect these potential resources because DOE would not use or otherwise disturb the subsurface geothermal resource.

Table 4-3. Summary of key information for assessing potential impacts from constructing the proposed railroad along Caliente rail alignment common segments (page 1 of 2).

Key information	Caliente common segment 1	Caliente common segment 2	Caliente common segment 3	Caliente common segment 4	Caliente common segment 5	Caliente common segment 6
Length (kilometers)[a,b]	110	50	110	11	40	51
Rise and fall (meters)[a,c]	1,300	430	720	18	170	410
Earthwork cut quantities (cubic meters)[a,d]	9.33 million	1.19 million	2.33 million	0.23 million	0.45 million	5.88 million
Earthwork fill quantities (cubic meters)[a,d]	5.89 million	0.52 million	1.93 million	0.2 million	1.01 million	2.94 million
Construction[e]	Generally, cuts and fills ranging 12 to 21 meters high; cut in rock to 21 meters high at Bennett Pass; 12-meter cuts and 19-meter high fill at the crossing of Black Canyon; fills and cuts up to 39 meters and cuts in rock to 30 meters high along White River.	Cuts and fills up to 18 meters high in irregular volcanic topography; shallower cuts and fills in alluvial deposits.	Cuts and fills up to 24 meters high; shallow cuts and fills.	Cuts and fills up to 6 meters high.	Cuts up to 15 meters high; fills generally up to 6 meters deep.	Cuts and fills up to 15 meters high; side hill cuts and fills to 42 meters high.
Number of construction camps[f]	2 (nos. 2, 3)	1 (no. 5)	3 (nos. 6, 7, 8)	1 (no. 9)	1 (no. 10)	1 (no. 12)
Number of well sites outside nominal width of construction right-of-way[f]	4 (nos. 4, 5, 6, 7)	2 (nos. 8, 9)	0	0	0	2 (nos. 14, 15)

Table 4-3. Summary of key information for assessing potential impacts from constructing the proposed railroad along Caliente rail alignment common segments (page 2 of 2).

	Caliente common segment 1	Caliente common segment 2	Caliente common segment 3	Caliente common segment 4	Caliente common segment 5	Caliente common segment 6
Disturbed area (square kilometers)[g]						
• Rail alignment[h]	11	4.1	9.7	1.0	3.1	5.3
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	0.023	0.012	Not applicable	Not applicable	Not applicable	0.012
• Access roads to construction camps/well sites/quarries[f]	0.46 (to construction camps 2, 3) 0.035 (to well sites 4, 5, 6, 7)	Not applicable 0.034 (to well sites 8, 9)	0.52 (to construction camps 6, 7, 8)	0.085 (to construction camp 9)	0.02 (to construction camp 10)	0.19 (to construction camp 12) 0.047 (to well sites 14, 15)
Total disturbed area (square kilometers)[i]	12	4.1	10	1.1	3.1	5.5
Percent soil characteristics[j]	18 erodes easily 0 blowing soils 2.6 prime farmland	16 erodes easily 10 blowing soils 0 prime farmland	17 erodes easily 32 blowing soils 0 prime farmland	41 erodes easily 1.4 blowing soils 0 prime farmland	0 erodes easily 2.6 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[k]	2.1 erodes easily 0 blowing soils 1.2 prime farmland	0.66 erodes easily 0.41 blowing soils 0 prime farmland	1.7 erodes easily 3.2 blowing soils 0 prime farmland	0.45 erodes easily 0.015 blowing soils 0 prime farmland	0 erodes easily 0.081 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Construction of Caliente common segment 1 would disturb approximately 1.2 square kilometer (300 acres) of prime farmland soils, which would be removed from agricultural use (see Table 4-3). These soils are on ***public lands*** and are not being used for agricultural production at present. A review of the prime, unique statewide, or locally important farmland by the Natural Resources Conservation Service identified evidence of past irrigation north of the beginning of Caliente common segment 1. This land has been out of production for more than 10 years (DIRS 181388-Arcaya 2007, p. 1). Although the Natural Resources Conservation Service office does not consider the current land as farmland, if it were to become irrigated again, it would be considered farmland of statewide importance. Caliente common segment 1 would disturb approximately 0.064 square kilometer (16 acres) of this land. DOE would limit the area of disturbance within the construction right-of-way to minimize impacts to private lands.

4.2.1.2.2.3 Garden Valley Alternative Segments. The Garden Valley alternative segments would generally cross moderately hilly terrain, and most of the cuts and fills would occur in gaps of the Golden Gate Range. Table 4-4 summarizes the key information DOE used to assess impacts to physical setting from construction of any of the Garden Valley alternative segments.

Garden Valley 3 would be the longest of the Garden Valley alternative segments, but would require the least total amount of cut and of fill. Garden Valley 1 would be the shortest of the Garden Valley alternative segments and would require the least amount of cuts, but would require more fill to obtain the appropriate grade. Garden Valley alternative segments 3 and 8 would disturb a total of 3.7 square kilometers (910 acres), 0.3 square kilometer (74 acres) more than Garden Valley 1. Garden Valley alternative segment 2 would disturb 3.6 square kilometers (890 acres) (see Table 4-4). Surface disturbance during construction would remove topsoil and increase the potential for erosion around the rail alignment. These impacts would be temporary and reduced by erosion control measures (see Chapter 7).

All of the Garden Valley alternative segments would cross the Golden Gate fault. However, the few earthquakes that have occurred in the area were low magnitude and not associated with the faults that the Garden Valley alternative segments would cross (see Figure 3-3).

Limestone is present in the bedrock of the Golden Gate Range where Garden Valley alternative segments 1 and 3 would cross (DIRS 182762-Shannon & Wilson 2005, Figure E2). However, rail line construction would not adversely impact the limestone resources because limestone is abundant in the mountains around the Golden Gate Range.

Garden Valley alternative segments 1, 2, and 8 would cross between 0.29 and 0.4 square kilometer (72 and 99 acres) of prime farmland soils. The prime farmland soils are in the southern section of Garden Valley, in isolated areas where there are no irrigation or farming practices (see DIRS 182843-ICF 2007, all, plates 144 to 147, 155 to 163, and 501 to 503). Garden Valley alternative segments 1 and 3 would have a larger percentage of soils with the erodes easily characteristic than Garden Valley alternative segments 1, 3, and 8 (see Table 4-4). When disturbed by construction, these soils would have a higher potential for erosion than other soil types. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

4.2.1.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Caliente common segment 2 would cross several valleys and one pass. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from the construction of Caliente common segment 2. Excess excavation material not needed for fill purposes would be graded and revegetated with native species, or reused as fill along other parts of the rail alignment. In total, construction along Caliente common segment 2 would disturb 4.1 square kilometers (1,000 acres). The disturbed areas would lose topsoil and have an increased potential for erosion. In addition, 0.66 square kilometer (160 acres) of common segment 2 would contain soils with the erodes easily characteristic, which would locally

Table 4-4. Summary of key information for assessing impacts from constructing Garden Valley alternative segment 1, 2, 3, or 8.

Attribute	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Length (kilometers)[a,b]	35	35	37	37
Rise and fall (meters)[a,c]	360	260	350	260
Earthwork cut quantities (cubic meters)[a,d]	0.28 million	0.72 million	0.5 million	0.89 million
Earthwork fill quantities (cubic meters)[a,d]	0.84 million	0.53 million	0.53 million	0.64 million
Construction[e]	Low embankment fills less than 3 meters deep; cuts and fills up to 12 meters high	Shallow cuts and fills	Cuts and fills to 9 meters high	Shallow cuts and fills
Number of construction camps[f]	1 (no. 4b)	1 (no. 4c)	1 (no. 4a)	1 (no. 4c)
Number of well sites outside nominal width of construction right-of-way[f]	0	0	0	0
Disturbed area (square kilometers)[g]				
• Rail alignment[h]	2.9	3.1	3.2	3.2
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way	Not applicable	Not applicable	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	0.45 (to construction camp 4b)	0.45 (to construction camp 4c)	0.45 (to construction camp 4a)	0.45 (to construction camp 4c)
Total disturbed area (square kilometers)[i]	3.4	3.6	3.7	3.7
Percent soil characteristics[j]	13 erodes easily 5.7 blowing soils 8.4 prime farmland	22 erodes easily 6.1 blowing soils 11 prime farmland	12 erodes easily 2.1 blowing soils 0 prime farmland	14 erodes easily 6 blowing soils 9.8 prime farmland
Soil characteristic area (square kilometers)[g,k]	0.44 erodes easily 0.19 blowing soils 0.29 prime farmland	0.79 erodes easily 0.22 blowing soils 0.4 prime farmland	0.44 erodes easily 0.078 blowing soils 0 prime farmland	0.52 erodes easily 0.22 blowing soils 0.36 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

increase the potential for soil erosion. DOE would implement best management practices (see Chapter 7) to reduce these impacts.

Caliente common segment 2 would not cross known Quaternary faults. There have been some earthquakes in the area of Caliente common segment 2, but they had magnitudes of 4.0 or lower. Potential hazards to people and structures from earthquakes of this magnitude would be very small.

A low to medium potential exists for undiscovered mineral, oil, and geothermal resources along Caliente common segment 2 (DIRS 182762-Shannon & Wilson 2005, all). Potential impacts to any undiscovered resources along this segment would be very small because the narrow footprint of the rail line would allow the extraction of most types of mineral and energy deposits.

4.2.1.2.2.5 South Reveille Alternative Segments. South Reveille alternative segments 2 and 3 would cross a relatively uniform valley with a rise and fall of 190 meters (630 feet) over 19 kilometers (12 miles) (DIRS 176165-Nevada Rail Partners 2006, Appendix E). Although there would be more cuts along South Reveille 3, it would require less earthwork to attain an appropriate grade. Table 4-5 summarizes the key information DOE considered to assess impacts to physical setting from construction of either South Reveille alternative segment.

Construction of the rail roadbed, quarries, and access roads would disturb an area of approximately 4.8 square kilometers (1,200 acres) along South Reveille alternative segment 2; South Reveille 3 would disturb slightly more surface area (5 square kilometers [1,240 acres]). In addition, a larger percentage of soils along South Reveille alternative segment 2 have the erodes easily characteristic (see Table 4-5). Surface disturbance would result in topsoil loss and a potential increase in erosion. However, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, potential impacts from either South Reveille 2 or South Reveille 3 would be similar except that South Reveille 3 would result in more land disturbance than South Reveille 2.

Neither South Reveille 2 nor South Reveille 3 would cross known faults. North of the alternative segments, Quaternary faults are identified on the east and west sides of the Reveille Range. However, these faults do not extend into the southern edge of Reveille Valley. Therefore, the potential hazards to people and structures from seismic activity would be very small.

There would be no impacts to mineral resources along South Reveille alternative segments 2 and 3 because there is a low potential for metallic and nonmetallic minerals, gas, or geothermal resources within the construction right-of-way. In addition, the bedrock is covered by more than 91 meters (300 feet) of recent alluvial deposits (DIRS 182762-Shannon & Wilson 2005, p. 53).

4.2.1.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Caliente common segment 3 would cross the Kawich Range, Cow Canyon, and part of Reveille and Hot Creek Valleys. Bridges might be required in the areas of Cow Canyon and Warm Springs Summit, where the rail line would pass through steep and rugged terrain. Cuts and fills up to 24 meters (79 feet) would also be required through the pass through the Kawich Range. The rugged topography and bridge construction would require total earthwork to include 2.33 million cubic meters (3.04 million cubic yards) in cuts and 1.93 million cubic meters (2.52 million cubic yards) in fills. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from construction of Caliente common segment 3.

East of Warm Springs, the rail line would cross the northern portion of the Kawich-Hot Creek Fault zone. While this fault zone was active at least 130,000 years ago, its slip rate is consistent with other large faults in the region (DIRS 174194-USGS 2005, all). In areas with high topographic relief, construction of the rail line would result in an increased potential for rock-slope failure and landslides along Caliente

Table 4-5. Summary of key information for assessing impacts from constructing South Reveille alternative segment 2 or 3.

Attribute	South Reveille 2	South Reveille 3
Length (kilometers)[a,b]	19	19
Rise and fall (meters)[a,c]	150	190
Earthwork cut quantities (cubic meters)[a,d]	0.51 million	0.33 million
Earthwork fill quantities (cubic meters)[a,d]	0.22 million	0.15 million
Construction[e]	Cuts and fills up to 9 to 12 meters high	Cuts and fills up to 15 meters high
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	1.5	1.7
• Quarries[f,i]	3.3 (NN-9A and NN-9B)	3.3 (NN-9A and NN-9B)
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (square kilometers)[f,j]	4.8	5
Percent soil characteristics[k]	19 erodes easily 6.3 blowing soils 0 prime farmland	15 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[l]	0.91 erodes easily 0.30 blowing soils 0 prime farmland	0.7544 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Assuming that both NN-9A and NN-9B would be developed.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 176781-MO0603GSCSSGEO.000.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

common segment 3, which could also be induced by earthquakes (DIRS 176184-Shannon & Wilson 2006, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. There is a high potential for some metallic and nonmetallic minerals in the bedrock below sections of Caliente common segment 3. The Warm Springs Summit area in the Kawich Range has a high potential for barite and metallic minerals such as gold and silver. Barite is found in small deposits in the Kawich range, and the rail alignment would cross a portion of the Clifford Mining District, which extracts metallic minerals (DIRS 173841-Shannon & Wilson 2005, p. 84). However, barite is not mined within the rail line construction right-of-way, and generally the bedrock is too deep for construction activities to affect the metallic minerals. There is also a high potential for traces of silver and gold east of the Kawich Range. Due to the size and location of the construction right-of-way, the impact to these mineral resources would be small. Section 4.2.2, Land Use and Ownership, provides more information about potential impacts to local mining districts.

The Warm Springs Summit area is also a well-known location for warm springs and other geothermal resources (DIRS 182762-Shannon & Wilson 2005, p. 23). The rail line would not cross any known warm springs; therefore, there would be no impacts to geothermal resources in the area.

Rail line construction along Caliente common segment 3 would disturb approximately 10 square kilometers (2,500 acres). There would be a loss of topsoil and an increased potential for erosion in the disturbed areas. In addition, terrain along Caliente common segment 3 consists of alluvial and ***playa*** deposits that are susceptible to water and wind erosion. Approximately 1.7 square kilometers (420 acres) of soils along Caliente common segment 3 have the easily eroded characteristic, and 3.2 square kilometers (790 acres) are considered to be blowing soils (see Table 4-3). The impacts from increased erosion would be small along most of the rail alignment, and moderate in Stone Cabin Valley and Cactus Flat, where there is a concentration of blowing soils (see Figure 3-5).

4.2.1.2.2.7 Goldfield Alternative Segments. Passing through the Goldfield Hills, the three Goldfield alternative segments would have similar rises and falls. To obtain the appropriate grade, Goldfield alternative segment 3 would require the most cuts and fills. Table 4-6 lists these values and the key information DOE considered to assess impacts to physical setting from construction of the Goldfield alternative segments.

Rail line construction would disturb from 6.5 square kilometers (1,600 acres) along Goldfield alternative segment 4 to 10.2 square kilometers (2,500 acres) along Goldfield alternative segment 3. Cuts and fills associated with construction of any of the Goldfield alternative segments would result in the loss of topsoil, and an increased potential for erosion. DOE would implement best management practices (see Chapter 7) to reduce the effects of these impacts.

Less than 10 percent of soils along each of the Goldfield alternative segments are considered to be blowing soils, which have a potential to be displaced easily by wind (see Table 4-6). DOE would implement best management practices to reduce the potential for additional soil loss due to wind erosion.

Section 4.2.4, Air Quality and Climate, includes more discussion of impacts related to blowing soils and fugitive dust emissions.

The southern sections of the Goldfield alternative segments would cross the Stonewall Flat fault sequences; however, the area surrounding the alternative segments has felt few earthquakes compared to other sections of the Caliente rail alignment. As shown in Figure 3-3, events in the magnitude 4.0 to 5.9 range have occurred around Ralston, Stonewall Mountain, and Tonopah. Where the selected Goldfield alternative segment would pass through rugged areas, DOE would employ stabilization measures (such as surface bolting and applying shotcrete) to ensure slope stability (see Chapter 7).

There is a high potential for metallic resources below all of the Goldfield alternative segments, each of which would cross the Goldfield Mining District, which has produced gold, silver, lead, and copper. Extraction of metallic minerals occurs in subsurface mines; therefore, there would be no impact to these mineral resources from construction of any of the Goldfield alternative segments.

There is also a high potential for the mineral zeolite to occur around the Goldfield alternative segments. Zeolite can be used as an antimicrobial agent and forms when saline ***groundwate***r reacts with certain volcanic deposits. Construction of the rail line could uncover zeolite deposits. Construction would be confined to the nominal width of the construction right-of-way, which would reduce the potential for

Table 4-6. Summary of key information for assessing impacts from constructing Goldfield alternative segment 1, 3, or 4.

Attribute	Goldfield 1	Goldfield 3	Goldfield 4
Length (kilometers)[a,b]	47	50	53
Rise and fall (meters)[a,c]	610	670	680
Earthwork cut quantities (cubic meters)[a,d]	3.07 million	2.29 million	1.87 million
Earthwork fill quantities (cubic meters)[a,d]	1.94 million	4.51 million	3.33 million
Construction[e]	Cuts up to 12 meters and fills up to 15 meters high	Cuts and fills up to 15 meters; local cuts and fills to 27 meters high	Generally cuts and fills up to 12 meters high; 1,800-meter long, 30-meter high cut
Number of construction camps[f]	0	0	0
Number of well sites outside nominal width of construction right-of-way[f]	1 (no. 12)	1 (no. 12)	3 (nos. 10, 11, 13)
Disturbed area (square kilometers)[g]			
• Rail alignment [h]	4.5	4.9	4.9
• Quarries[f,i]	5.3 (NS-3A, NS-3B)	5.3 (NS-3A, NS-3B)	1.5 (ES-7)
• Well sites outside nominal width of construction right-of-way[f]	0.0058	0.0058	0.017
• Access roads to construction camps/well sites/quarries[f]	0.011 (to well site 12)	0.011 (to well site 12)	0.057 (to well sites 10, 11, 13)
Total disturbed area (square kilometers)[f,j]	9.8	10.2	6.5
Percent soil characteristics[k]	0 erodes easily 8.8 blowing soils 0 prime farmland	0 erodes easily 9.5 blowing soils 0 prime farmland	0 erodes easily 7.7 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[l]	0 erodes easily 0.86 blowing soils 0 prime farmland	0 erodes easily 0.95 blowing soils 0 prime farmland	0 erodes easily 0.54 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Assuming that both NS-3A and NS-3B would be developed.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 176781-MO0603GSCSSGEO.000.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

additional disturbance. Therefore, potential impacts to local mineral resources would be small. Section 4.2.2, Land Use and Ownership, also addresses impacts to the Goldfield Mining District.

4.2.1.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Crossing the Stonewall Flat area, Caliente common segment 4 would have a relatively low rise and fall amount and low cut and fill requirements (see Table 4-3). Caliente common segment 4 would cross the eastern portion of the Stonewall Flat fault zone, northwest of Ralston. However, there have been few earthquakes in the area. In the southern portion of the Goldfield Hills, one earthquake of magnitude 4.0 has been recorded within the past 150 years.

There is a high potential for metallic minerals along the central portion of Caliente common segment 4. Gold and silver deposits have been mined from the Stonewall and Cuprite Mining Districts (DIRS 173841-Shannon & Wilson 2005, pp. 56 to 59). However, impacts to these areas would be small because the minerals have not been found within the rail line construction right-of-way. Section 4.2.2, Land Use and Ownership, further describes impacts related to access to and use of such minerals and energy resources. There are also warm heat-flow wells near Caliente common segment 4. DOE would avoid these wells during rail line construction; therefore, impacts would be small.

Construction along Caliente common segment 4 would disturb approximately 1.1 square kilometers (270 acres). The surface area disruption would result in a loss of topsoil and the potential for increased erosion. The rail alignment would disturb 0.015 square kilometer (3.7 acres) of soils along Caliente common segment 4 with the erodes easily characteristic, soils that would be especially susceptible to erosion during construction, particularly from wind and water (see Table 4-3). DOE would implement best management practices (see Chapter 7) to reduce the potential for loss of topsoil and additional soil loss due to erosion.

There are also soils characterized as ***soft soils*** in playa deposits present along Caliente common segment 4. The saline conditions of these soils limit the chemical and physical potentials of the soil and could have negative effects on the vegetation-bearing capacity of the soil. Reclamation of these soils following construction would be more difficult than on non-saline soils, and would require more maintenance and care than on more productive soils. These soils would have a higher potential for erosion until revegetation was complete. DOE might need to implement additional reclamation measures and erosion control measures until the vegetation could be established (DIRS 174296-Shannon & Wilson 2005, pp. 13 and 14).

4.2.1.2.2.9 Bonnie Claire Alternative Segments. The two Bonnie Claire alternative segments would pass through Lida Valley and Sarcobatus Flat. The alternative segments would require similar amounts of fill, but Bonnie Claire alternative segment 2 would require excavation of twice as much cut material as Bonnie Claire alternative segment 3. Table 4-7 summarizes the key information DOE considered to assess impacts to physical setting from construction of either of the Bonnie Claire alternative segments.

Each alternative segment would result in a total land disturbance of 1.9 square kilometers (470 acres) (see Table 4-7). Areas disturbed during construction would result in a loss of topsoil and increase the potential for erosion. However, these impacts would be temporary and would be reduced through the implementation of best management practices (see Chapter 7).

Although the alternative segments would pass through areas that have experienced recent low-level ***seismicity*** (magnitude 3.0 to 3.9) events, neither Bonnie Claire 2 nor Bonnie Claire 3 would cross known Quaternary fault traces. The primary seismic activity within the past 150 years occurred in 1999, when a magnitude 5.3 earthquake triggered many aftershocks over a series of days. Since then, earthquakes in

Table 4-7. Summary of key information for assessing impacts from constructing Bonnie Claire alternative segment 2 or 3.

Attribute	Bonnie Claire 2	Bonnie Claire 3
Length (kilometers)[a,b]	21	19
Rise and fall (meters)[a,c]	160	170
Earthwork cut quantities (cubic meters)[a,d]	0.46 million	0.24 million
Earthwork fill quantities (cubic meters)[a,d]	0.95 million	0.7 million
Construction[e]	Cuts to 30 meters high in ***tuff***; cuts and fills to 15 meters deep in ***alluvium***	Cuts to 15 meters high in tuff; cuts and fills to 6 meters deep in alluvium; low strength rock; broken rock expected because of faults visible in outcrop
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	1.9	1.9
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (square kilometers)[f,i]	1.9	1.9
Percent soil characteristics[j]	27 erodes easily 0 blowing soils 0 prime farmland	25 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[k]	0.51 erodes easily 0 blowing soils 0 prime farmland	0.48 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

the immediate vicinity of the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 176184-Shannon & Wilson 2006, Plate 4). Seismic hazards in the area are considered consistent with the rest of southern Nevada.There is a potential for metallic mineral deposits along both Bonnie Claire alternative segments. Each segment would travel around the Wagner Mining District, which has produced low-tonnage mixed oxide and sulfide copper ore (DIRS 173841-Shannon & Wilson 2005, p. 54). DOE would position the rail alignment to avoid the mining district and to reduce the potential for

impacts to mineral deposits. Section 4.2.2, Land Use and Ownership, addresses potential impacts to the Wagner Mining District.
The rail alignment would travel along the low sections of Stonewall Flat; therefore, impacts to metallic mineral deposits would be small.

About 0.48 to 0.51 square kilometer (120 to 130 acres) of the soils along Bonnie Claire alternative segment 3 and Bonnie Clair alternative segment 2, respectively, have soils with the erodes easily characteristic (see Table 4-7). Thus, there would be a high potential for erosion along these alternative segments. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, the potential impacts from constructing a rail line along either Bonnie Claire 2 or Bonnie Claire 3 would be similar.

4.2.1.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Passing through Sarcobatus Flat, common segment 5 would have a low rise and fall. Table 4-3 summarizes the key information DOE considered to assess impacts to physical setting from construction of common segment 5.

The potential to expose people or structures to seismic hazards would be small because common segment 5 would not cross any known Quaternary fault traces, and would travel over relatively level terrain.

There is a high potential for metallic mineral resources where common segment 5 would pass near the Clarkdale Mining District. Small gold and silver deposits have been mined in Clarkdale, and are hypothesized to extend below portions of common segment 5 (DIRS 173841-Shannon & Wilson 2005, Table 1). However, construction activities would not uncover the bedrock and disturb the mineral resources. The area of common segment 5 also has a generally high potential for geothermal resources; there are several thermal springs near U.S. Highway 95 that would be parallel to the rail line (DIRS 173841-Shannon & Wilson 2005, p. 23). However, because DOE would avoid these resources during rail line construction, the potential for impacts would be small.

Construction of this common segment would disturb a total of 3.1 square kilometers (770 acres) of land. Surface disturbance related to construction activities would remove topsoil and increase the potential for erosion along the rail alignment. These impacts would be temporary and would be reduced through the use of best management practices (see Chapter 7).

Approximately 0.081 square kilometer (20 acres) of common segment 5 has the blowing soils characteristic, which would increase the potential for soil loss from wind. DOE would implement best management practices to minimize any additional soil loss from erosion. Section 4.2.4, Air Quality and Climate, addresses impacts related to construction-generated fugitive dust emissions.

4.2.1.2.2.11 Oasis Valley Alternative Segments. Oasis Valley alternative segments 1 and 3 would have a similar profile throughout the valley. Table 4-8 summarizes the key information DOE considered to assess impacts to physical setting from construction of either Oasis Valley alternative segment.

The Oasis Valley alternative segments would not cross known fault traces. Within the past 150 years of seismic records, there has been generally low earthquake activity in the area, so the potential seismic-related impacts to humans and structures would be small.

There is a low potential for commercial metallic, nonmetallic, and oil resources in the area of the Oasis Valley alternative segments (DIRS 182762-Shannon & Wilson 2005, Appendix E). The minerals present in the area around the alternative segments are found in small veins in the surrounding hills. There would be small impacts to such resources because the rail alignment would remain in the valley, away from

Table 4-8. Summary of key information for assessing impacts from constructing Oasis Valley alternative segment 1 or 3.

Attribute	Oasis Valley 1	Oasis Valley 3
Length (kilometers)[a,b]	10	14
Rise and fall (meters)[a,c]	70	66
Earthwork cut quantities (cubic meters)[a,d]	0.051 million	0.12 million
Earthwork fill quantities (cubic meters)[a,d]	0.55 million	1.03 million
Construction[e]	Cuts and fills to 6 meters high	Cuts and fills to 12 meters high
Number of construction camps[f]	1 (no. 11)	1 (no. 11)
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	0.97	1.3
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	0.04 (to construction camp 11)	0.04 (to construction camp 11)
Total disturbed area (square kilometers)[f,i]	1	1.3
Percent soil characteristics[j]	0 erodes easily 13 blowing soils 0 prime farmland	0 erodes easily 4.8 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[g,k]	0 erodes easily 0.13 blowing soils 0 prime farmland	0 erodes easily 0.062 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

mineral-bearing ***outcrops***. There is a high potential for geothermal deposits in the area; however, neither Oasis Valley alternative segment would approach any known hot springs or wells.

Oasis Valley alternative segment 3 would require more earthwork than Oasis Valley alternative segment 1 to obtain the appropriate grade (see Table 4-8) and would disturb 0.3 square kilometer (74 acres) more land area than Oasis Valley alternative segment 1. Construction activities would remove topsoil in the area and increase the potential for erosion along the rail alignment. Oasis Valley alternative segment 1 also contains about twice as much blowing soils as Oasis Valley alternative segment 3. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Overall, potential impacts along either Oasis Valley alternative segment would be small. Oasis Valley alternative segment 3 would be longer and would require more land disturbance than Oasis Valley alternative segment 1, and Oasis Valley alternative segment 1 would contain more soils with a high potential for erosion.

4.2.1.2.2.12 Common Segment 6 (Yucca Mountain Approach). Approaching Yucca Mountain, common segment 6 would pass through rugged terrain and along fault blocks. To achieve an appropriate grade, 15-meter (49-foot) cuts and fills would be required with up to 42-meter (140-foot) cuts and fills in some areas (see Table 4-3). Some of the fill would be required to build the bridge over Beatty Wash.

There is a low potential for ground rupture associated with the eastern and western Yucca Fault systems (DIRS 176184-Shannon & Wilson 2006, Table 6). In areas with high topographic relief, construction of this common segment would also result in an increased potential for rock-slope failure and landslides (DIRS 176184-Shannon & Wilson 2006, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. Construction activities would not be expected to result in off-site rock falls and landslides.

There is a high potential for the occurrence of some metallic and nonmetallic minerals along common segment 6. The rail alignment would cross the northeastern portion of the Bare Mountain Mining District, which has extracted a variety of minerals commodities over its period of operation, including fluorspar, silica, limestone, and trace amounts of gold and mercury (DIRS 173841-Shannon & Wilson 2005, p. 39). Construction impacts to mineral resources in this area would be small because the width of the construction right-of-way would allow for the extraction of the mining district's resources. Section 4.2.2, Land Use and Ownership, further describes impacts to the Bare Mountain Mining District.

There is a potential for geothermal resources in the northern portions of common segment 6. There are several warm and hot springs around Beatty, some of which are used as warm bathing pools. The rail alignment would bypass the springs; therefore, there would be no impact to local geothermal resources (DIRS 182762-Shannon & Wilson 2005, p. 23).

Construction activities along common segment 6 would disturb an estimated 5.5 square kilometers (1,400 acres). These activities could cause topsoil loss and increase erosion potential. DOE would implement best management practices (see Chapter 7) to minimize these impacts. There are no special soil characteristics along this common segment.

4.2.1.2.3 Facilities

4.2.1.2.3.1 Facilities at the Interface with the Union Pacific Railroad Mainline. There would be two facilities at the Interface with the Union Pacific Railroad Mainline: the Staging Yard and the Interchange Yard. The Staging Yard would be constructed on one of two potential locations along the Caliente alternative segment (Caliente-Indian Cove or Caliente-Upland) or on the Eccles alternative segment (Eccles-North).

The Staging Yard would disturb approximately 0.2 square kilometer (50 acres) and consist of a 610-square-meter (6,600-square-foot) office, a 560-square-meter (6,000-square-foot) Satellite Maintenance-of-Way Facility, and a paved access road (DIRS 176168-Nevada Rail Partners 2006, pp. 5-1 and 5-2).

The Interchange Yard would disturb 0.061 square kilometer (15 acres) at the Caliente location or 0.12 square kilometer (30 acres) at the Eccles location. The total amount of earthwork required would be 15,000 cubic meters (20,000 cubic yards) for Caliente and 120,000 cubic meters (150,000 cubic yards) for

Eccles (DIRS 176170-Nevada Rail Partners 2006, p. A-5). There would be no buildings in the Interchange Yard.

Construction of these facilities would result in the removal of topsoil and an increased potential for erosion within the disturbed areas. DOE would implement best management practices (see Chapter 7) to minimize potential erosion impacts. There would be a permanent loss of topsoil in the areas under the buildings and paved roads.

4.2.1.2.3.2 Maintenance-of-Way Facilities. The Maintenance-of-Way Headquarters Facility would be south of Tonopah and would disturb 0.012 square kilometer (3 acres). Construction of the Trackside Facility along Caliente common segment 3 northeast of Goldfield would disturb 0.061 square kilometer (15 acres) (DIRS 176170-Nevada Rail Partners 2006, Appendix B). Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices to minimize potential erosion impacts. During construction, the topsoil would be sequestered and stabilized to prevent its permanent loss.

4.2.1.2.3.3 Rail Equipment Maintenance Yard. Construction of the Rail Equipment Maintenance Yard would disturb approximately 0.41 square kilometer (100 acres) (DIRS 176170-Nevada Rail Partners 2006, p. A-5). This area could include the Cask Maintenance Facility, and escort-car and locomotive light-repair garages. It could also house the ***Nevada Railroad Control Center*** and the National Transportation Operations Center. Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices to minimize potential erosion impacts. During construction, the topsoil would be sequestered and regraded to prevent its permanent loss.

4.2.1.2.3.4 Cask Maintenance Facility. The ***Cask Maintenance Facility*** would be used to house the transportation casks, and would process them during routine inspections, cleaning, and repair. The facility would disturb 0.081 square kilometer (20 acres), which would include buildings, a rail yard, and track siding (DIRS 176168-Nevada Rail Partners 2006, p. 1-3). The facility could be in one of three locations: collocated with the Rail Equipment Maintenance Yard, along one of the rail alignment segments outside the ***Yucca Mountain Site boundary***, or at a currently undetermined location outside Nevada.

4.2.1.2.4 Quarries

DOE would develop up to four of six potential quarry sites along the Caliente rail alignment. Each quarry site would contain an operations plant, quarry and production area, access roads, a railroad siding with loading facility, and could contain a conveyor belt (see Figure 2-33). The operations plant would include administrative offices, a parking area, sanitary facilities, and an equipment fueling and service area. The quarry and production area would include the pit, which would vary in size depending on quarry location, a waste-rock pile with a rectangular footprint of 0.057 square kilometer (14 acres), a ballast stockpile, settling ponds, a water well, and emergency generators.

The maximum disturbance area for each quarry was calculated from the areas that would be disturbed from excavating the quarry pit and building the associated plant facilities, roads, railroad siding, and conveyor belts. A construction buffer was also included, and would be reclaimed once construction was completed. The quarry pit would create the largest disturbance area, so if less ballast was needed, or high-quality minerals were excavated, the total disturbance area for the quarry site would likely be much smaller. Depending on the topography, the relative positions of the facilities, and quality and amount of extracted rock, the total area of disturbance from a quarry site would range from 1.3 to 3.8 square kilometers (320 to 930 acres).

Construction and operation of quarries would modify the physical setting in multiple ways. Construction of the buildings, access roads, and conveyer belts would disturb topsoil. During quarry operation, rock extraction would require the removal of the thin soil overburden. The result would be some topsoil loss during quarry construction and operation. Construction and operation of the quarries would also increase the potential for erosion. These impacts would be temporary, limited to the area around the quarry facilities, and DOE would implement best management practices (see Chapter 7) to reduce the impacts. Where practicable, the topsoil would be reserved for reclamation and revegetation. Excavation of bedrock from the pit would result in permanent loss of the mineral resources and change the local topography. However, the quarries would be in areas with abundant mineral resources; therefore, impacts to the overall availability of minerals suitable for quarrying would be small.

After construction, DOE would implement reclamation activities to reduce permanent impacts. The Department would demolish quarry access roads by removing the roadway materials and regrading the area. Terrain restoration around the quarry facility and pit would include restoring quarry pit walls to more stable slopes, grading and replacing topsoil, and revegetating the area (DIRS 176172-Nevada Rail Partners 2006, p. 3-4). Reclamation activities would reduce the direct and indirect topsoil loss and increased erosion impacts caused by quarry construction and operation.

Sections 4.2.1.2.4.1 through 4.2.1.2.4.6 describe potential impacts related to each potential quarry site along the Caliente rail alignment.

4.2.1.2.4.1 Quarry CA-8B. Potential quarry CA-8B would be in hilly terrain west of the Caliente alternative segment. The quarry pit (see Figure 2-24) would be mined from the side of a hill with a vertical relief of 61 meters (200 feet). The ballast produced from this quarry could be a portion of the 2.15 million metric tons (3.47 million tons) required for railroad construction and maintenance. At most, this quarry pit could occupy an area of 0.093 square kilometer (23 acres) to a depth of 61 meters, which would produce approximately 14.5 million metric tons (16 million tons) of ballast (DIRS 176172-Nevada Rail Partners 2006, p. A-2). The actual quarry dimensions would likely be much smaller – approximately 0.04 square kilometer (10 acres) to a depth of 24 meters (80 feet) (DIRS 176172-Nevada Rail Partners 2006, p. 3-2). The entire quarry footprint, including roads, conveyer belt, quarry and production area, and its construction buffer zones would disturb 1.6 square kilometers (400 acres).

Access to quarry CA-8B would be by existing and new roads (DIRS 176172-Nevada Rail Partners 2006, Appendix I). DOE would construct 5.4 kilometers (3.4 miles) of new roadway and would improve 4.3 kilometers (2.7 miles) of existing roadway to access the quarry pit and facilities (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). Excavated ballast would be trucked to the quarry plant, which would be on a nearby plateau. Once the ballast was separated, it would be transported to the Caliente alternative segment by one of two proposed conveyer-belt options. One option would be for the conveyer belt to travel east from the processing plant to the railroad siding. Under the other option, it would travel south and service the Staging Yard. The conveyer belt and service road would disturb a 15-meter (50-foot)-wide path from the processing plant to the rail loading facility. Existing roads would be updated by grading and adding a gravel roadbed.

4.2.1.2.4.2 Quarry NN-9A. Quarry NN-9A is one of two potential quarries along the South Reveille alternative segments. When operational, this quarry could supply a portion of the 3.15 million metric tons (3.47 million tons) of ballast required for railroad construction and maintenance (DIRS 176172-Nevada Rail Partners 2006, p. 3-1). The quarry pit and associated facilities would be east of the junction of South Reveille alternative segments 2 and 3 shown on Figure 2-25. Two 12-meter (40-foot)-high hills would be mined for the ***basalt*** bedrock. For quarry NN-9A, DOE would construct 7.1 kilometers (4.4 miles) of new roadway and would update 15 kilometers (9.5 miles) of existing roads (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). Quarry NN-9A would be able to produce a maximum of 36.3 million metric tons (40 million tons) of ballast excavated out of a 1.3-square-kilometer (330-acre) pit 11 meters (36 feet) deep. There would be two potential plant facilities to the north and south of the quarry pit. Ballast would be trucked along existing County Road 525 to the loading facility on Caliente common segment 3. The disturbance area for the entire quarry footprint would be 2 square kilometers (490 acres).

4.2.1.2.4.3 Quarry NN-9B. Potential quarry NN-9B would be smaller than NN-9A and would be east of the quarry NN-9A location shown on Figure 2-25. Although either quarry would be at the junction of the two South Reveille alternative segments, quarry NN-9B would be closer to South Reveille 2 and would require less road construction and shorter transport routes. This quarry could supply a portion of the 3.15 million metric tons (3.47 million tons) of required ballast (DIRS 176172-Nevada Rail Partners 2006, p. 3-1).

Quarry NN-9B would excavate a 37-meter (120-foot)-high ridge. For quarry NN-9B, DOE would construct 7.1 kilometers (4.4 miles) of new roadway and would update 15 kilometers (9.1 miles) of existing roads (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). Quarry NN-9B would produce 2.72 million metric tons (3 million tons) of ballast from a 0.23-square-kilometer (60-acre) pit 4.6 meters (15 feet) deep. These dimensions would likely be smaller to satisfy the ballast requirements for construction. The ballast from quarry NN-9B would be trucked on new unnamed roads to the loading facility on the selected alternative segment. The disturbance area for the quarry NN-9B construction footprint would be 1.3 square kilometers (320 acres).

4.2.1.2.4.4 Quarry ES-7. Potential quarry ES-7 would be west of Goldfield alternative segment 4 and could be developed if DOE selected Goldfield alternative segment 4 (see Figure 2-26). The quarry pit and plant facilities would be on a 49-meter (160-foot)-high mesa with access to two basalt deposits. DOE could extract a maximum of 8.49 million metric tons (9.36 million tons) of basalt ballast from the 0.11-square-kilometer (27-acre) pit with a depth of 30 meters (100 feet). Depending on the amount of ballast required, the footprint of this quarry would likely be smaller. There could also be a secondary quarry of variable-quality rock in the area. It would be able to produce a maximum of 2.9 million metric tons (3.2 million tons) of ballast from a 37,000-square-meter (9.2-acre) pit 30 meters deep. However, the final dimensions of this secondary quarry would likely be smaller. This quarry could supply a portion of the required 3.15 million metric tons (3.47 million tons) of ballast (DIRS 176172-Nevada Rail Partners 2006, p. 3-1).

Access to the quarry pit and production plant would be via an existing road off U.S. Highway 95, with new roadway construction to extend into the quarry site (DIRS 176172-Nevada Rail Partners 2006, Appendix I). DOE would construct approximately 6.6 kilometers (4.1 miles) of new roadway and would improve approximately 8.4 kilometers (5.2 miles) of existing roadway to access the quarry pit and facilities (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). A conveyer belt would carry the ballast from the production facility to the rail siding. The conveyer belt and correlating service road would be 15 meters (50 feet) wide. The total disturbance area of the quarry footprint would be 1.5 square kilometers (370 acres).

4.2.1.2.4.5 Quarry NS-3A. Potential quarry NS-3A would be on basalt hills in a valley along the eastern side of Goldfield alternative segment 3 (see Figure 2-27) and could be constructed if DOE selected Goldfield alternative segment 1 or 3. The quarry pit might have to be split into two locations because of the large quantities of overburden in the area (DIRS 176172-Nevada Rail Partners 2006, p. D-1). The quarry would be able to produce a maximum of 99.8 million metric tons (110 million tons) of basalt rock from two pits totaling 21 square kilometers (530 acres) with depths ranging from 12 to 30 meters (40 to 100 feet). However, rail line construction would require 3.15 million metric tons (3.47 million tons) of ballast. The ballast would be processed at one of the two potential quarry plant facilities and trucked to the loading facilities along 13 kilometers (8 miles) of existing roads and 3.5 kilometers (2.2 miles) of new road (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). The total quarry footprint disturbance area would be 3.8 square kilometers (940 acres).

4.2.1.2.4.6 Quarry NS-3B. Potential quarry NS-3B would also be on basalt hills along Goldfield alternative segment 3 (see Figure 2-27) (DIRS 176172-Nevada Rail Partners 2006, Appendix I) and could be constructed if DOE selected Goldfield alternative segment 1 or 3. The quarry area would be south of the quarry NS-3A potential location. Basalt rock would be quarried on either side of the rail alignment in 21- to 30-meter (69- to 100-foot) cuts, which would produce a maximum of 27.2 million metric tons (30 million tons) of ballast. The cuts would occupy an area of 12 square kilometers (2,900 acres). The ballast from quarry N3-3B would be trucked on new unnamed roads to the loading facility on Goldfield alternative segment 3. If chosen, this quarry could supply a portion of the required 3.15 million metric tons (3.47 million tons) of ballast. The total quarry footprint disturbance area would be 1.5 square kilometers (370 acres).

4.2.1.3 Railroad Operations Impacts

The proposed railroad would operate for up to 50 years (DIRS 176173-Nevada Rail Partners 2006, p. 4-1). The operations right-of-way would be nominally 61 meters (200 feet) on either side of the centerline of the rail line. By definition, the operations right-of-way would be within the construction right-of-way; therefore, use of the completed rail line to Yucca Mountain would have no additional impact to physical setting beyond the permanent alterations resulting from construction.

Rail line maintenance would require periodic inspections to verify the condition of the track, drainage structures, and rock-wall surfaces. When necessary, rock faces on cuts would be repaired to minimize the potential for rockfall or landslide. Areas along the rail line would also be monitored for evidence of erosion, particularly where there is a high percentage of soils classified as erodes easily (Caliente alternative segment [74 percent], Eccles alternative segment [71 percent], Bonnie Claire alternative segment 2 [26 percent], Bonnie Claire alternative segment 3 [25 percent], and Caliente common segment 4 [41 percent]).

Eroded areas encroaching on the track bed would be repaired, which could include replacement of ballast and subballast to reduce erosion of exposed soils. Although there would be a potential for erosion and landslides along the rail line, the potential would be substantially similar to ***baseline*** conditions, and would be attributed to natural occurrences after construction was completed, not to due to train operations. In addition, DOE would use appropriate slope-stabilizing engineering practices (see Chapter 2) during the construction phase that would reduce hazards from rockfalls and landslides during the operations phase. Section 4.2.8, Noise and Vibration, describes potential impacts from vibration in more detail.

During the operations phase, DOE would continue to monitor seismic activity in the region. DOE would also continue to follow the procedures based on the American Railways Engineering and Maintenance-of-Way Association seismic guidelines it adopted during the construction phase (see Section 4.2.1.2.1.2 and Table 4-1). These measures, also outlined in Chapter 7, would reduce the potential for structural damage and human exposure to seismic hazards.

4.2.1.4 Impacts under the Shared-Use Option

The Shared-Use Option would include the construction and operations activities described in Sections 4.2.1.2 and 4.2.1.3, and private companies would use the rail line for shipment of general freight. Under the Shared-Use Option, potential construction and operations impacts would be very similar to those identified in Sections 4.2.1.2 and 4.2.1.3 for the Proposed Action without shared use.

The Shared-Use Option would require the construction of more rail sidings within the rail line construction right-of-way in areas of relatively flat terrain. A commercial-use interchange facility at the beginning of the line and a facility at the termination point of commercial use to support the Shared-Use Option would also be constructed within the construction right-of-way. Implementation of the Shared-

Use Option would increase the area of surface disturbance by less than 0.1 percent (see Chapter 2). There would be a potential for topsoil loss and increased erosion in this area.

Under the Shared-Use Option, the rail line would likely be in use for more than 50 years, compared to the railroad operations life under the Proposed Action without shared use. Shared use of the proposed rail line would add no impacts to physical setting beyond the permanent alterations already described.

4.2.1.5 Summary

Table 4-9 summarizes potential impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment. With the exception of topsoil loss, the overall impacts would be small because of the best management practices or ***mitigation*** measures DOE would implement (see Chapter 7). There would be a potential for increased erosion because relatively undisturbed land would be extensively graded. Impacts related to soil erosion or loss of topsoil would be small, because implementation of best management practices would effectively reduce the potential for increased erosion and sedimentation that could occur during construction activities. In addition, soil disturbance would be distributed throughout several counties, reducing the concentration of increased soil erosion.

The Caliente rail alignment would cross faults in Nevada, a seismically active area. However, DOE would adopt the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. Additional seismic monitoring procedures would also be implemented during the construction and operations phases. Construction of the rail alignment would avoid known commercial mineral deposits, and would not remove them from permanent use. The quarries and borrow sites that would be opened and used for supplying the ballast and subballast would remove mineral resources from the area. However, construction would consume only a small percentage of the total available supply of these materials over several counties. There would be no additional impacts to the physical setting from the railroad operations under the Proposed Action or the Shared-Use Option.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 1 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment		
Caliente alternative segment (Lincoln County)	Total surface disturbance: 3.1 square kilometers, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.16 square kilometer; less than 0.1 percent of prime farmland soils in Lincoln County. Small impact to local mineral resources due to potentially disturbed perlite deposits near the alternative segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 2 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Eccles alternative segment (Lincoln County)	Total surface disturbance: 2.1 square kilometers, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 0.1 square kilometer; less than 0.1 percent of prime farmland soils in Lincoln County. Small impact to local mineral resources due to potentially disturbed perlite deposits near the alternative segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 1 (Lincoln County and Nye County)	Total surface disturbance: 12 square kilometers, would result in topsoil loss and increased potential for erosion. Loss of prime farmland soils: 1.2 square kilometer; less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties. Small impact to limestone resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Garden Valley 1 = 3.4 square kilometers Garden Valley 2 = 3.6 square kilometers Garden Valley 3 = 3.7 square kilometers Garden Valley 8 = 3.7 square kilometers Loss of prime farmland soils: Garden Valley 1 = 0.29 square kilometers Garden Valley 2 = 0.4 square kilometers Garden Valley 8 = 0.36 square kilometers Less than 0.1 percent of prime farmland soils in Lincoln and Nye Counties. No impacts to limestone resources due to location.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 2 (Lincoln County and Nye County)	Total surface disturbance: 4.1 square kilometers, would result in topsoil loss and increased potential for erosion. No impact to mineral or geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
South Reveille alternative segments 2 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: South Reveille 2 = 4.8 square kilometers South Reveille 3 = 5 square kilometers No impact to mineral or geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 3 (Nye County)	Total surface disturbance: 10 square kilometers, would result in topsoil loss and increased potential for erosion. Small potential impact to barite, gold, silver, and geothermal resources due to location of common segment.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 3 of 4).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Goldfield alternative segments 1 and 4 (Nye County and Esmeralda County) Goldfield alternative segment 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Goldfield 1 = 9.8 square kilometers Goldfield 3 = 10.2 square kilometers Goldfield 4 = 6.5 square kilometers Potential impacts to metallic and nonmetallic resources would be small.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Caliente common segment 4 (Nye County and Esmeralda County)	Total surface disturbance: 1.1 square kilometers, would result in topsoil loss and increased potential for erosion. Small impacts to metallic and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Bonnie Claire 2 = 1.9 square kilometers Bonnie Claire 3 = 1.9 square kilometers Small impacts to metallic mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 5 (Nye County)	Total surface disturbance: 3.1 square kilometers, would result in topsoil loss and increased potential for erosion. Small impact to metallic mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Oasis Valley alternative segment 1 = 1 square kilometer Oasis Valley alternative segment 3 = 1.3 square kilometers Small impacts to mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 6 (Nye County)	Total surface disturbance: 5.5 square kilometers, would result in topsoil loss and increased potential for erosion. Small impacts to mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Facilities		
Access roads (included in total surface disturbance in individual segments) (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 3.4 square kilometers, would result in topsoil loss and increased potential for erosion. Alteration of prime farmland soils (see table entries for Caliente alternative segment, Eccles alternative segment, and Caliente common segment 1)	Potential for soil erosion in localized areas along access roads; implementation of erosion prevention methods would reduce impacts.
Facilities at the Interface with the Union Pacific Railroad Mainline (includes the Interchange Yard, the Staging Yard, and the Satellite Maintenance-of-Way Facility) (Lincoln County)	Total surface disturbance: 0.26 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facilities; implementation of erosion prevention methods would reduce impacts.

Table 4-9. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 4 of 4).

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Quarries		
Maintenance-of-Way Facilities (includes the Maintenance-of-Way Headquarters Facility and the Maintenance-of-Way Trackside Facility) (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 0.073 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facilities; implementation of erosion prevention methods would reduce impacts.
Rail Equipment Maintenance Yard (includes Cask Maintenance Facility) (Nye County)	Total surface disturbance: 0.41 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Water wells (Lincoln, Nye, and Esmeralda Counties)	Total surface disturbance: 0.11 square kilometer, would result in topsoil loss and increased potential for erosion. (137 potential well sites with 231 potential wells; 117 well sites would be within the nominal width of the construction right-of-way; 20 well sites would be outside the nominal width of the construction right-of-way, at 0.0057 square kilometer surface disturbance at each well site)	Potential for soil erosion in localized areas around the well sites; implementation of erosion prevention methods would reduce impacts.
Potential quarry CA-8B (Lincoln County)	Total surface disturbance: 1.6 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 14.5 million metric tons of rock would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarry ES-7 (Nye County)	Total surface disturbance: 1.5 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 11.4 million metric tons from two pits would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarries NS-3A and NS-3B (Esmeralda County)	Total surface disturbance: 3.8 (NS-3A) to 1.5 (NS-3B) square kilometers, would result in topsoil loss and increased potential for erosion. NS-3A: Extraction of all 99.8 million metric tons would reduce the availability of local construction mineral materials. NS-3B: Extraction of all 27.2 million metric tons would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.

a. To convert square kilometers to acres, multiply by 247.10; to convert metric tons to tons, multiply by 1.1023.

4.2.2 LAND USE AND OWNERSHIP

This section describes impacts to land use and ownership from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.2.1 describes the methods DOE used to assess potential impacts; Section 4.2.2.2 describes potential impacts to land use during the construction phase; Section 4.2.2.3 describes potential railroad operations impacts; Section 4.2.2.4 describes potential impacts under the Shared-Use Option; and Section 4.2.2.5 summarizes potential impacts to land use and ownership.

Section 3.2.2.1 describes the region of influence for land use and ownership.

4.2.2.1 Impact Assessment Methodology

Table 4-10 lists factors DOE considered to determine potential impacts to land use and ownership from project-related construction and operations activities.

Table 4-10. Impact assessment considerations for land use and ownership.

Land use	Potential for impact
General	Nonconformance with applicable general and regional plans and approved or adopted policies, goals, or operations of communities or governmental agencies
Private land	Change in current land use
	Permanent displacement of existing, developing, or approved urban/industrial buildings or activities (residential, commercial, industrial, governmental, or institutional)
	Loss of ownership or title to private land
American Indian land	Conflict with existing land-use plans or cause incompatible land uses
Department of Defense land	Conflict with existing land-use plans or cause incompatible land uses
Livestock grazing lands	Loss of grazing land and associated ***animal unit months***
	Alteration of livestock operations or disruption of livestock movement
	Change to the amount or distribution of existing stockwater sources
	Potential human disturbance to livestock (such as loss of livestock due to collisions with trains)
Mineral and energy resources	Potential to preclude mining operations or the extraction of oil, gas, and geothermal resources within the rail line construction right-of-way
	Disturbance to existing or proposed mining operations with an approved mining plan
	Potential to cause the collapse of active underground mines, tunnels, or shafts
Recreational areas and access to public or private lands	Potential disturbance to federal, state, local, or private land designated as recreational sites
	Potential alteration of routes for large, recurring organized off-highway vehicle events and races
	Restricted or altered access to federal, state, local, or private recreational sites or public land
	Restricted or altered access to private land
Utility and transportation corridors and rights-of-way	Interference with an existing or planned utility or transportation right-of-way
	Need for a new right-of-way within a BLM-designated right-of-way avoidance area, such as an Area of Critical Environmental Concern

4.2.2.1.1 Assumptions and Approach

DOE assessed potential impacts to land use and ownership along the rail line based on the nominal width of the construction right-of-way.

For railroad construction and operations support facilities, this section describes potential impacts to land use and ownership in conjunction with each facility's nearest segment, based on the current land use at the site. Table 4-11 describes the required support facilities and the current land uses at their proposed locations. Chapter 2 describes the facilities and their locations in more detail.

Because the basis for rail line impacts is the construction right-of-way, impacts from construction camps, some construction wells, and some facilities that would be within the rail line construction right-of-way are included in the analysis of that area and are not addressed separately.

Table 4-11. Land use associated with railroad construction and operations support facilities (page 1 of 2).

Facilities	Number of facilities under the Proposed Action[a,b]	Within the nominal width of the construction right-of-way	Land ownership
Construction camps	Up to 12 Camp 1 would occupy 0.23 square kilometer for the Caliente alternative alignment or 0.05 square kilometer for the Eccles alternative alignment	All but camp 1	BLM-administered public land, except for a portion of camp 1 that would be on private land
Construction wells	Maximum of 107 well sites Area of disturbance for each would be 0.0057 square kilometer	All but 14	Construction wells outside the nominal width of the construction right-of-way would be on BLM-administered land
Quarries	Up to four needed out of six potential sites	No	All on BLM-administered land except for sidings for quarry CA-8B, which would be on private land
Interchange Yard	One on either the Caliente or Eccles alternative segment 0.061 square kilometer of land at Caliente or 0.12 square kilometer at Eccles	No	Would fall within existing Union Pacific Railroad right-of-way
Upland or Indian Cove Staging Yard	One if DOE selected the Caliente alternative segment 0.45 square kilometer at Upland or 0.73 square kilometer at Indian Cove	No	Private land
Eccles-North Staging Yard	Required if DOE selected the Eccles alternative segment, occupying 0.3 square kilometer	No	BLM-administered public land
Maintenance-of-Way Trackside Facility	One required	Yes	BLM-administered public land

Table 4-11. Land use associated with railroad construction and operations support facilities (page 1 of 2).

Facilities	Number of facilities under the Proposed Action[a,b]	Within the nominal width of the construction right-of-way	Land ownership
Maintenance-of-Way Headquarters Facility	One, occupying 0.013 square kilometer of land	No	BLM-administered public land
Rail Equipment Maintenance Yard	Includes the Satellite Maintenance-of-Way Facility, possibly the Nevada Railroad Control Center and National Transportation Operations Center	No	DOE-managed land (Yucca Mountain Site)[c]
Cask Maintenance Facility	One This facility has three location options: (1) collocated with the Rail Equipment Maintenance Yard, (2) anywhere along the rail line outside the Yucca Mountain Site boundary, or (3) anywhere outside Nevada	No	For purposes of analysis, collocated with the Rail Equipment Maintenance Yard

a. To convert square meters to square feet, multiply by 10.76.
b. To convert square kilometers to acres, multiply by 247.10.
c. DOE would implement the Proposed Action only after the proposed public land withdrawal for the Yucca Mountain Site was completed, when control of the land would be transferred to DOE.

Although not all the well locations identified would be used for the project, for purposes of analysis and to conservatively estimate impacts to land use and ownership, DOE assumes that it would develop all the well locations outside the rail line construction right-of-way and footprints of the quarry sites.

4.2.2.2 Construction Impacts to Land Use and Ownership

Sections 4.2.2.2.1 through 4.2.2.2.8 discuss potential land-use impacts during the construction phase. Because potential impacts to land use would occur primarily from the presence of the rail line, the construction timeframe (which could range from 4 to 10 years) would have little effect on the resulting land-use impacts, other than to provide greater lead time to implement mitigation measures, establish land-use agreements, and revise grazing allotment permits where applicable. Therefore, DOE did not assess potential land-use impacts for different construction timeframes.

Table 4-12 provides an overview of land ownership within the rail line construction right-of-way and the locations of support facilities.

4.2.2.2.1 Private Land

4.2.2.2.1.1 County and Local Land-Use Plans. In general, DOE developed the Caliente rail alignment to avoid private land. There would be no land-use conflicts in terms of county land uses, projects, or planning.

- *Lincoln County Master Plan* (DIRS 174520-State of Nevada 2001, all)

This plan addresses the proposed Yucca Mountain Repository and discusses the potential impacts of the repository on the county, which include an anticipated increase in ***demand*** for housing, schools, medical services, police and fire protection, and highway patrols due to rail or facility workers in Caliente. Lincoln County also proposes to revise its Emergency Management Plan to address the issue of hazardous cargo transport along U.S. Highway Route 93 and other roads in the county (DIRS 174520-State of Nevada 2001, p. 24).

Table 4-12. Land ownership by alternative segment and common segment within the rail line construction right-of-way and facilities outside the construction right-of-waya.

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)
Caliente alternative segment	Private	0.31	77
	Public (BLM-administered)	0.35	87
Staging Yard, Caliente-Indian Cove	Private	0.73	180
Staging Yard, Caliente-Upland	Private	0.45	110
Construction camp 1 (Caliente alternative segment)	Private	0.15	38
	Public (BLM-administered)	0.08	21
Potential quarry CA-8B	Private	0.27	66
	Public (BLM-administered)	1	330
Eccles alternative segment	Private	0.31	77
	Public (BLM-administered)	4.5	1,130
Staging Yard, Eccles-North	Public (BLM-administered)	0.30	74
Construction camp 1 (Eccles alternative segment)	Private	0.005	1.4
	Public (BLM-administered)	0.05	12
Caliente common segment 1	Private	0.001	0.2
	Public (BLM-administered)	35	8,540
Garden Valley alternative segment 1	Public (BLM-administered)	11	2,590
Garden Valley alternative segment 2	Public (BLM-administered)	11	2,620
Garden Valley alternative segment 3	Public (BLM-administered)	11	2,830
Garden Valley alternative segment 8	Public (BLM-administered)	10	2,550
Caliente common segment 2	Public (BLM-administered)	15	3,690
South Reveille alternative segment 2	Public (BLM-administered)	56	1,370
South Reveille alternative segment 3	Public (BLM-administered)	6.0	1,490
Caliente common segment 3	Public (BLM-administered)	33	8,270
Goldfield alternative segment 1	Private	0.37	91
	Public (BLM-administered)	13	3,330
Goldfield alternative segment 3	Private	0.01	2.4
	Public (BLM-administered)	15	3,780
Goldfield alternative segment 4	Private	0.23	56
	Public (BLM-administered)	16	3,850
Caliente common segment 4	Public (BLM-administered)	3.5	870
Bonnie Claire alternative segment 2	Public (BLM-administered)	6.1	1,520
Bonnie Claire alternative segment 3	Public (BLM-administered)	6.1	1,500
Common segment 5	Public (BLM-administered)	12	2,950
Oasis Valley alternative segment 1	Private	0.04	9.9
	Public (BLM-administered)	3.8	940
Oasis Valley alternative segment 3	Public (BLM-administered)	5.3	1,300
Common segment 6	Public (BLM-administered)	12	2,880
	Public (DOE)	4.1	1,020

a. Source: DIRS 181617-Hopkin 2007, all.
b. Values are rounded to two significant figures, except for areas larger than 1,000 acres, which are rounded to nearest value of 10.

- *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all)

  This plan addresses the proposed Yucca Mountain Repository and states that the repository could affect the county's future economy and the quality of life of its residents. The plan does not address the proposed railroad. However, DOE has determined that a rail line along the Caliente rail alignment would not substantially alter current land uses or impact future land-use plans in Nye County.

- *Esmeralda County Master Plan* (DIRS 176770-Duval et al. 1976, all)

  This plan predates plans for a repository at Yucca Mountain; therefore, it does not address the project. The plan states that the county must be consulted on all proposed federal projects. DOE continues to consult Esmeralda County (and other affected counties) on the Proposed Action. DOE has determined that a rail line along the Caliente rail alignment would not substantially alter current land uses or impact future land-use plans in Esmeralda County. The only private land that would be affected within an established town in Esmeralda County would be along Goldfield alternative segment 4 (see discussion in Section 4.2.2.2.1.2).

None of the three county plans discusses proposed or existing land uses along the Caliente rail alignment. Although there are no land-use plans at the county level, DOE does not anticipate potential land-use conflicts in relation to future county projects and planning.

- *City of Caliente Master Plan* (DIRS 157312-Sweetwater and Anderson 1992, all)

  This plan acknowledges that railroad operations will continue to be a primary economic activity in the City of Caliente. The Caliente alternative segment would utilize the former Pioche and Prince Branchline of the Union Pacific Railroad and the proposed Staging Yard on the alternative segment would be north of the city at either Indian Cove or Upland. Locating the Staging Yard north of the city would reduce disruption to the community due to noise, traffic, dust, and trains blocking the vehicle crossing, in accordance with the provisions of the master plan (DIRS 157312-Sweetwater and Anderson 1992, p. 54). The master plan also directs new residential development and "major economic centers" to the north of the city, but does not indicate exact locations. Possible future residential clustering near the Caliente alternative segment within or north of the city may be deemed an incompatible land use due to train noise. However, the Caliente alternative segment would not pose a direct conflict with current land zoning within the City of Caliente. The lands encompassing the former Pioche and Prince Branchline within the City of Caliente do not have any zoning designation. Current land zoning surrounding the Caliente alternative segment in the city is largely commercial or industrial, although the Lincoln County Hospital, senior citizen apartments, and a trailer court are immediately west of U.S. Highway 93; all of these locations are well outside the proposed construction right-of-way. While there is no zoning within the former branchline right-of-way within the city, adjacent property owners, such as the Caliente Hot Springs Motel, have come to use portions of this land. Section 4.2.2.2.1.2 discusses impacts to individually owned private parcels.

Although there is no zoning designation in the community of Goldfield, the designation of its historic district is a consideration for determining potential adverse impacts to land use. The historic district would be approximately 0.6 kilometer (0.4 mile) from the Goldfield alternative segment 4 construction right-of-way. Goldfield has been historically linked with both mining and railroad activity. Therefore, a new rail line adjacent to the town would not be a wholly incompatible feature with its historic characteristics. The BLM, DOE, and the Surface Transportation Board (STB) signed a Programmatic Agreement regarding the Yucca Mountain rail alignment project with the Nevada State Historic Preservation Office on April 17, 2006, to formalize the consultation process (DIRS 176912-Wenker et al. 2006, all). Appendix M is a copy of the Programmatic Agreement. As for any other potential cultural resources along the rail alignment, DOE would consult with the State Historic Preservation Office to determine potential impacts and possible mitigation measures (see discussion in Section 4.2.13, Cultural Resources).

4.2.2.2.1.2 Private Parcels. DOE would need to gain access to private land that falls within the Caliente rail alignment construction right-of-way and the locations of support facilities. Segments that would cross private lands include the Caliente alternative segment, the Eccles alternative segment, Caliente common segment 1, Goldfield alternative segment 4, and Oasis Valley alternative segments 1, 3, and 4. None of the other segments would cross private land.

While the nominal width of the rail line construction right-of-way would be 300 meters (1,000 feet), DOE would reduce the area of disturbance in some areas to minimize impacts to private land. For example, along the Caliente alternative segment, the area of disturbance would be 31 meters (100 feet). Where practicable, DOE would also reduce the area of disturbance (variable widths) adjacent to private lands near Goldfield to avoid individual parcels.

Land uses along the Caliente and Eccles alternative segments construction rights-of-way and facilities locations consist of private residential, commercial, and industrial uses concentrated along U.S. Highway 93, and ranch lands and residential uses dispersed beyond the municipal jurisdiction of the City of Caliente. There would be direct impacts to private property within the Caliente rail alignment construction right-of-way, resulting in changes of land use.

The Caliente alternative segment construction right-of-way would encompass or cross 32 parcels totaling 0.31 square kilometer (77 acres) (see Table 4-12 and Figure 3-14). These 32 parcels have 22 property owners. The Eccles alternative segment would cross 11 private parcels totaling 0.32 square kilometer (80 acres) (see Table 4-13). These 11 parcels have 10 property owners.

The parking lot and access road to the Caliente Hot Springs Motel would lie within the Caliente alternative segment construction right-of-way. While the ownership of this land along the former Pioche and Prince Branchline is uncertain, the motel has used this land for many years. The motel could be adversely affected because of the rail line’s proximity. If DOE selected the Caliente alternative segment, the Department would negotiate with the motel owner to gain access to the land. The likely socioeconomic impacts to the motel would be a consideration when determining compensation.

In addition, there are three structures on residential properties that would be within the Caliente alternative segment construction right-of-way. DOE would need to gain access to these private lands, and the structures could be demolished or relocated.

The Caliente alternative segment would also pass through the location of existing Union Pacific Railroad buildings, requiring their demolition or relocation.

Construction of the Staging Yard at the Caliente-Indian Cove location would require access to 0.73 square kilometer (180 acres) of land across 6 parcels west of the rail alignment with four owners and at present used for ranching and farming. Construction of the Staging Yard at Caliente-Upland would require acquisition of approximately 0.45 square kilometer (110 acres) across 17 parcels with 12 owners.

Section 4.2.2.2.3.2 discusses the Eccles-North location for the Staging Yard, which would be on public land.

The rail siding for potential quarry CA-8B would be on private land, across two parcels occupying 0.27 square kilometer (66 acres) of land.

There are two private parcels within the construction right-of-way of Caliente common segment 1. The first is near the easternmost end of the segment in Meadow Valley. Approximately 810 square meters (0.2 acre) would be within the construction right-of-way (see Figure 3-14).

Table 4-13. Uses of private land along the Caliente and Eccles alternative segments.[a]

Alternative segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (square meters)[b]
Caliente alternative segment		
Vacant	17	75,000
Residential	42	6,400
Commercial	1	260
Industrial	1	80
Rural	10	225,000
Unknown[c]	1	6,100
Eccles alternative segment		
Vacant	6	7,500
Residential	2	1.400
Rural	3	315,000

a. Source: DIRS 181617-Hopkins 2007, all.
b. To convert square meters to acres, multiply by 0.000247.
c. According to the Land Ownership Geographic Information System datasets for the Caliente rail alignment, one parcel of land has a land-use code listed as "unknown."

Goldfield alternative segment 1 would cross the most private land of the Goldfield alternative segments (six parcels covering 0.37 square kilometer [91 acres] of land). Goldfield alternative segment 3 would cross the least amount of private land (0.01 square kilometer [2.4 acres]) among the Goldfield alternative segments. Goldfield alternative segment 4 would pass to the immediate west and south of the community of Goldfield, which is clustered along U.S. Highway 95. The Goldfield alternative segment 4 construction right-of-way would intersect 37 privately owned parcels (including four patented ***mining claims***) with at least 20 individual landowners (0.225 square kilometer [56 acres]) (see Table 4-14 and Figure 3-23). Esmeralda County owns 12 of the 37 parcels, and the Nevada Department of Highways owns one parcel (while state and county entities own 13 parcels, they are non-federal lands and still

considered private land in this Rail Alignment EIS). DOE would gain access to portions of privately owned land if the Department selected Goldfield alternative segment 4. This would result in direct impacts to private land within the construction right-of-way, resulting in change of land use.

The Oasis Valley alternative segment 1 construction right-of-way would cross one parcel owned by a cattle company (see Figure 3-25), impacting 0.04 square kilometer (9.9 acres) of land. DOE would need to gain access to this land, causing a change in land use.

4.2.2.2.2 American Indian Land

During the first scoping period for this Rail Alignment EIS in 2004, DOE received comments from the Western Shoshone Nation indicating that a rail line crossing Timbisha Shoshone Trust Land would be incompatible with current and planned land uses. The opposition was based, in part, on treaty issues involving land in the vicinity of the Caliente rail alignment (see Section 3.4). The Department subsequently eliminated Bonnie Claire alternative segment 1, which would have crossed onto Timbisha Shoshone Trust Land, from analysis.

4.2.2.2.3 BLM-Administered Public Land

4.2.2.2.3.1 Consistency with BLM Resource Management Plans. Some portions of the Caliente rail alignment would cross federal land the BLM has identified for potential disposal (sale). The ***withdrawal*** of these lands along the rail alignment for other federal use would take precedence over potential land disposals.

Table 4-14. Uses of private land along the Goldfield alternative segments.

Segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (square meters)[a]
Goldfield alternative segment 1	6 (all patented mining claims)	370,000
Goldfield alternative segment 3	2 (both patented mining claims)	10,000
Goldfield alternative segment 4		
Vacant	27	78,100
Residential	1	470
Commercial	1	65
Utilities	4	9,500
Patented mining claims	4	137,000

a. To convert square meters to acres, multiply by 0.000247.

While this federal use would not pose a conflict with BLM ***resource management plans***, the community or public would lose the ability to use affected land for future economic or private development.

DOE reviewed existing documentation to determine whether construction and operation of the proposed railroad along the Caliente rail alignment would be consistent with existing land-use plans and policies.

- *Draft Resource Management Plan/Environmental Impact Statement for the Ely District* (Draft Ely District Resource Management Plan; DIRS 174518-BLM 2005, all)

  The Draft Ely District Resource Management Plan preferred alternative proposes to dispose of public lands north of Caliente through which portions of the Caliente and Eccles alternative segments would pass. The lands within the proposed rail alignment are withdrawn under Public Land Order 7653 (70 *Federal Register* 76854), and the withdrawal supersedes the planned land disposal on affected property; therefore, the proposed railroad project does not currently conflict with the plan. In conformance with the Draft Ely District Resource Management Plan, the rail line would not pass through designated or potential ***Areas of Critical Environmental Concern***. In addition, in conformance with the plan, the rail alignment construction right-of-way would conform to the criteria of the plan, and would be less than 0.8 kilometer (0.5 mile) wide. Although the rail alignment would not be entirely located within the existing designated corridors, under the plan's preferred alternative, the BLM can grant rights-of-way on a case-by-case basis. Section 4.2.11 of this Rail Alignment EIS describes potential impacts on utilities.

- *Tonopah Resource Management Plan and* ***Record of Decision*** (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)

  The Tonopah Resource Management Plan designates 1,075 kilometers (668 miles) for transportation and utility corridors (DIRS 173224-BLM 1997, p. 2). It also allows rights-of-way on more than 600 square kilometers (149,000 acres) if the land use is compatible with existing land values. The plan identifies areas for potential disposal at Goldfield, Scottys Junction, and Beatty. The Tonopah Resource Management Plan does not specifically address the portions of land released from withdrawal in 1999 adjacent to (on the western border of) the Nevada Test and Training Range. Because withdrawal for other federal use has precedence over potential land disposals, there would be no conflict with the Tonopah Resource Management Plan.

- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

  The Las Vegas Resource Management Plan designates corridors within its planning area to avoid Areas of Critical Environmental Concern. The proposed rail alignment would not pass through or near any right-of-way avoidance areas, such as Areas of Critical Environmental Concern. The portion of the rail alignment (common segment 6) that would pass through this district would be on land for which DOE already has a temporary right-of-way and a portion of which is slated for future land withdrawal for the Yucca Mountain Project. Therefore, there would be no conflict with the Las Vegas Resource Management Plan.

BLM-administered lands encompassing the Caliente rail alignment have been withdrawn from surface and mineral entry to avoid land-use conflicts in the near term (70 *FR* 76854, December 28, 2005). Furthermore, this withdrawal takes precedence over potential land disposals that might be planned in and around the rail alignment. Under the terms of the BLM land-disposal policy, identification of the lands for another federal purpose, such as the proposed railroad, would disqualify the land for disposal for other uses. Therefore, there would be conflict with current BLM land-use plans or policies.

4.2.2.2.3.2 Construction Impacts to BLM Grazing Allotments. Construction of the rail line and support facilities would result in surface disturbance across a number of grazing allotments. Wherever the rail line would cross a grazing allotment, DOE quantified the amount of forage loss in animal unit months.

DOE calculated potential loss of animal unit months as the proportion of land within each grazing allotment that would be crossed by the footprints of the rail line construction right-of-way and support facilities. The Department did not consider site-specific allotment characteristics. The BLM would determine actual loss of animal unit months for each affected allotment in association with the issuance of a ***right-of-way grant***. For this analysis, DOE conservatively assumed that all the area within the rail line construction right-of-way would be unavailable for forage. Section 4.2.9, Socioeconomics, describes the economic consequences of reductions in permitted animal unit months.

The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. The rail line could pose additional risk to ranching operations because livestock could be struck by passing trains. DOE or the commercial user (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. The rail line could intersect existing fences on active grazing allotments. The BLM and DOE would review with the affected allotment permittees the need to restore fences.

The Caliente rail alignment would cross a number of stockwater pipelines on active ***grazing allotments***. During the construction phase, DOE would sleeve these pipelines within a casing pipe under the rail roadbed to protect them and keep them operational. The casing pipe would be capable of withstanding the load of the roadbed, track, and rail traffic.

There would also be a number of new construction wells on grazing allotments outside the construction right-of-way. The well footprints would be small (approximately 0.0057 square kilometer [0.4 acre] each) and would not affect grazing patterns except for the presence of human activity during the construction phase.

The Maintenance-of-Way Headquarters Facility would be in Esmeralda County, approximately 8 kilometers (5 miles) southeast of Tonopah along U.S. Highway 95 (see Figure 2-50). It would occupy approximately 0.013 square kilometer (3.2 acres) of vacant, BLM-administered land. The facility would be within the Silver King allotment, which at present is unused (DIRS 176942-Metscher 2006, all). There is no specific segment or alignment associated with the Maintenance-of-Way Headquarters Facility. Although there is no active grazing on this land, because a permanent structure would be constructed, there would be long-term changes in land use.

Alternative Segments at the Interface with Union Pacific Railroad Mainline

Caliente Alternative Segment: This alternative segment would run along the former Union Pacific Railroad Pioche and Prince Branchline, generally parallel and east of U.S. Highway 93 (see Figure 3-27). It would cross the Comet and Panaca Allotments. There would be no stockwater sources within the Caliente alternative segment construction right-of-way. Overall, using the nominal width of the construction right-of-way, the Caliente alternative segment would encompass approximately 0.81 square kilometers (200 acres) of grazing allotment land. The loss of this amount of grazing land could result in the total loss of up to five animal unit months across all three affected allotments (see Table 4-15).

Approximately 1.3 square kilometers (320 acres) of grazing land on the Highway Allotment would be affected if DOE developed potential quarry CA-8B. Quarry CA-8B would impact 7.6 percent of the allotment. Assuming a direct correlation between allotment size and animal unit months, the quarry could reduce the animal unit months on this allotment by nine. Quarry CA-8B would also impact 0.07 square kilometer (18 acres) of grazing land on the Peck Allotment. Similarly, this could reduce animal unit months on the Peck Allotment by less than one.

Eccles Alternative Segment: The Eccles alternative segment would cross the Clover Creek, Little Mountain, Peck, and Comet Allotments (see Figure 3-27). At present, the Little Mountain Allotment is not active. The rail alignment would intersect fences that separate the Peck and Comet Allotments and the Peck and Little Mountain Allotments. There would be no stockwater sources within the Eccles alternative segment construction right-of-way. Overall, the Eccles alternative segment would encompass approximately 4.8 square kilometers (1,200 acres) of grazing allotment land. Assuming a direct correlation between allotment size and animal unit months, the Eccles alternative segment could reduce animal unit months by 18 (see Table 4-15).

The Eccles alternative segment Interchange Yard would fall within the current Union Pacific Railroad right-of-way within the Clover Creek Allotment, running parallel to the north side of the existing Union Pacific tracks. Because the Interchange Yard would be within the existing Union Pacific Railroad right-of-way, there would no additional impacts to grazing uses on this land. The Eccles-North location for the Staging Yard would be entirely on BLM-administered land within the Peck Allotment, occupying approximately 0.3 square kilometer (74 acres) of land within the Eccles alternative segment construction right-of-way. The Eccles-North Staging Yard would reduce animal unit months by 2.

Caliente Common Segment 1 (Dry Lake Valley Area): Caliente common segment 1 would cross the Comet, Rocky Hill, Bennett Spring, Black Canyon, Ely Springs Cattle, Rattlesnake, Wilson Creek, Timber Mountain, Sunnyside, and Needles Allotments. Figures 3-27 and 3-28 show these grazing allotments and their stockwater features. Overall, using the nominal width of the construction right-of-way, common segment 1 would encompass approximately 35 square kilometers (8,600 acres) of grazing allotment land and could result in an overall loss of up to 453 animal unit months (see Table 4-16) across the 10 affected allotments (a potential 0.7-percent loss overall).

Garden Valley Alternative Segments: Garden Valley alternative segments 1 and 3 would cross the Needles, Batterman Wash, Pine Creek, Cottonwood, and McCutcheon Springs Allotments. Garden Valley 2 and 8 would cross the Coal Valley Lake, Pine Creek, Cottonwood, McCutcheon Springs, and Needles Allotments. Figure 3-29 shows the grazing allotments along the Garden Valley alternative segments. Table 4-17 lists the potential reduction in animal unit months for allotments the Garden Valley alternative segments would cross.

Table 4-15. Potential loss of animal unit months associated with the Caliente and Eccles alternative segments.

Alternative segment/facility/ allotment	Construction right-of-way or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Calculated loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Caliente alternative segment				
Comet	0.71	214 on 37 square kilometers	4	1.9
Panaca Cattle	0.02	453 on 66 square kilometers	1	0.2
Peck[c]	0.08	397 on 72 square kilometers	1	0.2
Totals	0.8[d]	1,064 animal unit months	6	0.6
Eccles alternative segment				
Clover Creek	0.15	613 on 93 square kilometers	1	0.2
Little Mountain	1.8	Grazing permit relinquished to BLM; allotment closed	Not applicable	Not applicable
Peck[c]	2.4	397 on 72 square kilometers	14	3.5
Comet	0.44	214 on 37 square kilometers	3	1.4
Totals	4.8[d]	1,224 animal unit months	18	1.5
Potential quarry CA-8B				
Highway	1.3	118 on 17 square kilometers	9	7.6
Peck	0.07	397 on 72 square kilometers	1	0.3
Eccles-North Staging Yard				
Peck	0.3	397 on 72 square kilometers	2	0.5

a. Source: DIRS 174518-BLM 2005, Table R-1.
b. To convert square kilometers to acres, multiply by 247.10.
c. Includes construction camp 1.
d. Rounded to two significant digits.

Caliente Common Segment 2 (Quinn Canyon Range Area): Caliente common segment 2 would cross the McCutcheon Springs, Sand Springs, and Reveille Allotments (see Figures 3-29 and 3-30). The Sand Springs Allotment has two permittees. Overall, using the nominal width of the construction right-of-way, common segment 1 would encompass approximately 16 square kilometers (4,000 acres) of allotment land and could reduce animal unit months across the three allotments by 0.4 percent (128 animal unit months total) (see Table 4-18).

South Reveille Alternative Segments: The South Reveille alternative segments (see Figure 3-30) would be on the southern portion of the Reveille Allotment. There are no stockwater features within the South

Reveille alternative segments construction rights-of-way. South Reveille alternative segments 2 and 3 could reduce animal unit months on the Reveille Allotment by 54 and 58, respectively (see Table 4-19).

Potential quarry sites NN-9A and NN-9B would also be on the Reveille Allotment. These quarries would occupy 2 and 1.3 square kilometers (500 and 320 acres), respectively. Individually, either quarry would result in less than a 0.1-percent reduction in land area on the Reveille Allotment and between 13 and 19 lost animal unit months (see Table 4-19).

Caliente Common Segment 3 (Stone Cabin Valley Area): Caliente common segment 3 would pass through the Reveille, Stone Cabin, and Ralston Allotments (see Figures 3-30 and 3-31). At present, the Ralston Allotment is not occupied (DIRS 176942-Metscher 2006, all).

Common segment 3 would encompass approximately 36 square kilometers (9,000 acres) of allotment land. The loss of this amount of grazing land could reduce assigned animal unit months by 250, a potential 0.6-percent loss overall (see Table 4-20).

The Maintenance-of-Way Trackside Facility would span the boundary of the Stone Cabin and Ralston Allotments. The facility would be entirely within the rail line construction right-of-way. Therefore, loss of animal units months associated with this facility is accounted for in the assessment of the common segment 3 construction right-of-way shown above.

Goldfield Alternative Segments: All of the Goldfield alternative segments would cross the northern portion of the Montezuma Allotment (see Figure 3-31). At present, this allotment has no permittees. The northernmost parts of Goldfield alternative segments 1 and 4 would pass through the Ralston Allotment, which is also inactive (DIRS 176942-Metscher 2006, all).

Potential quarry sites NS-3A, NS-3B, and ES-7 would all be within the Montezuma Allotment. These quarries would require up to 3.8, 1.5, and 1.5 square kilometers (930, 370 and 360 acres), respectively. Because the allotment is inactive, there would be no impacts to grazing associated with any of these quarries.

Caliente Common Segment 4 (Stonewall Flat Area): Caliente common segment 4 would also pass through the inactive Montezuma Allotment (see Figures 3-31 and 3-32). Because the allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along common segment 4.

Bonnie Claire Alternative Segments: The Bonnie Claire alternative segments would cross a narrow stretch of the inactive Montezuma Allotment west of the Nevada Test and Training Range and east of the Magruder Mountain Allotment (see Figure 3-32). Because the Montezuma Allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along either of the Bonnie Claire alternative segments.

Common Segment 5 (Sarcobatus Flat Area): Common segment 5 would pass through the southern portion of the inactive Montezuma Allotment near the southwestern boundary of the Nevada Test and Training Range (see Figures 3-32 and 3-33). Because the Montezuma Allotment is inactive, rail line construction along common segment 5 would not impact grazing activities or stockwater resources.

Oasis Valley Alternative Segments: The Oasis Valley alternative segments would cross the inactive Montezuma Allotment and the active Razorback Allotment (see Figure 3-33). The Razorback Allotment has one permittee. Oasis Valley alternative segment 1 would pass near the northeastern corner of the small Springdale 2 Allotment, but its construction right-of-way would not fall within the allotment. There are no stockwater features within the construction right-of-way of either of the Oasis Valley alternative segments.

Table 4-16. Potential loss of animal unit months associated with Caliente common segment 1.

Allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Comet	1.1	214 on 37 square kilometers	6	2.8
Rocky Hill	0.2	Grazing permit relinquished to BLM	Not applicable	Not applicable
Bennett Spring	5.1	3,498 on 200 square kilometers	89	2.6
Black Canyon	1.6	1,105 on 34 square kilometers	52	4.7
Ely Springs Cattle	5.8	4,248 on 220 square kilometers	112	2.6
Rattlesnake	0.53	1,180 on 120 square kilometers	5	0.4
Wilson Creek	7.4	48,250 on 4,360 square kilometers	82	0.2
Timber Mountain	3.1	2,373 on 180 square kilometers	41	1.8
Sunnyside	5.5	5,402 on 890 square kilometers	33	0.6
Needles	4.3	2,679 on 350 square kilometers	33	1.2
Totals	35.0[c]	68,949 animal unit months	453	0.7[d]

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 174518-BLM 2005, Table R-1.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Table 4-17. Potential loss of animal unit months associated with the Garden Valley alternative segments (page 1 of 2).

Alternative segment/allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Garden Valley 1				
Needles	2.9	2,679 on 350 square kilometers	22	0.8
Batterman Wash	2.6	2,093 on 160 square kilometers	34	1.6
Pine Creek	2.4	2,667 on 140 square kilometers	46	1.7
Cottonwood	2.2	1,177 on 170 square kilometers	15	1.3

Table 4-17. Potential loss of animal unit months associated with the Garden Valley alternative segments (page 2 of 2).

Alternative segment/allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Garden Valley 1 (continued)				
McCutcheon Springs	0.44	446 on 74 square kilometers	3	1.8
Totals	11[c]	9,062 animal unit months	120	1.43
Garden Valley 2				
Needles	2.7	2,679 on 350 square kilometers	21	1.4
Coal Valley Lake	0.438	4,821 on 470 square kilometers	4	0.1
Pine Creek	4.6	2,667 on 140 square kilometers	88	3.1
Cottonwood	2.6	1,177 on 170 square kilometers	18	0.2
McCutcheon Springs	0.38	446 on 74 square kilometers	2	1.8
Totals	11[c]	11,790 animal unit months	133	1.1
Garden Valley 3				
Needles	2.9	2,679 on 350 square kilometers	22	0.8
Batterman Wash	4.5	2,093 on 160 square kilometers	59	2.8
Pine Creek	1.4	2,667 on 140 square kilometers	27	1.0
Cottonwood	2.0	1,177 on 170 square kilometers	14	1.2
McCutcheon Springs	0.68	446 on 74 square kilometers	4	0.9
Totals	12[c]	9,062 animal unit months	126	1.4
Garden Valley 8				
Needles	2.7	2,679 on 350 square kilometers	21	8.0
Coal Valley Lake	0.42	4,821 on 470 square kilometers	4	0.1
Pine Creek	4.2	2,667 on 140.4 square kilometers	80	3
Cottonwood	2.6	1,177 on 170 square kilometers	18	1.5
McCutcheon Springs	0.38	446 on 74 square kilometers	2	0.5
Totals	10[c]	11,790 animal unit months	131	1.1[d]

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 174518-BLM 2005, Table R-2.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Table 4-18. Potential loss of animal unit months associated with Caliente common segment 2.

Allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c,d]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
McCutcheon Springs	2.5	446 on 74 square kilometers	15	3.4
Sand Springs	6.7	7,055 on 1,010 square kilometers	47	0.7
Reveille	6.8	25,730 on 2,660 square kilometers	66	0.3
Totals	16[e]	33,231 animal unit months	128	0.4[d]

a. To convert square kilometers to acres, multiply by 247.10.
b. Source: DIRS 174518-BLM 2005, Table R-1.
c. Source: DIRS 173224-BLM 1997, p. A-12.
d. This is not column total; it is a value calculated using the totals from columns 3 and 4.
e. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.

Table 4-19. Potential loss of animal unit months on the Reveille Allotment associated with the South Reveille alternative segments.

Alternative segment/quarry	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area (Reveille)[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
South Reveille 2	5.6	25,730 animal unit months on 2,660 square kilometers	54	0.2
South Reveille 3	6.0	25,730 animal unit months on 2,660 square kilometers	58	0.2
Potential quarry NN-9A	2.0	25,730 animal unit months on 2,660 square kilometers	19	0.07
Potential quarry NN-9B	1.3	25,730 animal unit months on 2,660 square kilometers	13	0.05

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-12.

Table 4-20. Potential loss of animal unit months associated with Caliente common segment 3.

Allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c,d]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Reveille	13	25,730 on 2,660 square kilometers	126	0.5
Stone Cabin	14	13,963 on 1,580 square kilometers	124	0.9
Ralston	8.6	Inactive allotment[c]	Not applicable	Not applicable
Totals	36	39,693 animal unit months	250	0.6[e]

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-12.
d. Source: DIRS 176942-Metscher 2006, all.
e. This is not column total; it is a value calculated using the totals from columns 3 and 4.

Oasis Valley alternative segments 1 and 3 could result in the loss of 8 and 12 animal unit months, respectively, within the Razorback Allotment (see Table 4-21).

Table 4-21. Potential loss of animal unit months associated with the Oasis Valley alternative segments.

Alternative segment/allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area[c]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Oasis Valley 1 – Razorback	2.3	959 animal unit months on 290 square kilometers	8	0.8
Oasis Valley 3 – Razorback	3.8	959 animal unit months on 290 square kilometers	13	1.4

a. To convert square kilometers to acres, multiply by 247.10.
b. Land area values are rounded to two significant figures, except for allotment areas over 1,000 square kilometers, which are rounded to the nearest 10.
c. Source: DIRS 173224-BLM 1997, p. A-14.

Common Segment 6 (Yucca Mountain Approach): Common segment 6 would cross a corner of the inactive Montezuma Allotment near the beginning of the common segment. At present, there are no permittees on this allotment (DIRS 176942-Metscher 2006, all). Common segment 6 would also pass through the Razorback Allotment (see Figure 3-33) and encompass approximately 5.4 square kilometers (1,300 acres) of the allotment. This would correspond to a potential loss of 18 animal unit months (1.9-percent loss of the grazing allotment) (see Table 4-22).

Table 4-22. Potential loss of animal unit months associated with common segment 6.

Allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Razorback	5.4	959 animal unit months on 290 square kilometers	18	1.9

a. To convert square kilometers to acres, multiply by 247.10.
b. Source: DIRS 173224-BLM 1997, p. A-14.

4.2.2.2.4 Department of Defense-Managed Land

The Department of Defense provided comments during the first scoping period for this Rail Alignment EIS in 2004, which resulted in DOE modifying Bonnie Claire alternative segment 2 and proposing Bonnie Claire alternative segment 3 as a new alternative segment to avoid crossing the Nevada Test and Training Range. Specifically, the Air Force commented that the earlier proposed rail segments were "within the weapons safety footprint for test and training munitions" and that the rail line would "impinge on Range testing and training activities."

The closest segments to the Nevada Test and Training Range would be South Reveille alternative segment 3 and Bonnie Claire alternative segment 2, the centerlines of which would be approximately 100 meters (330 feet) from the Range boundary. DOE has narrowed the proposed construction right-of-way along these 2 segments to specifically avoid entering Range land. Other segments that would be closer to the Range boundary and the distances from the edge of the construction right-of-way to the boundary include Goldfield alternative segment 3 (485 meters [1,600 feet]), common segment 5 (560 meters [1,800 feet]), and Oasis Valley alternative segment 3 (280 meters [920 feet]). While the Caliente rail alignment would not directly affect land use on the Nevada Test and Training Range, portions of Bonnie Claire alternative segment 2 and common segment 5 would cross land formerly within the western border of the Range. The land released by the Range now falls under the BLM Tonopah planning area. Portions of the rail line (common segment 5 and common segment 6) would be beneath restricted air space or military operations areas associated with the Range. However, testing and training activities within the restricted air spaces would generally not exceed the western boundary of the Range and the Department of Defense would not institute controls so that activities across all related air spaces would not pose harm to the rail line. The proposed railroad would not interfere with Range activities and would not conflict with the Range's Resource and Management Plan.

4.2.2.2.5 DOE-Managed Land

The Rail Equipment Maintenance Yard, Cask Maintenance Facility, and a portion of common segment 6 would be within the Yucca Mountain Site boundary. These proposed maintenance facilities would be on land that is currently part of the Nevada Test Site, and used for Yucca Mountain Project characterization. Because the proposed railroad project would proceed only after control of the Yucca Mountain Site was transferred to DOE, the Rail Equipment Maintenance Yard and Cask Maintenance Facility and portions of common segment 6 within the Yucca Mountain Site boundary would not conflict with future land uses on the Nevada Test Site.

4.2.2.2.6 Construction Impacts to Mineral and Energy Resources (Public and Private Land)

Because of the relatively high mineral and energy potential to lands along the Caliente rail alignment, DOE evaluated potential impacts to these resources. To construct the rail line, DOE would need to gain access to lands that contain patented or ***unpatented mining claims*** or have active energy leases (oil, gas, or geothermal). DOE would also need substantial quantities of ballast and subballast that would be obtained from existing or new quarry and borrow sites (see Sections 2.2.2.3.2 and 2.2.2.3.3). Section 4.2.11, Utilities, Energy, and Materials, describes the impacts on regional material availability of removing material from the proposed quarries and ballast sites.

The land encompassing the Caliente rail corridor was withdrawn through Public Land Orders from surface and mineral entry through December 2015 so DOE could evaluate the land for the rail alignment. If the BLM granted DOE a right-of-way for the rail line before the Public Land Orders expired, the surface and mineral entry prohibitions would be removed from lands not part of the right-of-way. Therefore, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resources extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mine shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

4.2.2.2.6.1 Alternative Segments at the Interface with Union Pacific Railroad Mainline. A commercial hotel and spa in Caliente uses a hot spring just outside the Caliente alternative segment construction right-of-way (DIRS 173841-Shannon & Wilson 2005, pp. 113 to 117). Because the Caliente alternative segment would utilize the footprint of the former Pioche and Prince Branchline, there would be no additional disruption to these geothermal resources. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way of either alternative segment at the interface with the Union Pacific Railroad mainline.

There would be no patented mining claims or underground mines, tunnels, or shafts within the construction right-of-way for either the Caliente or Eccles alternative segment (see Figure 3-35).

Potential quarry CA-8B would be within the Chief Mining District, which was organized in 1870. There is no active mining and there are no patented mining claims within this district; therefore, there would be no impacts to mining from the introduction of a quarry in this area.

4.2.2.2.6.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross the northernmost portion of the Seaman Range Mining District (see Figure 3-36). Most of the past mining activity in this district occurred more than 5 kilometers (3 miles) south and southwest of the common segment. Therefore, there would be no impacts to mining from the construction of common segment 1. Common segment 1 would not affect energy leases (oil, gas, or geothermal) or resources.

4.2.2.2.6.3 Garden Valley Alternative Segments. The western junction of Garden Valley alternative segments 2 and 3 is approximately 0.8 kilometer (0.5 mile) north of the Freiberg Mining District (see Figure 3-37). Most of the past mining activity in this district occurred more than 5 kilometers (3 miles) south of this point (DIRS 173841-Shannon & Wilson 2005, pp. 99 to 101). Mineralization does not appear to trend toward the alternative segments, and the distance of the Freiberg mining activities from the Garden Valley alternative segments would preclude construction-related impacts to mining in this area. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for any of the Garden Valley alternative segments.

4.2.2.2.6.4 Caliente Common Segment 2 (Quinn Canyon Range Area). There would be no ***mining districts or areas***, or patented mining claims within the Caliente common segment 2 construction right-of-way (see Figure 3-37 and 3-38). The closest mining district would be the Queen City Mining District, 3.2 kilometers (2.0 miles) south of Caliente common segment 2, and it has only small localized areas of potential mineralization that trend away from the rail alignment (DIRS 173841-Shannon & Wilson 2005, pp. 97 to 99). Therefore, construction of Caliente common segment 2 would not impact mining in this area. There are no energy leases (oil, gas, or geothermal) that would be in the common segment 2 construction right-of-way.

4.2.2.2.6.5 South Reveille Alternative Segments. There would be no mining districts or areas, energy leases, or patented mining claims within the construction rights-of-way of the South Reveille alternative segments (see Figure 3-38). In terms of unpatented mining claims within or near the construction right-of-way, South Reveille alternative segments 2 and 3 would intersect two Township and Range Sections containing 72 mining claims. Because information is available only at the section level (where the area of a section is several times larger than a nominal area of a rail line segment that would fully bisect it), the actual number of claims within the construction right-of-way would likely be fewer. DOE would negotiate surface rights across affected unpatented mining claims with claim holders.

The closest mining area is the Reveille Valley mining area, approximately 0.8 kilometer (0.5 mile) from South Reveille alternative segment 3 and 3 kilometers (2 miles) from South Reveille alternative segment 2. Although exploration and drilling in this mining area were observed in June 2004 and the existence of a 90-year lease agreement under the Alien Gold Project indicates that exploration efforts will be ongoing, this area would not be directly impacted by the South Reveille segments (DIRS 173841-Shannon & Wilson 2005, pp. 95 to 97). There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for either South Reveille alternative segment.

4.2.2.2.6.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Only the Clifford Mining District would be near Caliente common segment 3 (see Figures 3-38 and 3-39). The Clifford Mining District is approximately 3 kilometers (2 miles) south of U.S. Highway 6 in Stone Cabin Valley, about 10 kilometers (6 miles) southwest of Warm Springs. Numerous claims have been staked in the area and exploration and mining are underway (DIRS 173841-Shannon & Wilson 2005, pp. 83 to 86). There are no patented mining claims that would be within the common segment 3 construction right-of-way, although the common segment construction right-of-way would intersect 10 Township and Range Sections containing 166 unpatented mining claims. Because data related to unpatented mining claims are available only at the section level, the actual number of unpatented claims within the construction right-of-way would likely be many fewer. DOE would negotiate the surface rights across unpatented claims that fall within the construction right-of-way. There is one underground mine (now abandoned) that would be outside the construction right-of-way, approximately 240 meters (790 feet) from common segment 3. As discussed in Chapter 2, DOE would conduct further investigations, including drilling ***boreholes***, ground-penetrating radar, and seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features.

There are no energy leases (oil, gas, or geothermal) that would be in the common segment 2 construction right-of-way.

4.2.2.2.6.7 Goldfield Alternative Segments. The only patented mining claims that would be within the rail line construction right-of-way are associated with the three Goldfield alternative segments (see Figure 3-39). Although DOE would reduce the area of disturbance to minimize impacts to these claims, Goldfield alternative segment 1 would intersect six patented mining claims; Goldfield 3 would intersect two; and Goldfield 4 would intersect four. The area of these parcels is reflected in the private land impacts in Section 4.2.2.2.1.2. Goldfield alternative segment 1 would intersect 14 sections containing 474 unpatented mining claims; Goldfield 3 would intersect 14 sections containing 359 unpatented mining claims; and Goldfield 4 would intersect 19 sections containing 538 unpatented mining claims (see Table 3-8). Because data related to unpatented mining claims are available only at the section level, the actual number of unpatented claims within the construction right-of-way would likely be many fewer. DOE would negotiate surface rights across affected unpatented mining claims with claim holders. There are no energy leases (oil, gas, or geothermal) that would be in the construction right-of-way for any of the Goldfield alternative segments.

There are a number of recorded underground tunnels, shafts, and mines that would be within the construction right-of-way of these alternative segments, and those could pose construction challenges or operational safety issues. There is one tunnel along Goldfield alternative segment 1; four associated with Goldfield 3; and one associated with Goldfield 4. Railroad construction and operations could affect these features and vice versa. As discussed in Chapter 2, DOE would conduct further investigations, including drilling boreholes, ground-penetrating radar, and seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features.

4.2.2.2.6.8 Caliente Common Segment 4 (Stonewall Flat Area). Caliente common segment 4 would cross the westernmost portion of the Stonewall Mining District (see Figures 3-39 and 3-40). However, most of the past mining activity in this district occurred approximately 5 kilometers (3 miles) east of common segment 4. The Cuprite Mining District would be west of common segment 4 but outside the construction right-of-way. Caliente common segment 4 would intersect five Township and Range Sections containing 169 unpatented mining claims. Because information is available only at the section level (where the area of a section is several times larger than a nominal area of a rail line segment that would fully bisect it), the actual number of claims within the construction right-of-way would likely be less. DOE would negotiate surface rights across affected unpatented mining claims with claim holders. There would be no patented mining claims, geothermal occurrences, or energy leases within the common segment 4 construction right-of-way. Therefore, common segment 4 would not affect mining activity or energy resources.

4.2.2.2.6.9 Bonnie Claire Alternative Segments. The Wagner Mining District would lie between the two Bonnie Claire alternative segments, just to the west of Bonnie Claire 3 (see 3.2.2-23). There are patented mining claims in this district, but they would all be outside the construction right-of-way of each alternative segment. There are no geothermal or oil and gas leases within the construction right-of-way of either alternative segment. Therefore, there would be no direct impacts to mining or energy resource extraction along either alternative segment. Section 4.2.2.2.7.2 describes potential impacts associated with road access to the patented mining claims in the Wagner Mining District.

4.2.2.2.6.10 Common Segment 5 (Sarcobatus Flat Area). The southwestern portion of the Clarkdale Mining District would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, outside the construction right-of-way (see Figure 3-40 and 3-41). Almost two-thirds of the Clarkdale Mining District is on the Nevada Test and Training Range, and the historically mined areas of the district are far enough away from common segment 5 that there would be no impacts to mining activities as a result of rail line construction (DIRS 173841-Shannon & Wilson 2005, pp. 50 to 52). Section 4.2.2.2.7.2 describes potential impacts to access to this mining district.

There are geothermal resources along U.S. Highway 95 in Sarcobatus Valley, but none would be within the rail line construction right-of-way. There is one warm spring that would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, and a geothermal well that would be approximately 0.4 kilometer (0.25 mile) northeast (DIRS 173841-Shannon & Wilson 2005, p. 50). There are no identified uses of these geothermal resources, and they would be far enough away from common segment 5 that they would not be affected by the rail line. The common segment 5 construction right-of-way would not cross any oil or gas lease areas.

4.2.2.2.6.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would intersect two sections containing 14 unpatented mining claims (DIRS 173841-Shannon & Wilson 2005, pp. 48 and 49); DOE would negotiate surface rights across affected unpatented mining claims with claim holders for either alternative segment. There are oil and gas leases north of Beatty along the southwest flank of Pahute Mesa in southern Nye County (see Figure 3-41). Oasis Valley alternative segments 1 and 3 would cross portions of this oil and gas lease block (DIRS 173837-Sweeney 2005, pp. 49 and 50). At present, the lease is not in production, and records show that there has been no exploration in these areas since the 1970s. Therefore, the Oasis Valley alternative segments would not affect ongoing operations associated with this oil and gas lease.

4.2.2.2.6.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross the northern section of the Bare Mountain Mining District. Most past mining activity in the district occurred more than 3 kilometers (2 miles) south of the common segment (see Figure 3-41). There are recently active gold mining operations within the district, approximately 6 to 8 kilometers (4 to 5 miles) from common segment 6. The Silicon Mine and Thompson Quicksilver Mine would be north of common segment 6. The Silicon Mine would be approximately 800 meters (2,500 feet) and the Thompson Quicksilver Mine would be approximately 1,400 meters (4,500 feet) outside the construction right-of-way. Recent mining activity in these areas would be outside the rail line construction right-of-way, and would not be directly affected by common segment 6. The common segment 6 construction right-of-way would intersect four sections containing 34 unpatented mining claims. DOE would negotiate the surface rights across unpatented mining claims with claim holders. Common segment 6 would not affect energy leases (oil, gas, or geothermal) or resources.

4.2.2.2.7 Construction Impacts to Recreation and Access (Private and Public Land)

DOE developed the Caliente rail alignment alternative segments and common segments to avoid crossing sensitive areas, such as Wilderness Areas, ***Wilderness Study Areas***, state and national forests and parks, and other prominent recreational and scenic areas (see Figures 3-42 through 3-49). DOE would maintain access for all existing roads the rail line would cross at or near their current location by constructing ***at-grade crossings*** (the road and the rail line would cross paths at the same elevation) or ***grade-separated crossings*** (the road and the rail line would cross paths via an overpass or an underpass), resulting in no long-term adverse impacts to traffic patterns and land access. However, there could be temporary small impacts to access to these areas during rail line construction due to temporary road closures and detours.

At locations where there would be several road crossings close to one another (generally over a distance of 0.8 kilometer [0.5 mile] or less), there could be some minor rerouting and consolidation of crossings, but these would not prevent crossing the rail line. The regulatory authority to make decisions regarding roads, road closures, and rail line crossings rests with the BLM and county and local governments. DOE would work in close consultation with these groups to ensure access would be maintained.

Although many undeveloped recreation opportunities exist over much of the public lands surrounding the rail alignment (such as off-highway vehicle use and dispersed hunting), descriptions of potential impacts in Sections 4.2.2.2.7.1 through 4.2.2.2.7.3 are limited to defined recreation areas. While impacts to non-designated recreation areas are not specifically addressed, individuals might have to alter their access routes to particular recreation areas near the rail line. Construction of the rail line might also cause some dispersed recreationists (such as hunters) who use non-designated areas nearby to temporarily relocate. Future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and the construction and operation of the railroad. Most organized off-highway vehicle events with previously approved race routes are on existing roads and trails, and access across the rail line for these events would not be compromised. However, some previously permitted routes that the rail line would cross might need to alter their crossing locations in areas where crossing are consolidated.

4.2.2.2.7.1 Lincoln County. Rail line alternative segments and common segments crossing through Lincoln County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

Both the Caliente and Eccles alternative segments would cross the Rainbow Canyon ***Back Country Byway*** (see Figure 3-43). However, DOE would install at-grade crossings at these points; thus, there would be no long-term impacts to the Byway. The Caliente alternative segment would be 3.2 kilometers (2 miles) northeast of Kershaw-Ryan State Park. The rail line would not affect the park or access thereto from existing roads.

Potential quarry CA-8B along the Caliente alternative segment would be within the 400-square-kilometer (100,000-acre) Chief Mountain Off-Highway Vehicle Emphasis Area, which is proposed under the preferred alternative of the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, Map 2.4-36). This recreation area has three primary trails – the Red Rhyolite Trail, the Grey Dome Rim Trail, and portions of the Silver State Trail. Access to these trails is primarily at Oak Springs Summit on the north side of U.S. Highway 93, 8 kilometers (5 miles) west of the City of Caliente. At their closest points, these trails would be more than 10 kilometers (6 miles) away from the quarry. Because the quarry would not interfere with the primary access to these trails and it would be many miles from active trails, there would be no impacts to these recreational areas.

Caliente common segment 1 would pass within 1.6 kilometers (1 mile) of the Weepah Spring Wilderness. However, there would be no impact to access to this area because access would be primarily south of the rail line along State Highway 318. Approximately one-third of the length of common segment 1 would pass through the northern portion of the Chief Mountain Off-Highway Vehicle Emphasis Area. The primary access to this area is from the south along U.S. Highway 93. Common segment 1 would be 5.3 kilometers (3.3 miles) southwest of Cathedral Gorge State Park and would not impact access to this park.

The Silver State Trail would be the only trail the rail alignment would intersect within the Chief Mountain area (see Figure 3-44). Bennett Pass Road, the Silver State Trail, and the rail line would all occupy the same route for approximately 1 kilometer (0.6 mile) on the west side of Bennett Pass. There is a 0.3-kilometer (0.2-mile) section on the east side of the pass where the road and the rail line would occupy the same route (DIRS 176796-Winslow 2006, p. 1).

The Humboldt-Toiyabe National Forest would lie north of Garden Valley alternative segment 3, 3.2 kilometers (2 miles) from the Garden Valley alternative segments where they converge at the easternmost end of common segment 2. Access to this national forest is by unimproved roads, which would be north of and would not intersect the rail alignment. Therefore, the rail line would not impact access to the Humboldt-Toiyabe National Forest.

Caliente common segment 2 would pass the Worthington Range Wilderness within 0.9 kilometer (0.6 mile) at its closest point. Primary access to this wilderness area is to travel on State Highway 375 northwest toward the town of Rachel and approximately 2.4 kilometers (1.5 miles) before reaching Rachel, and then turn right on an unnamed county road northbound for approximately 29 kilometers (18 miles). This primary route to the Worthington Range Wilderness includes roads that would be south of and would not intersect the rail alignment. Therefore, there would be no impacts to access to the Worthington Range Wilderness.

There are a number of privately owned parcels of land between Garden Valley alternative segments 1 and 2, but they would be outside the rail line construction right-of-way. Access to private property in Garden Valley would be through existing county roads. DOE would maintain access where the rail line would cross existing roads.

4.2.2.2.7.2 Nye County. Rail line alternative segments and common segments crossing through Nye County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

South Reveille alternative segment 2 would follow the southern boundary of the South Reveille Wilderness Study Area and would be 30 meters (100 feet) from the study area at its closest point. Rail line workers would be instructed not to trespass into the area. In addition, DOE would use institutional markers, such as temporary fencing, ropes, or other markers, to limit access. DOE would consult with the BLM about construction practices that could be used to minimize impacts to Wilderness Study Areas.

The easternmost portion of Caliente common segment 3 would pass between the South Reveille Wilderness Study Area and the Kawich Wilderness Study Area. Primary access to the South Reveille Wilderness Study Area is from roads off State Highway 375, which would be approximately 16 kilometers (10 miles) north of the rail alignment. Common segment 3 could cross access roads to the Kawich Wilderness Study Area near U.S. Highway 6 near Warm Springs, and networks of roads from the east or west of the Study Area. DOE would instruct rail line workers not to trespass into the area. In addition, DOE would use institutional markers, such as temporary fencing, ropes, or other markers, to limit access. The road between the common segment 3 construction right-of-way and the Kawich Wilderness Study Area could also serve as a visual guide for workers to avoid trespass. DOE would consult with the BLM about construction practices that could be used to minimize impacts to Wilderness Study Areas.

Bonnie Claire alternative segments 2 and 3 would cross few roads or trails (see Figure 3-48 and Table 3-9). There is no active grazing on the land surrounding these alternative segments. However, Bonnie Claire 3 would be west of and Bonnie Claire 2 would be east of patented mining claims within the Wagner Mining District (see Figure 3-48). If DOE selected Bonnie Claire 3, the rail line would cross one access road to these mining claims.

There are more than a dozen privately owned properties that would be west of common segment 5 clustered at Scottys Junction. These properties lie on either side of U.S. Highway 95. Because the rail line would be to the east of these properties and not interfere with access from U.S. Highway 95, it would not impact access to land near Scottys Junction. Common segment 5 would cross one road that provides primary access from U.S. Highway 95 to oil and gas leases that would be north of the rail line and provides access to the Nevada Test and Training Range. DOE proposes an active at-grade crossing for this location (DIRS 176165-Nevada Rail Partners 2006, pp. D-1 and D-2). However, temporary small impacts to access could occur during the construction phase.

Each of the Oasis Valley alternative segments would cross a limited number of roads (see Figure 3-49 and Table 3-9). Roads in this area provide access to private property owned by a cattle company; the northern portion of the Razorback Allotment; oil and gas leases; and the northwestern portion of the Nevada Test and Training Range. Oasis Valley alternative segment 3 would pose minimal restriction to road access from U.S. Highway 95 to the oil and gas leases and privately owned land, and access within the Razorback Allotment because it would be farthest away from these established areas.

Common segment 6 would cross six public roads, some of which provide access to the Nevada Test and Training Range and the northern portion of the Razorback Allotment (see Figure 3-49). The only privately owned properties in the vicinity of common segment 6 are west of the rail alignment at its northernmost point. These properties are adjacent to U.S. Highway 95 and the rail line would not impact access thereto.

4.2.2.2.7.3 Esmeralda County. Rail line alternative segments and common segments crossing through Esmeralda County would intersect a number of roads that provide access to nearby public and private lands (see Table 3-9).

There is privately owned land, primarily within the community of Goldfield, where access to the community is chiefly from U.S. Highway 95. Only Goldfield alternative segment 4 would cross U.S. Highway 95, and it would cross twice. If DOE selected this alternative segment, the Department would construct a grade-separated road crossing at both these intersections (DIRS 176165-Nevada Rail Partners 2006, p. D-2).

There are a number of patented and unpatented mining claims near Goldfield alternative segments 1 and 4, with a large network of roads between the two alternative segments (see Figure 3-47). If DOE selected Goldfield alternative segment 4, there would be no impacts to access to the claims east of the rail alignment. If DOE selected Goldfield alternative segment 1, the rail line would cross six roads in Esmeralda and Nye County that are not considered primary access routes.

Common segment 4 would cross a number of roads and trails (see Figure 3-47 and Table 3-9).

4.2.2.2.8 Land-Use Conflicts with Utility Corridors and Rights-of-Way

Where the rail line would cross an existing utility right-of-way, DOE would take precautions to minimize disturbance and disruption of the utilities. Section 4.2.11, Utilities, Energy, and Materials, describes measures the Department would implement to protect existing utilities.

Of the 543 kilometers (337 miles) of rail line proposed under the longest possible alignment, only 134 kilometers (83 miles), or 25 percent, would fall within corridors designated by the applicable resource management plans. However, the resource management plans allow for transportation rights-of-way outside these designated corridors if no other option is feasible and the right-of-way would not substantially conflict with other land-use goals and designations. No parts of the rail line segments would cross right-of-way avoidance areas. DOE would perform field verifications of utility right-of-way locations and would incorporate the information into the final rail line design.

Because final engineering design for utility connections is not complete, DOE does not know the exact tie-in locations for electricity along the rail alignment. While the Department expects that transmission lines could be tapped where they currently cross the proposed rail line location, there is a possibility that the project could require additional utility rights-of-way for small feeder lines.

4.2.2.3 Operations Impacts

Land-use and ownership impacts would occur before or during the railroad construction phase. The operations right-of-way would be generally narrower than the construction right-of-way along most of the rail alignment, and some of the land could therefore be returned to its previous uses.

Topics related to the quality-of-life aspects of land use include visual quality, air quality, and noise and vibration, as described in other sections of this Rail Alignment EIS (see Section 4.2.3, Aesthetic Resources; Section 4.2.4, Air Quality and Climate; and Section 4.2.8, Noise and Vibration).

Railroad operations could affect the use of grazing land. For example, the presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes after construction of the rail line was complete and could acclimate to and cross the rail line in most areas. The noise and presence of people along the rail alignment during construction activities could cause livestock to avoid nearby areas at first, although they could become accustomed to the presence of people over time (DIRS 176920-Metscher 2005, p. 4).

Nevada is an open-range state, where it is the responsibility of private landowners to fence their properties to prevent livestock from damaging their property and where ranchers could be compensated for the loss of their livestock killed by vehicles and trains. If DOE trains struck and killed livestock, DOE or the commercial carrier (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate.

As discussed in Section 4.2.2.2.6, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resources extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mine shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

The parallel rail alignment access roads (unpaved) could improve land access along most of the rail alignment. While most of the rail alignment would follow or be within a few kilometers of existing unpaved roads and trails that are currently open for public use, the new access roads could be of better quality in some areas than nearby existing roads, increasing the likelihood of use. Off-road vehicle use, hunting intensity, and other recreational activities could increase along the rail alignment access roads, Improved human and vehicle access to surrounding areas could result in indirect impacts to vegetation and wildlife, as described in Section 4.2.7, Biological Resources. Recreational uses of public land along the access roads (as with other similar roads on public land) would be monitored by the BLM to ensure compliance with its land management goals, as stated in applicable BLM resource management plans. It is important to note that DOE would not maintain the access roads as public roads, except in locations where they would be used for rerouting to consolidate rail line crossings, and the Department would post signs indicating potential users would proceed on the roads at their own risk.

Lastly, future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and operation of the rail line. This might require new routes to minimize or avoid crossing the rail line and greater manpower to implement and monitor these new routes during recreation events.

4.2.2.4 Impacts under the Shared-Use Option

Impacts to land use and ownership under the Shared-Use Option would be similar to those described for the Proposed Action without shared use, with a small addition of impacts from the construction and operation of commercial sidings. Under the Shared-Use Option, commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials (see Section 2.2.6.3). DOE cannot predict the exact locations of these possible commercial-use sidings, but they could include Caliente, Panaca/Bennett Pass, the Warm Springs Summit area, Tonopah, Goldfield, and the Beatty Wash/Oasis Valley area. The sidings would likely be constructed within the railroad operations right-of-way; if so, there would be no additional impacts to land use and ownership (see Figure 2-55). Because only approximately 1 percent of land within the rail line construction right-of-way is privately owned, any commercial sidings or commercial facilities that would be outside the construction right-of-way would likely be on BLM-administered land, and implemented under a separate BLM-issued right-of-way.

Implementation of the Shared-Use Option could facilitate the expansion or introduction of industrial (mining) or commercial operations in the region. This could have future, long-term impacts on land use, such as new or revised land-use zoning plans to accommodate industrial and commercial land uses in the vicinity of the rail line. The expansion of industrial or commercial activity from shared use of the rail line could also indirectly result in land-use changes in relation to additional residential development. Increased rail traffic could also increase the likelihood of livestock mortality along the rail line within active grazing allotments.

4.2.2.5 Summary

The Caliente rail alignment construction right-of-way would occupy between 156 and 164 square kilometers (38,500 and 40,600 acres) of land. Most of the land would be public land, although DOE would need to gain access to up to 0.72 square kilometer (178 acres) of private land for the rail alignment and another possible 1.15 square kilometers (284 acres) required to accommodate support facilities. This amount of private land would be very small (about 1 percent) compared to the total amount of land that would be required for the project.

The Caliente rail alignment would not displace existing or planned land uses over a substantial area, nor would it substantially conflict with applicable land-use plans or goals. The areas with the highest densities of private land the rail alignment would cross are near Caliente and Goldfield. If DOE selected the Caliente alternative segment, some structures at the existing Union Pacific Railroad train yard and three structures along the former Pioche and Prince Branchline would need to be demolished or relocated. This alternative segment would also occupy portions of the access road and parking lot of the Caliente Hot Springs Motel. Alternative segments near Goldfield would cross private (although vacant) land, including patented mining claims and state and county land.

DOE developed the Caliente rail alignment to avoid American Indian lands. The closest rail line segment, common segment 5, would be approximately 3 kilometers (2 miles) east of the Timbisha Shoshone Trust Lands near Scottys Junction.

The Caliente rail alignment would use up to 161.9 square kilometers (40,000 acres) of BLM-administered land. Some of the rail line segments would pass through lands the BLM has identified for potential disposal (sale). However, the land withdrawals already in place for the rail alignment and the potential use by another federal agency would take precedence over disposal actions that could affect the project.

Where the rail line segments and facilities would cross active grazing allotments on BLM-administered land, some grazing land would be lost. Because the land would be restored after the construction phase and the operations right-of-way would be smaller than the construction right-of-way, long-term impacts to grazing allotments would be small. In total, the Caliente rail alignment would result in less than a 2-percent loss of animal unit months across all affected allotments. The greatest percentage loss of animal unit months for any one grazing allotment would occur on the Black Canyon Allotment under Common Segment 1 (4.7 percent loss). Of the potential quarries, quarry CA-8B would result in the highest percentage loss of animal unit months (7.6 percent on the Highway Allotment). The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. The rail line could affect ranching operations because livestock could be struck by passing trains. DOE or the railroad’s commercial operator (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. DOE would consult with the BLM during the final design phase to determine if any of the rail line would need to be fenced.

Construction wells located on grazing allotments outside the construction right-of-way would have small and temporary impacts in terms of loss of grazing area. Once each well was drilled, DOE would reclaim the site in accordance with DOE and BLM requirements. The Department would construct a 10- to 15-centimeter (4- to 6-inch)-diameter temporary pipeline on top of the ground along access roads to transport water to the construction right-of-way. Wells not needed for railroad operations would be properly abandoned in compliance with State of Nevada regulations and sites and access roads would be reclaimed (DIRS 176172-Nevada Rail Partners 2006, p. 4-12).

Most of the local mining activity would be outside the rail line construction right-of-way. DOE would need to negotiate the surface rights to cross the few affected unpatented mining claims the rail line would cross. All the Goldfield and Oasis Valley alternative segments and common segment 6 would cross several sections that contain many unpatented mining claims. The actual number of claims the rail line construction right-of-way would cross would need to be determined through additional record searches and field verification. DOE would negotiate surface rights across affected unpatented mining claims with the claim holders. There is also the possibility that the rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design phase of the project, DOE would perform a survey to verify the locations of tunnels and shafts to avoid adverse impacts.

DOE developed the Caliente rail alignment to avoid Wilderness Areas and other scenic and recreational areas. Road crossings would be constructed to prevent the rail line from obstructing access to private and public land. While there could be temporary road closures or detours during the rail line construction phase, there would be no impact to land access during the operations phase. In addition, organized off-highway vehicle events permitted in the past by BLM might need to alter their routes to avoid the rail line.

Depending on the alternative segments selected, the rail line would cross between 12 and 34 known utility lines. DOE would negotiate crossing agreements with the right-of-way holders and the BLM to determine the duration of use, access needs, mitigation, and compensation, as applicable. DOE would protect existing utilities from damage so that disruption to utility service or damage to lines would be at most small and temporary. The project would require a new BLM right-of-way outside the existing planning corridors, which would be outside of right-of-way avoidance areas. Under the longest potential route, approximately 25 percent of the Caliente rail alignment would fall within existing planning corridors. In addition, to avoid the proliferation of new rights-of-way, the BLM may elect to grant future rights-of-way for new utilities adjacent to the proposed rail line.

Construction and operation of a railroad along the Caliente rail alignment could result in the following general impacts to land use and ownership along the entire alignment:

- Changes in land uses on private and public lands within the construction and operations rights-of-way
- Possible increase in livestock mortality (collisions with trains)
- Reduced animal unit months on affected grazing allotments as determined by the BLM
- Reduction in land available for BLM disposal
- Alteration of past routes for BLM-permitted off-highway vehicle events
- Possible expansion of mining, manufacturing, industrial, or commercial land uses under the Shared-Use Option

Tables 4-23 through 4-30 summarize potential impacts to land use and ownership for each rail line segment and construction and operations support facility.

Table 4-23. Summary of potential impacts to land use and ownership – Caliente and Eccles alternative segments (Lincoln County).

Construction impacts	Caliente	Eccles
Private parcels the alignment would cross (construction right-of-way)	32	11
Affected property owners	22	10
Land area of private land affected (including patented mining claims)	0.31 square kilometers[a]	0.32 square kilometers
Grazing allotments the alignment would cross	2	4
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	6 or 0.6 percent	18 or 1.5 percent
Allotment land that would be within the construction right-of-way	0.81 square kilometers	4.8 square kilometers
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	2 kilometers[b]	15.1 kilometers
Roads and trails the alignment would intersect	7	8
Utility lines/rights-of-way the alignment would cross or overlap	13	1

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-24. Summary of potential impacts to land use and ownership – Caliente common segments 1 through 6 (Lincoln and Nye Counties) (page 1 of 2).

Construction impacts	Common segment 1	Common segment 2	Common segment 3	Common segment 4	Common segment 5	Common segment 6
Private parcels the alignment would cross (construction right-of-way)	1	0	0	0	0	0
Affected property owners	1	0	0	0	0	0
Land area of private land affected (including patented mining claims)	0.0007 square kilometer[a]	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Grazing allotments the alignment would cross	10	3	3	1, inactive	1, inactive	1, inactive

Table 4-24. Summary of potential impacts to land use and ownership – Caliente common segments 1 through 6 (Lincoln and Nye Counties) (page 2 of 2).

Stockwater pipelines the alignment would cross	3	2	5	0	0	0
Animal unit months lost (estimated) or percent of allotment(s)	453 or 0.7 percent	128 or 0.4 percent	250 or 0.6 percent	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)
Allotment land that would be within the construction right-of-way	35 square kilometers	16 square kilometers	36 square kilometers	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)
Unpatented mining claims the alignment would cross	0	0	10 sections with 166 claims	0	0	4 sections with 34 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0	1	0	0	0
Linear distance outside BLM utility corridors	113 kilometers[b]	42.8 kilometers	33 kilometers	12 kilometers	20.2 kilometers	39.2 kilometers
Roads and trails the alignment would intersect	39	13	30	14	14	7
Utility lines/rights-of-way the alignment would cross or overlap	4	0	4	0	1	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-25. Summary of potential impacts to land use and ownership – Garden Valley alternative segments (Lincoln and Nye Counties).

Construction impacts	Garden Valley 1	Garden Valley 2	Garden Valley 3	Garden Valley 8
Private parcels the alignment would cross (construction right-of-way)	0	0	0	0
Affected property owners	0	0	0	0
Grazing allotments the alignment would cross	5	4	5	4
Stockwater pipelines the alignment would cross	1	2	1	1
Animal unit months lost (estimated) or percent of allotment(s)	120 or 1.34 percent	131 or 1.1 percent	126 or 1.4 percent	131 or 1.1 percent
Allotment land that would be within the construction right-of-way	11 square kilometers[a]	11 square kilometers	12 square kilometers	10 square kilometers
Unpatented mining claims the alignment would cross	0	0	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0	0	0
Linear distance outside BLM utility corridors	35 kilometers[b]	36 kilometers	38 kilometers	37 kilometers
Roads and trails the alignment would intersect	8	12	10	14
Utility lines/rights-of-way the alignment would cross or overlap	1	2	1	1

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-26. Summary of potential impacts to land use and ownership – South Reveille alternative segments (Nye County).

Construction impacts	South Reveille 2	South Reveille 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Grazing allotments the alignment would cross	1	1
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	54 or 0.2 percent	58 or 0.2 percent
Allotment land that would be within the construction right-of-way	5.6 square kilometers[a]	6.0 square kilometers
Unpatented mining claims the alignment would cross	2 sections with 72 claims	2 sections with 72 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	19 kilometers[b]	19 kilometers
Roads and trails the alignment would intersect	1	1
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-27. Summary of potential impacts to land use and ownership – Goldfield alternative segments (Nye and Esmeralda Counties) (page 1 of 2).

Construction impacts	Goldfield 1	Goldfield 3	Goldfield 4
Private parcels the alignment would cross (construction right-of-way)	6	2	37
Affected property owners	0	0	20
Land area of private land affected (including patented mining claims)	0.37 square kilometer[a]	0.01 square kilometer	0.23 square kilometer
Grazing allotments the alignment would cross	2, both inactive	1, inactive	2, both inactive
Stockwater pipelines the alignment would cross	0	0	4 (unused)
Animal unit months lost (estimated) or percent of allotment(s)	Not applicable	Not applicable	Not applicable
Allotment land that would be within the construction right-of-way	Not applicable	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	14 sections containing 474 claims	14 sections containing 359 claims	19 sections containing 538 claims
Underground mines, shafts, and tunnels the alignment would cross	14	4	5
Linear distance outside utility corridors	43.8 kilometers[b]	46.8 kilometers	47.9 kilometers
Roads and trails the alignment would intersect	15	5	44
Utility lines/rights-of-way the alignment would cross or overlap	0	0	8

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-28. Summary of potential impacts to land use and ownership – Bonnie Claire alternative segments (Nye County).

Construction impacts	Bonnie Claire 2	Bonnie Claire 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Land area of private land affected (including patented mining claims)		
Grazing allotments the alignment would cross	1, inactive	1 , inactive
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated)	Not applicable	Not applicable
Allotment land that would be within the construction right-of-way	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside utility corridors	20 kilometers[a]	18.4 kilometers
Roads and trails the alignment would intersect	1	4
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert kilometers to miles, multiply by 0.62137.

Table 4-29. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Lincoln, Nye, and Esmeralda Counties) (page 1 of 2).

Potential quarries	Construction impacts
CA-8B	This quarry would result in the loss of 1.3 square kilometers[a] of grazing land on the Highway Allotment, and the loss of nine animal unit months (7.6 percent loss). The quarry would also use 0.07 square kilometer of land on the Peck Allotment, resulting in a loss of less than one animal unit month (0.3 percent loss). The siding for the quarry would be on private land and would impact at least 0.27 square kilometer across two parcels (two owners).
NN-9A	This quarry would be within the Reveille Allotment, and would result in the loss of 2.0 square kilometers of grazing land and 19 animal unit months (less than 0.1 percent loss).
Potential quarries	Construction impacts
NN-9B	This quarry would be within the Reveille Allotment, and would result in the loss of 1.3 square kilometers of grazing land and 13 animal unit months (less than 0.1 percent loss).
ES-7	This quarry would be on 1.5 square kilometers of public land within an inactive grazing allotment.
NS-3A	This quarry would be on 3.8 square kilometers of public land within an inactive grazing allotment.
NS-3B	This quarry would be on 1.5 square kilometers of public land within an inactive grazing allotment.

Table 4-29. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Lincoln, Nye, and Esmeralda Counties) (page 2 of 2).

Facility	Construction impacts
Interchange Yard	The Interchange Yard would be within existing Union Pacific Railroad right-of-way. Thus, there would be no impacts.
Staging Yard at Caliente-Indian Cove	The Staging Yard would be on 0.73 square kilometer of private land (across 6 parcels). There would be direct changes to land use on this property.
Staging Yard at Caliente-Upland	The Staging Yard would be on 0.45 square kilometer of private land (across 17 parcels). There would be direct changes to land use on this property.
Staging Yard at Eccles-North	The Staging Yard would be on public land, on an active grazing allotment. The yard would use 0.3 square kilometer of grazing land, resulting in an estimated loss of 2 animal unit months on the Peck Allotment.
Maintenance-of-Way Headquarters Facility	Building would be on vacant BLM-administered land and would use 0.013 square kilometer of land. This would be a permanent change in land use.
Maintenance-of-Way Trackside Facility	Facility would be within the rail line construction right-of-way, across two active grazing allotments.
Rail Equipment Maintenance Yard, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center	These facilities would be on DOE-controlled land on the Yucca Mountain Site. There would be no change in land use or ownership.

a. To convert square kilometers to acres, multiply by 247.10.

Table 4-30. Summary of potential impacts to land use and ownership – Oasis Valley alternative segments (Nye County).

Construction impacts	Oasis Valley 1	Oasis Valley 3
Private parcels the alignment would cross (construction right-of-way)	1	0
Affected property owners	1	0
Land area of private land affected (including patented mining claims)	0.04 square kilometer[a]	Not applicable
Grazing allotments the alignment would cross	2 (1 active)	2 (1 active)
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	8 or 0.8 percent	13 or 1.4 percent
Allotment land that would be within the construction right-of-way	2.3 square kilometers	3.8 square kilometers
Unpatented mining claims the alignment would cross	2 sections containing 14 claims	2 sections containing 14 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	1.7 kilometers[b]	4 kilometers
Roads and trails the alignment would intersect	3	3
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

4.2.3 AESTHETIC RESOURCES

This section describes potential impacts to aesthetic (visual) resources from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.3.1 describes the methods DOE used to assess potential impacts; Section 4.2.3.2 describes potential impacts during the construction phase; Section 4.2.3.3 describes potential impacts during the operations phase; Section 4.2.3.4 describes potential impacts under the Shared-Use Option; and Section 4.2.3.5 summarizes potential impacts to aesthetic resources.

Section 3.2.3.1 describes the region of influence for aesthetic resources along the Caliente rail alignment.

4.2.3.1 Impact Assessment Methodology

4.2.3.1.1 Approach

Most of the lands along the Caliente rail alignment are BLM-administered public lands. For this reason, DOE utilized BLM methods to evaluate potential impacts to visual resources.

The BLM uses a process to rate visual resource contrast and evaluate the magnitude of a project's impact on existing visual resources (DIRS 173053-BLM 1986, all). The BLM evaluates the contrast between existing conditions and conditions expected during a project, drawing on information from the BLM visual resource management inventory, which the BLM uses to classify the aesthetic value of BLM-administered lands (DIRS 101505-BLM 1986, all). BLM management objectives allow different levels of project-related contrast for each visual resource management class (DIRS 101505-BLM 1986, Section VB). Figure 3-58 in Section 3.2.3 shows the visual resource management classes for lands surrounding the Caliente rail alignment. DOE used the BLM methodology to assign visual resource management classes to non-BLM public and private land.

To identify potential impacts to aesthetic resources, DOE applied the process for rating visual resource contrast specified in BLM Manual Handbook 8431-1. This process involved comparing the existing and proposed conditions in relation to:

- Landform, vegetative features, and structural features (such as existing and proposed rail roadbeds, power distribution lines, buildings, and communication towers)
- Form, line, color, and texture
- Other factors including distance, angle of observation, how long the project feature would be visible, relative size or scale, season of use, light conditions, recovery time for vegetation after construction, spatial relationships, and atmospheric conditions

DOE developed contrast ratings using the methodology in BLM Manual Handbook 8410-1 (DIRS 101505-BLM 1986, all) from the key observation points identified in Section 3.2.3 (see Figure 3-58). DOE prepared simulations to illustrate the expected project-related contrast at some key observation points. Appendix D, Aesthetics, Section D.1, provides baseline photographs and simulations for the Caliente rail alignment.

4.2.3.1.2 Criteria for Determining Impacts

DOE used the criteria listed in Table 4-31 to rank the contrast between existing conditions and conditions expected during the railroad construction and operations phases at each key observation point. DOE then considered contrast ratings against the BLM visual resource management objectives listed in Table 4-32, where applicable. In general, the BLM manages areas of high visual value (Classes I and II) to minimize contrast, while allowing more contrast in areas of lower visual value (Classes III and IV).

Table 4-31. Criteria for determining degree of visual contrast.[a]

Degree of contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

a. Source: DIRS 173053-BLM 1986, Section III.D.2.a.

In this analysis, the primary basis for identifying potential adverse impacts to aesthetic resources is inconsistency with BLM management objectives for a ***viewshed***. This includes consideration of effects on the visual values of parks, recreation areas, and other scenic resources (recognized at the national, state, or local level) and visual intrusions or contrasts affecting the quality of landscapes. Along much of the Caliente rail alignment, where the landscape is sparsely populated and undeveloped, the visual impact of equipment, facilities, and activities could create a weak or moderate contrast, according to the criteria listed in Table 4-31. That is, from key observation points that are within a few miles, equipment, facilities, and activities could be seen (weak contrast) or would begin to attract attention and begin to dominate the viewshed (moderate contrast). However, as noted in BLM guidance, distance and duration of project activities affect perceptions of contrast (DIRS 173053-BLM 1986, Section III.D.2.b).

Table 4-32. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

Distance of an observer from project activities and facilities would greatly affect the observer's perception of project-related contrasts with the landscape. The likelihood that activities or facilities would divert an observer's attention away from the landscape would decrease as distance increased.

Thus, views from observation points where the project would appear in ***distance zones*** foreground or middleground would usually be affected more than views from observation points where the project was in the background.

Duration of activities also affects conclusions about a project's consistency with BLM visual resource management objectives in a particular location. For example, visible construction activities over 18 months could cause a moderate degree of contrast and be inconsistent with Class II objectives. Such activities would be recognized as a moderate adverse impact of construction in Class II areas, although BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7). In contrast, passage of a train on a track more than approximately 1.6 kilometers (1 mile) from observers for a few minutes three times a day for up to 50 years might comply with Class II objectives if the track itself did not attract attention or dominate the view of a casual viewer, thus creating only a weak degree of contrast. In such a case, presence of the rail line would be recognized as a small adverse impact of operation.

4.2.3.2 Construction Impacts

Table 4-33 lists contrast ratings for views from each key observation point along the Caliente rail alignment and consideration of project consistency with BLM management objectives. In cases where construction and operations activities would cause different levels of contrast, the table identifies the phase for each rating; otherwise, a single rating applies to both construction and operations. Figure 4-1 is the same as Figure 3-58 in Section 3.2.3, showing visual resource management classifications of lands around each key observation point. It is a useful reference when reading impact discussions in this section. Appendix D, Section D.1, provides photographs of views from each key observation point and simulations of views including the track, trains, or other features.

4.2.3.2.1 Construction Impacts Common to the Entire Caliente Rail Alignment

Construction-related equipment, facilities, and activities would be potential sources of short-term (temporary) impacts to visual resources during the construction phase. Most of the equipment, facilities, and activities would be situated within the nominal width of the construction right-of-way. From some viewpoints, the presence of workers, vehicles, equipment, supply trains, borrow sites, quarries, laydown yards, well pads, construction camps, and electric distribution lines, and the generation of dust and vehicle exhaust, might be seen or might attract the attention of a casual observer during construction. These would result in small impacts to visual setting except in areas discussed in Section 4.2.3.2.2.

New cut and fill slopes could temporarily result in a weak to strong contrast with adjacent soils and vegetation. The short-term level of impact to the visual setting from this contrast would be small to large, and would decrease with the reestablishment of vegetation. Cuts in virgin rock would initially show a weak to strong contrast between freshly exposed rock and previously weathered rock. Without mitigation, this contrast would result in long-term small to large impacts to the visual setting.

Construction supply trains consisting of 8 to 20 cars would pass eight times per day, at most (loaded on the trip out, empty on the return), along rail line segments under active construction. Construction trains would likely be visible for between 5 and 20 minutes from a single vantage point, depending on train speed and terrain. In addition, small pieces of equipment such as track tampers, ballast regulators, tie handlers, rail-clip applicators, and ballast consolidators would pass two to eight times per day (DIRS 180874 -Nevada Rail Partners 2007, Appendix A). The level of impact to visual resources would be small.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 1 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
1	U.S. Highway 93 at Dry Lake Valley, views toward common segment 1	Surrounding lands (III and IV), Highland and Chief Ranges (II and III)	None	Yes	Small	Rail line would not be visible to viewers.
2	Staging Yard Caliente-Indian Cove option, view north	Surrounding lands (III)	Moderate	Yes	Moderate	
3	Conveyer crossing U.S. Highway 93 to feed Staging Yard Caliente-Indian Cove option, view north-northwest	Surrounding lands (II)	Construction: moderate Operations: weak	No Yes	Constructio n: moderate Operation: small	DOE would dismantle the quarry conveyor system after construction was complete. Only the track would be source of operations impact.
4	Conveyor crossing U.S. Highway 93 to feed Staging Yard Caliente-Upland option, view south-southwest	Surrounding lands (III)	Construction: moderate Operations: none	Yes	Constructio n: moderate Operation: small	DOE would dismantle the quarry conveyor system after construction was complete.
5	Staging Yard Caliente-Upland option, view north-northeast	Surrounding lands (III)	Weak to none	Yes	Small	Presence of other structures would minimize contrast.
6	Rail line crossing of U.S. Highway 93, view north-northeast to common segment 1	Surrounding lands (III)	Weak	Yes	Small	
7	U.S. Highway 93 north of rail line crossing, view west toward common segment 1	Surrounding lands (III), Big Hogback (II)	Weak	Yes	Small	Rail line would not be visible in view toward Big Hogback.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 2 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
8	U.S. Highway 93 at State Route 319	Surrounding lands (III)	None to weak	Yes	Small	Class II lands of Cathedral Gorge would not be visible to the north; rail line could be faintly visible to the south.
9	Miller Point - Cathedral Gorge, view south toward common segment 1	Surrounding lands (III), Cathedral Gorge State Park (II)	Weak	Yes	Small	Rail line would barely be visible from the park.
10	State Route 318 crossing, view northwest toward common segment 1	Surrounding lands (III), Weepah Springs Wilderness (I)	Weak	Yes	Small	Typical highway crossing structure would not draw attention.
11	Off county road west of State Route 318 north of rail line crossing, view west toward common segment 1	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)	Weak	Yes	Small	Distance from key observation point would reduce contrast.
12	Rail line crossing Timber Mountain Pass Road, view east-northeast	Surrounding lands (III), Timber Mountain (II), Weepah Springs Wilderness (I)	Moderate	Yes	Moderate	

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 3 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
13 and 15	County road on south side of Garden Valley, views toward Garden Valley alternative segments	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1 or Garden Valley 3: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer and; would not detract from views of surrounding mountains.
			Construction of Garden Valley 2 or Garden Valley 8: strong to none	No	Large to small	Contrast would be reduced with increased distance from viewer and; would not detract from views of surrounding mountains.
			Operation of Garden Valley 1 or Garden Valley 3: weak to none	Yes	Small	
			Operation of Garden Valley 2 or Garden Valley 8: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer; an earthwork berm with soil and vegetation consistent with surrounding landscape would reduce contrast of nearby track to weak.

Table 4-33. Contrast ratings along the proposed rail alignment and consistency with BLM objectives (page 4 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
14	County road in middle of Garden Valley, view south to Garden Valley alternative segments 1, 2, and 8	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1: strong to none	No	Large to small	Would demand attention where close to viewer and would be less noticeable with increasing distance from viewer.
			Construction of Garden Valley 3: moderate to none	No	Moderate to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 2, Garden Valley 8: weak to none	Yes	Small	
			Operation of Garden Valley 1: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer; an earthwork berm with soil and vegetation consistent with surrounding landscape would reduce contrast of nearby track to weak.
			Operation of Garden Valley 2, 3, or 8 weak to none	Yes	Small	

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 5 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
16 to 18	Top of *City* structure element, views toward Garden Valley alternative segments	Garden Valley (II), Golden Gate Range (III), Quinn Canyon Range (III), Quinn Canyon Wilderness (I), Grant Range Wilderness (I), Worthington Mountains (II), Worthington Mountains Wilderness (I)	Construction of Garden Valley 1: moderate to weak	No	Moderate to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 2 or Garden Valley 8: strong to none	No	Large to small	Contrast would be reduced with increased distance from viewer.
			Construction of Garden Valley 3: weak to none	Yes	Small	Contrast would be reduced with increased distance from viewer.
			Operation of Garden Valley 1, Garden Valley 2, or Garden Valley 8: weak to none	Yes	Small	Track and train would cause weak contrast; contrast would be reduced with increased distance from viewer.
			Operation of Garden Valley 3: none	Yes	Small	
19	State Route 375 near rail line crossing, view south-southwest toward common segment 2 and construction camp	Surrounding lands (IV)	Weak	Yes	Small	Construction camp and grade-separated crossing would be visible but would not draw attention.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 6 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
20	Cedar Pipeline Ranch, view northeast toward common segment 2	Surrounding lands (IV), Kawich Range (II), Reveille Range (II), Quinn Canyon Range (III), South Reveille Wilderness Study Area (I)	Moderate to weak	Yes	Moderate to small	
21, 22	Near intersection of U.S. Highway 6 and State Route 375, views toward common segment 3	Surrounding lands (IV), Kawich Range (II), Kawich Wilderness Study Area (I)	Weak	Yes	Small	Rail line would cross Class IV; contrast against Class II; distance would reduce contrast against Class II background or topography would impede view of rail line.
23	U.S. Highway 6 on east side of Warm Springs Summit, view south-southwest toward common segment 3	Surrounding lands (IV), Kawich Range (II)	Weak	Yes	Small	Rail line would cross Class IV; hilly topography would reduce contrast against Class II background.
24	Warm Springs Summit, view east-southeast toward common segment 3	Surrounding lands (IV), Kawich Range (II)	None	Yes	Small	Rail line would be in a cut, not visible from highway; no contrast with Class II background.
25	U.S. Highway 6 at a mine access road, view southeast toward common segment 3	Surrounding lands (IV), Kawich Range (II), Kawich Wilderness Study Area (I)	None	Yes	Small	Rail line would be in a cut, not visible from highway; no contrast with Class II background.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 7 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
26	Nevada Test and Training Range Road near rail line crossing, view east-northeast toward common segment 3	Surrounding lands (IV), Kawich Wilderness Study Area (I)	Weak	Yes	Small	
27	Nevada Test and Training Range Road, view east-northeast toward common segment 3	Surrounding lands (IV), Kawich Wilderness Study Area (I)	Weak	Yes	Small	Distance would eliminate contrast with Class I background.
28	U.S. Highway 6 at Nevada Test and Training Range Road, view southwest toward common segment 3	Surrounding lands (IV)	Weak	Yes	Small	
29	U.S. Highway 95 north of Goldfield, view east-northeast toward quarry	Surrounding lands (IV)	Weak	Yes	Small	Distance of quarry facilities would minimize contrast.
30	U.S. Highway 95 at north end of Goldfield, view south-southeast toward Goldfield 4	Surrounding lands (IV)	Weak	Yes	Small	Topography and distance would minimize contrast.
31	Rail line crossing U.S. Highway 95 south of Goldfield, view south-southeast toward Goldfield 4	Surrounding lands (IV)	Weak	Yes	Small	Typical highway crossing structure would not draw attention.
32	U.S. Highway 95 at State Route 266, view east to common segment 4	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)	Weak	Yes	Small	Rail line would be distant from Class II feature, which would be in background; Class III lands would not be visible in views from highway over the track.

Table 4-33. Contrast ratings along the Caliente rail alignment and consistency with BLM objectives (page 8 of 8).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
33	U.S. Highway 95 at State Route 267, view north-northeast over common segment 5	Surrounding lands (IV), State Route 267 (III)	Weak	Yes	Small	
34	U.S. Highway 95 (typical cut), view toward common segment 5 hill cuts	Surrounding lands (IV)	Strong to moderate	Yes	Large to moderate	
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)	Weak	Yes	Small	Rail line would be visible but would not attract attention away from topography in background.
36	U.S. Highway 95 and Beatty Wash access road, view northeast to construction access road	Surrounding lands (IV)	None to weak	Yes	Small	Rail line would not be visible from key observation point; increased traffic along access road would be visible but would not attract attention.
37	U.S. Highway 95 at proposed Maintenance-of-Way Headquarters Facility, view northeast to facility	Surrounding lands (IV)	Weak	Yes	Small	

a. Source: DIRS 101505-BLM 1986, Section V.B.
b. Contrast rating definitions from DIRS 173053-BLM 1986, Section III.D.2.a; see Table 4.4-1.
c. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).
d. Impact level definitions from Section 4.1.

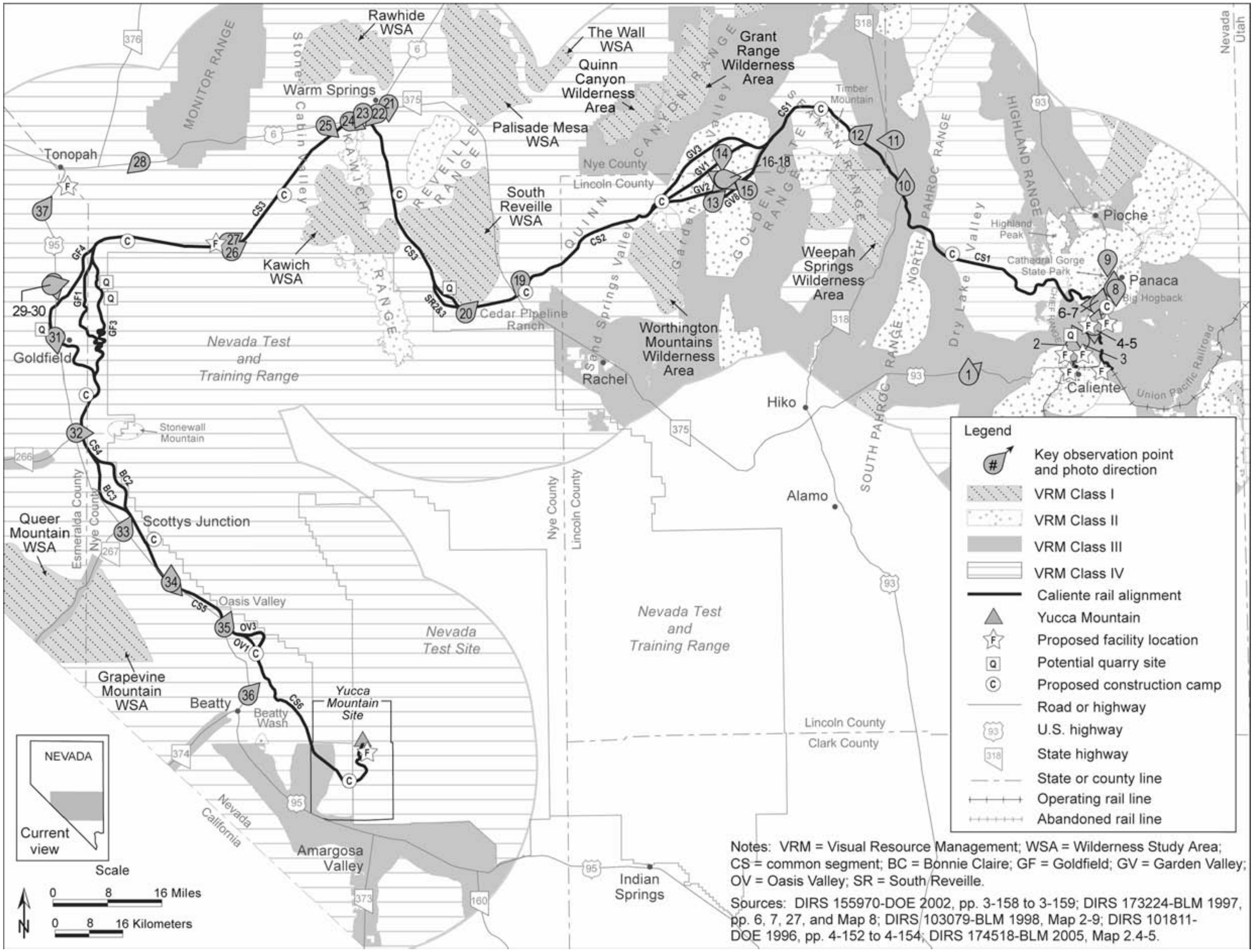


Figure 4-1. Visual resource management classifications and key observation points along the Caliente rail alignment.

Activities associated with two of the potential quarry sites would be visible from highways. One, quarry NS-3A (see Figure 2-9) northeast of Goldfield, would be in Class IV lands more than 8 kilometers (5 miles) from U.S. Highway 95. Because of their distance from the viewer, the quarry and ballast production facilities would cause weak or no contrast from the nearest key observation point (29); see Figure D-68 in Appendix D. A potential quarry site north of Caliente, CA-8B (see Figure 2-25), would not be visible to passersby, but a conveyor to carry material from the quarry to the Staging Yard, either at Caliente-Indian Cove or Caliente-Upland, would be visible from U.S. Highway 93 at key observation point 3 or 4 (see Figure 4-2, and Figures D-7 through D-9 in Appendix D) while it was under construction and during quarry operation. DOE would remove the conveyor once quarry operations ended. Activities associated with potential quarry sites NA-9A or NA-9B between the Reveille and Kawich Ranges would cause moderate to high contrast to viewers on a lightly traveled county road. This level of contrast is compatible with objectives for the Class IV lands in which the quarries would be located. Potential quarry sites ES-7 west of Goldfield and NS-3B east of Goldfield would not be visible from highways or county roads.

In situations where water wells could not be constructed within the nominal width of the construction right-of-way (see Figure 2-3), they would lie within a 23-square-meter (250-square-foot) drilling area, connected to the construction right-of-way by small pipelines feeding temporary 9.3-square-meter (100-square-foot) reservoirs. These would cause localized short-term weak-to-moderate contrast, compatible with BLM management objectives in surrounding lands, except for Class II lands in Garden Valley.

Up to 12 temporary construction camps would be situated along the rail alignment at intervals of approximately 50 kilometers (30 miles) (see Figure 2-22). The camps, which would each average 0.1 square kilometer (25 acres) in size, would have a long and narrow layout of approximately 730 meters by 120 meters (2,400 feet by 400 feet) and would be within the nominal width of the rail line construction right-of-way as close as possible to intersections of existing public roads and the rail alignment access roads. Each camp would consist of single-story housing, offices, support facilities (commissary, kitchen, cafeteria, recreation facilities, service station, fueling area, and medical facilities), utilities (power lines, water- and wastewater-treatment facilities, and trash storage), a contractor work area (sections for maintenance and parts and materials storage), and parking (DIRS 180922-Nevada Rail Partners 2007, Chapter 4). The most visible structures at each construction camp would be the housing facilities. The camps would contrast weakly against the landscape as observed by passing motorists, resulting in short-term small impacts to the visual setting. See Figure 4-3 for a simulation showing a construction camp.

Electricity distribution lines would be buried within the operations right-of-way over the length of the rail line. Where the lines connected to the commercial power grid, an electrical substation and a line of power poles extending from the substation to the rail line would be visible. These would cause weak contrast against the existing transmission lines of the commercial power grid, with corresponding small impacts to the visual setting. Temporary poles would also be visible carrying power to facilities within construction camps, contributing to short-term small impacts to the visual setting around the camps.

Construction duration at most individual locations along the rail line would be a period of weeks or a few months under a 4-year construction schedule. Under a 10-year schedule, there would be multiple phases of work (of weeks or a few months) separated by years of inactivity. Active construction would be longer at locations of major structures, such as bridges and railroad operations support facilities, but nowhere would construction be expected to exceed 18 continuous months except at the bridge over Beatty Wash, which DOE expects would take 2 years to construct. DOE would withdraw construction camps from service and keep them in reserve during periods of construction inactivity, and would close camps and reclaim the land as sections of the rail line were completed.

Figure 4-2. Simulation of rock conveyor in view south-southwest from key observation point 4 on U.S. Highway 93.

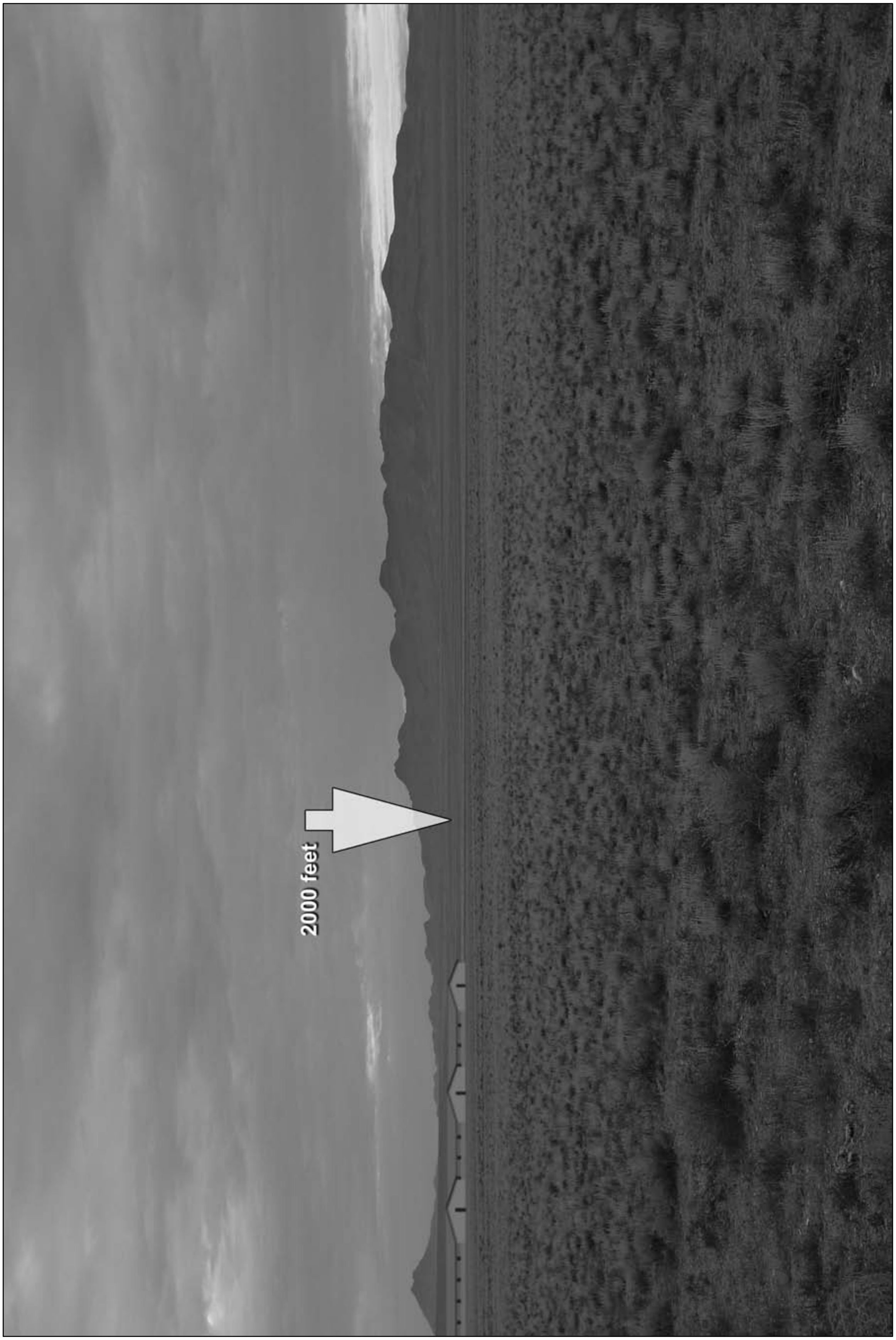


Figure 4-3. Simulation of track and construction camp in view south-southwest from key observation point 19 on State Route 375.

Thus, a longer construction schedule would not increase the level of visual impact because inactivity would minimize the visual contrast at individual locations where construction was halted, although the impact of disturbed soil and vegetation would be prolonged. Under either construction schedule, DOE would consider requests by local governments to leave individual construction camp sites (the cleared and hardened site the camp occupied) in place after permanent closure of the facility for possible use by these governments or their designees. The visual impacts from these sites would likely be small because the Department would remove equipment and structures prior to transfer, and rail line-related construction activities would cease.

Considering the effects of distance and duration, construction activities or facilities would either not be visible or would be noticeable during the construction phase but would not dominate the attention of a viewer. That is, they would create no contrast or a weak degree of contrast at key observation points, with the exception of those discussed in Section 4.2.3.2.2. A weak degree of contrast, even where Class I and II lands are present in the viewshed, is compatible with BLM management objectives for all classes of land. Thus, there would be small, temporary project-related impacts to the visual setting during construction of any of the Caliente rail alignment alternative segments and common segments, except as described in Section 4.2.3.2.2. As noted in Section 4.2.3.1.2, BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.2.3.2.2 Construction Impacts along Alternative Segments and Common Segments

The aesthetic resources impact analysis identified moderate or strong contrast ratings associated with rail line construction along four portions of the Caliente rail alignment, as described in Sections 4.2.3.2.2.1 through 4.2.3.2.2.4.

4.2.3.2.2.1 Facilities at the Interchange with the Union Pacific Railroad Mainline. The Staging Yard, Caliente-Indian Cove option, would be within non-BLM-administered lands that would be considered as Class III with application of the BLM methodology (DIRS 176988-Quick 2006, all). Because it would lie so close to U.S. Highway 93, construction of the Staging Yard in these Class III lands would likely draw the attention of passing motorists, resulting in a moderate contrast rating from key observation point 2 (see Figures D-4 through D-6 in Appendix D). Construction and use of a rock conveyor across the highway to bring ballast from potential quarry site CA-8B to the north end of the Staging Yard would also cause moderate contrast from adjacent key observation point 3 against the Class II BLM-administered lands north of the Staging Yard (see Figure D-7 in Appendix D). If DOE selected the Caliente-Upland option for the Staging Yard, the conveyor would cross the highway farther north, near key observation point 4; construction and use of a conveyor there would also cause a moderate contrast, but against Class III lands (see Figure 4-2, and Figures D-8 and D-9 in Appendix D). A contrast rating of moderate means that construction activity would meet BLM management objectives for the Class III lands in the Upland area, but not for the Class II lands in the Indian Cove area.

4.2.3.2.2.2 Common Segment 1. Caliente common segment 1 would pass through the Chief and Highland Ranges, where portions of the landscape are Class II. Construction activities would attract the attention of viewers, if any, and result in a moderate contrast rating if a key observation point existed within the area. However, because the Caliente common segment 1 crossing of the Class II lands in this area would not be visible from public roads there would be no contrast from key observation points (see Appendix D, Figures D-2 and D-15 through D-17, which show views from key observation points 1 and 7), and construction would be consistent with BLM management objectives for this Class II area.

4.2.3.2.2.3 Garden Valley Alternative Segments. The rail line would cross the Class II lands of Garden Valley. To evaluate impacts, DOE established contrast ratings from key observation points (13 and 15) on a county road in the south of Garden Valley, from a key observation point (14) on a county road in the middle of Garden Valley, and from key observation points (16 to 18) on top of one of the structures comprising City, a sculpture. Appendix D, Figures D-29 through D-50, provide views across the Garden Valley alternative segments from these key observation points. In rating contrast, DOE assumed that construction activities would be confined to laying track along one of the alternative segments, with one construction camp near the west end of the valley and with laydown yards situated within the construction right-of-way. One general finding from all key observation points was that the contrast expected from construction activities would decrease with distance from the viewer.

Views from key observation points 13 and 15, on a county road in the south of Garden Valley, would show strong to moderate contrast of construction activities along Garden Valley alternative segment 2 and Garden Valley alternative segment 8 within approximately 10 kilometers (6 miles), especially where Garden Valley alternative segment 8 would run parallel and immediately adjacent to one of the county roads. Construction would show moderate contrast against foothills to the east and west when viewed from these county roads, diminishing to weak or none when construction activities reached approximately more than 20 kilometers (12 miles) to the west. Views to the north and northwest would show weak contrast along Garden Valley alternative segment 1, diminishing to none with distance; and weak contrast, if any, with activities along Garden Valley alternative segment 3.

From key observation point 14, on a county road in the middle of Garden Valley, the view across the immediately adjacent portion of Garden Valley alternative segment 1 would show strong contrast during construction, but construction along more distant portions would show less contrast. From key observation point 14, activities along Garden Valley alternative segment 2, Garden Valley alternative segment 3, and Garden Valley alternative segment 8 would cause weak contrast, except where Garden Valley alternative segment 3 would be within approximately 10 kilometers (6 miles), where the construction activities would contrast moderately with the surroundings.

These findings indicate that construction along any of the Garden Valley alternative segments, when viewed from county roads near the construction activities, would not meet the BLM Class II objectives for the area over a period of a few months under the 4-year construction schedule, or for several periods of a few months under a longer construction schedule, because the BLM objectives provide only for management activities that "may be seen but should not attract the attention of the casual observer."

Views toward Garden Valley alternative segment 1 from key observation points 16 to 18 on top of a structure within *City* would show moderate to weak contrast between construction activities and the landscape. Activities would be visible from the tops of *City* structures, though not visible from portions of the sculpture that are below grade. Project construction would be more visible along the flat lands of Garden Valley, especially along portions of Garden Valley alternative segment 1 within a few kilometers of the key observation point. Construction would be less visible against the foothills to the east and west, both because of distance and because of a more complex visual background. The distance of the construction from the observer would help to minimize visual impacts. The construction camp at the west end of the valley would not be discernible. The resulting contrast rating of moderate to weak would not meet BLM Class II management objectives over a period of a few months under the 4-year construction schedule, or for several periods of a few months under a longer construction schedule.

Views toward Garden Valley alternative segment 2 and Garden Valley alternative segment 8 from the key observation points on top of a structure within *City* would show strong to moderate contrast of construction activities against the landscape, diminishing to weak or none with distance. Construction activities along Garden Valley alternative segment 2 and Garden Valley alternative segment 8 would be visible from the tops of *City* structures though not visible from portions of the sculpture that are below grade. Construction activities would be highly visible along the nearby flat lands of Garden Valley and less visible in the more distant and more variegated foothills to the east and west. Because Garden Valley alternative segment 8 is farther away from the *City* key observation points than Garden Valley alternative segment 2 for most of its length, construction activities would be less noticeable on Garden Valley 8 than on Garden Valley 2. The resulting contrast rating of strong to none for Garden Valley alternative segment 2 and Garden Valley alternative segment 8 would not meet BLM Class II management objectives during construction of parts of Garden Valley alternative segment 2 or Garden Valley alternative segment 8 in the flat lands over a period of a few months under the 4-year construction schedule or several periods of a few months under a longer construction schedule.

Construction of Garden Valley alternative segment 3 would barely be visible from key observation points within *City* and at most would create a weak level of contrast. The contrast rating of weak to none would meet BLM management objectives for Class II.

4.2.3.2.2.4 South Reveille Alternative Segments. Activities associated with potential quarry sites NA-9A or NA-9B would cause moderate contrast visible to viewers on the lightly traveled county road that passes within a few hundred meters of the potential quarry sites. The sites and surrounding area between them and the county road all fall on Class IV lands. The contrast rating of moderate would meet BLM Class IV management objectives.

4.2.3.3 Operations Impacts

4.2.3.3.1 Operations Impacts Common to the Entire Caliente Rail Alignment

Sources of potential impacts to the visual setting during the operations phase would be the presence of the rail line and the operations support facilities in the landscape, and the passage of trains to and from the repository. There would be less impact to the visual setting during the operations phase than during the construction phase, because there would be less activity (fewer, shorter trains and equipment, and fewer people), the operations right-of-way (nominally 61 meters [200 feet] on either side of the centerline of the rail line) would be narrower in some areas, and disturbed areas outside the operations right-of-way would be reclaimed (see Chapter 7 for a discussion of best management practices).

The primary visual impact of railroad operations would be the existence of the linear track for up to 540 kilometers (340 miles), with ***wayside signals*** and communications towers visible from short distances. In addition to the impact of the track itself, the passage of a train would attract the attention of a casual observer, both because of the sound associated with the train and its appearance on the track, but this would be an infrequent, short-duration visual distraction. DOE anticipates an approximate peak frequency of 17 one-way trips per week (DIRS 180874-Nevada Rail Partners 2007, Appendix C). This would average fewer than three one-way trips per day. Trains would be up to 19 cars long, and would likely be visible for between 5 and 20 minutes from a single vantage point, depending on train speed and terrain. Passage of these trains would create a small impact to the visual setting.

DOE would install 4.6-meter (15-foot)-tall wayside signals to control train movements along the rail alignment at intervals sufficient to connect each by line-of-sight. DOE would place 23-to-30-meter (75- to-100 foot)-tall radio communications towers at the beginning and the end of the line and at intervals along the rail line as needed to ensure signal transmission (DIRS 180923-Nevada Rail Partners 2007, Chapter 6). See Figures 4-4 and 4-5 for simulations showing signals and communications towers. The wayside signals, radio communication towers, and distribution lines all would create small impacts to the visual setting unless placed in visually sensitive areas close to observers, where impacts could be moderate or large. DOE established contrast ratings at key observation points considering the view of the rail line or operations support facilities and the nature and extent of operations activities that would be visible. The Department compared ratings with BLM visual resource management objectives for the lands in the viewshed.

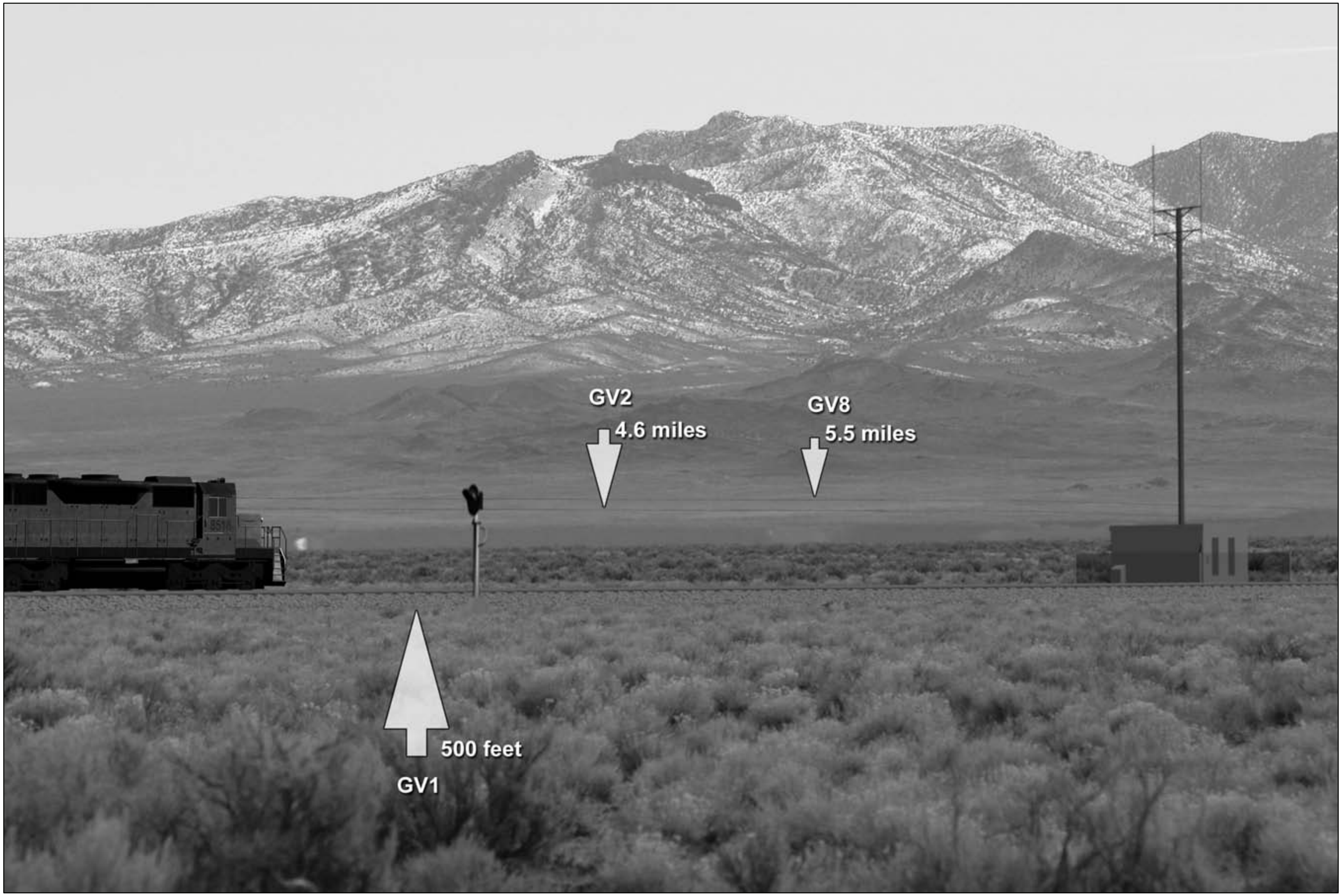


Figure 4-4. Simulation of view south from key observation point 14 on a county road in the middle of Garden Valley, showing track on three alternative segments, and a train and signal and communications tower along Garden Valley 1.

Figure 4-5. Simulation of train, track, and communications tower in view south-southwest from key observation point 23 on U.S. Highway 6 east of Warm Springs Summit (power poles in photo are not related to proposed project).

Contrast ratings at all key observation points confirmed that the presence of the rail line itself, while noticeable in some cases, would not dominate a viewer's attention and would result in a weak level of contrast (see Figure 4-6), except in some cases where the rail line would be within approximately 1.6 kilometers (1 mile) of the viewer and the linear track would cause a moderate contrast (see Section 4.2.3.3.2). A weak level of contrast is compatible with BLM management objectives for all classes of land; a moderate level of contrast is compatible with BLM management objectives for Class III and IV lands, but not for Class II lands. Ratings from key observation points with views of operations support facilities found contrasts would range from moderate to none, compatible with the Class III and IV lands that would surround the locations of the facilities. These include the grade-separated crossings of U.S. Highways 93 and 95 and State Routes 318 and 375 (see Figures 4-7 and 4-8, and Figures D-13, D-14, and D-22 in Appendix D). As transportation structures familiar to motorists, these would not draw attention away from the surrounding landscape.

Contrast ratings confirmed that the level of contrast between a passing train and the landscape would be strong (demanding a viewer's attention) or moderate (beginning to attract attention) where the rail line would fall in the foreground or middleground of the viewshed. Contrast between the landscape and a passing train would be less where the rail line would be in the background. In such cases, the level of contrast would be moderate or weak, where the passing of a train could be noticeable but would not demand attention (see Figure 4-6). The extremely short duration of the passage would diminish the effect, so that BLM management objectives would be met for Class II, III, and IV lands, even if the rail line were to fall in the foreground or middleground of the viewshed, as long as it would not create a linear feature across the landscape that would attract attention or would begin to dominate the landscape.

4.2.3.3.2 Operations Impacts along Alternative Segments and Common Segments

The analysis of impacts to aesthetic resources identified moderate contrast ratings associated with railroad operations along two portions of the Caliente rail alignment, as discussed in Sections 4.2.3.3.2.1 and 4.2.3.3.2.2.

4.2.3.3.2.1 Facilities at the Interface with the Union Pacific Railroad Mainline. Operation of the Staging Yard, Caliente-Indian Cove option, would likely draw the attention of passing motorists on U.S. Highway 93, resulting in a moderate contrast rating from key observation point 2. This moderate adverse impact would be consistent with BLM Class III management objectives, applicable to the non-BLM-administered lands here that would be considered Class III with application of the BLM methodology (DIRS 176988-Quick 2006, all). Presence of the track north of the Staging Yard would create only a weak contrast because it would follow the line of a former rail roadbed that is currently visible as a linear berm near the highway. This weak contrast would be consistent with BLM Class II management objectives applicable to these lands.

4.2.3.3.2.2 Garden Valley Alternative Segments. Views toward all four Garden Valley alternative segments from the key observation points on county roads show weak contrast of the rail line against the landscape, depending on the distance and intervening topography and vegetation. The communications tower would be much less noticeable at a distance of approximately 0.8 kilometer (0.5 mile) in Figure 4-9 than at approximately 150 meters (500 feet) in Figure 4-4. At short distances, passage of a train would increase the contrast to strong for the short duration of the passage, but not enough to raise the overall contrast rating.

Based on views from the key observation points and the simulations for Figures D-29 through D-37 in Appendix D of track, train, and communications signals in the views, it can be concluded that where the track would be more than approximately 1.6 kilometers (1 mile) from a viewer on a county road in Garden Valley, it would not create a new linear feature that would begin to attract attention or begin to dominate the landscape; that is, it would not create a moderate level of contrast.

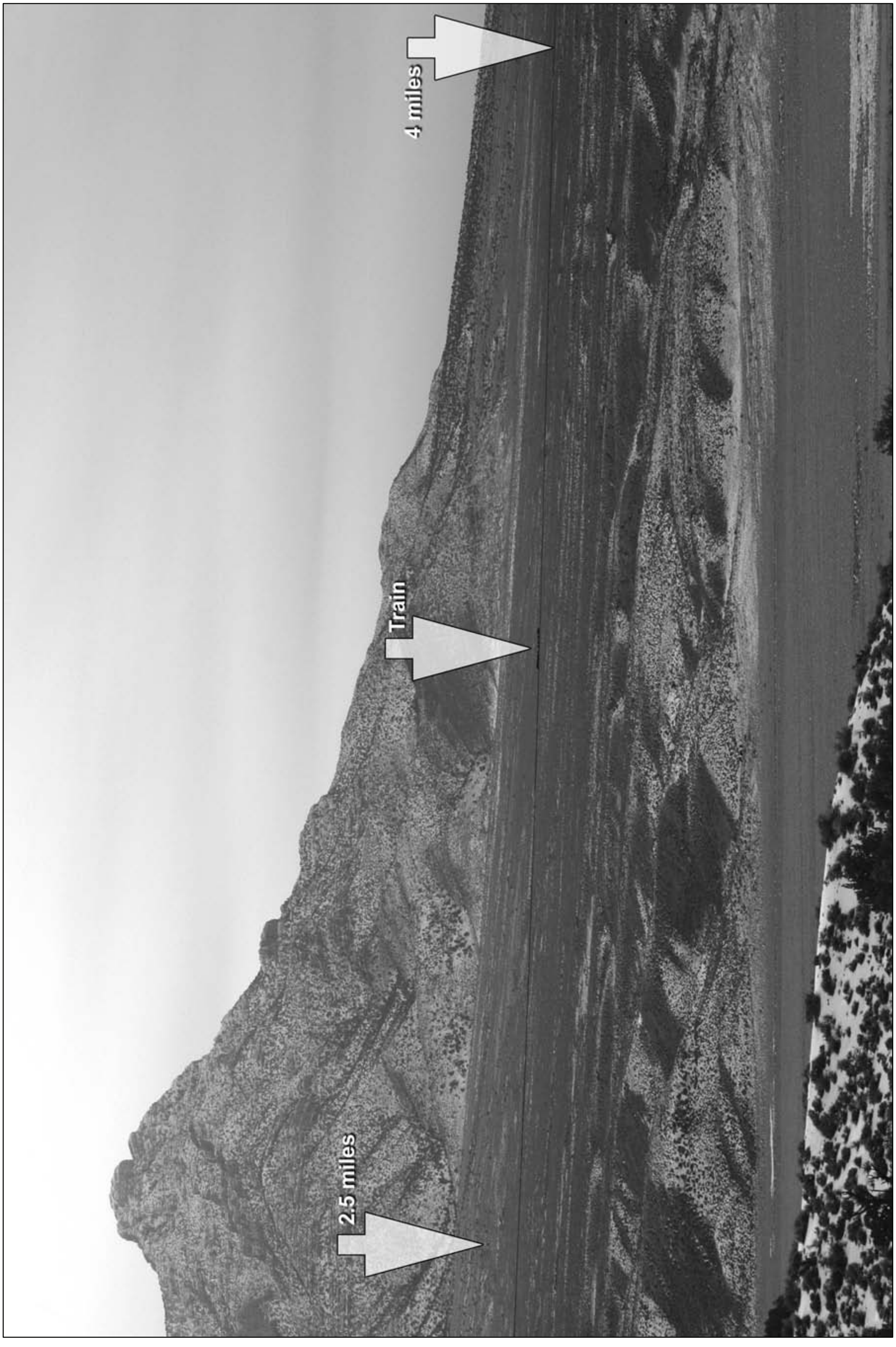


Figure 4-6. Simulation of train and track in view west from key observation point 11 off county road west of State Route 318.

Figure 4-7. Simulation of U.S. Highway 93 crossing over rail line in view north-northeast from key observation point 6 (power poles in photo are not related to proposed project).

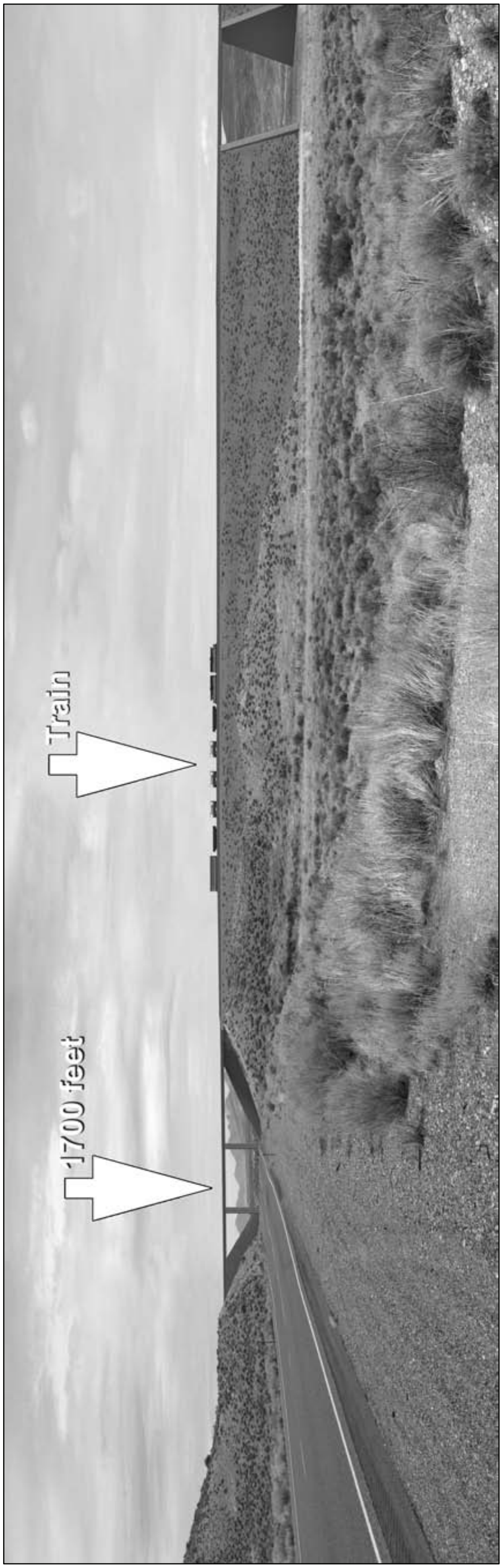


Figure 4-8. Simulation of crossing structure and train on rail line in view northwest to northeast from key observation point 10 on State Route 318.

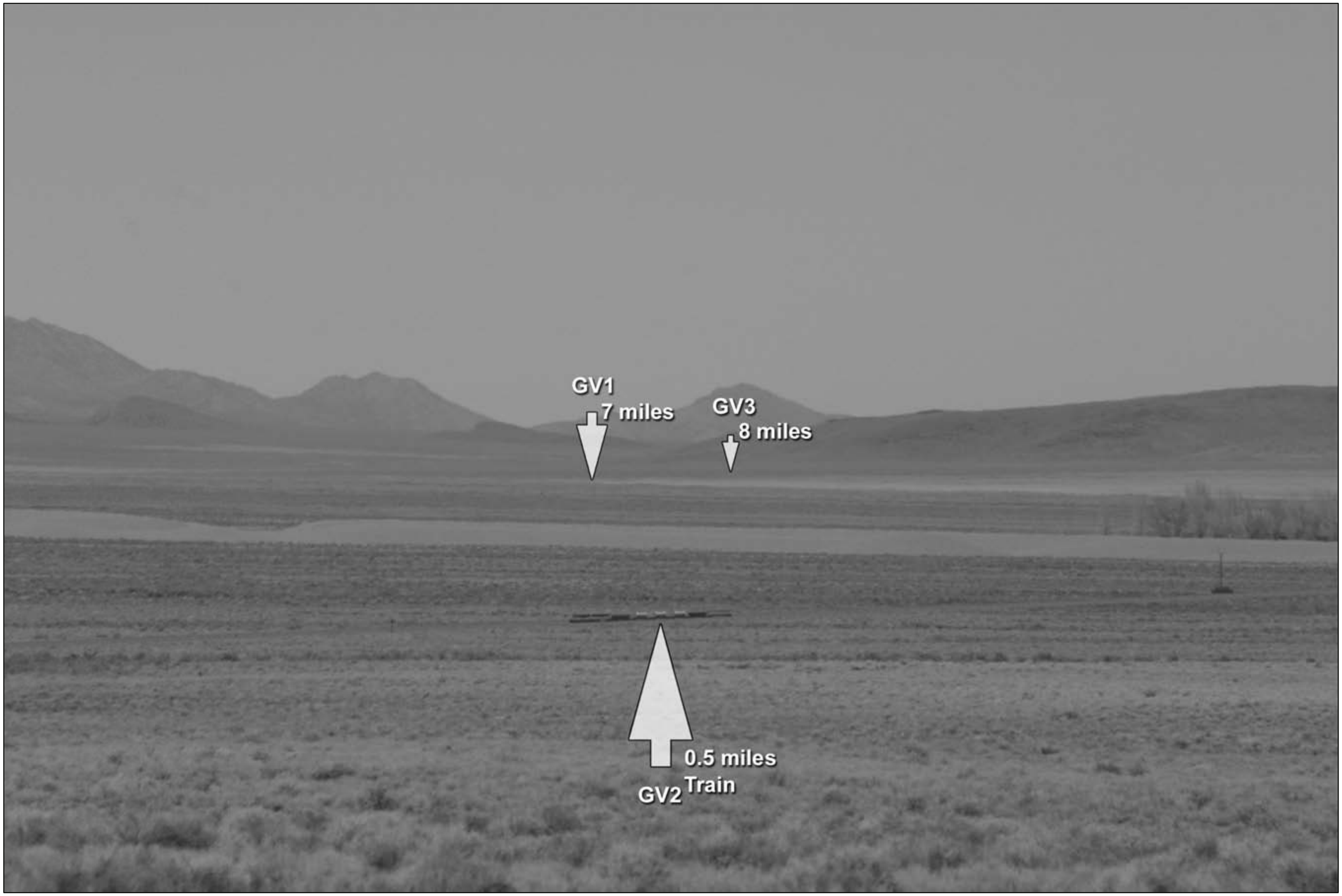


Figure 4-9. Simulation of track in view northeast from key observation point 13 on a county road south of Garden Valley. (Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 2.)

While observations would be necessary along the entire length of each county road to determine the precise places where an alternative segment within 1.6 kilometers or less would cause a moderate contrast, Table 4-34 provides a conservative approximation. The table lists the total length of each alternative segment that would fall within 1.6 kilometers of a county road in Garden Valley. Portions of three of the alternative segments would lie immediately adjacent and parallel to a county road; along these portions, the rail line would not create a new linear feature because the road itself is a linear feature; therefore, this distance is excluded from the total distance where the alternative segment could create a moderate contrast. Table 4-34 indicates that Garden Valley alternative segment 8 and Garden Valley alternative segment 1 would cause moderate contrast in views from county roads to a lesser degree than Garden Valley alternative segment 2 or Garden Valley alternative segment 3. In locations in Garden Valley where the track would otherwise cause a moderate contrast in Class II lands, DOE would construct low, rolling earthwork berms with soils and vegetation that match the surroundings to mask the linear track from viewers. Construction of these berms would reduce the level of contrast to weak. If DOE could not avoid placing communications towers in such areas, the Department would use non-contrasting, non-reflective paint on the towers and associated buildings and place them as far from public viewpoints as feasible.

Table 4-34. Lengths of Garden Valley alternative segments near county roads.

Alternative segment	Length within 1.6 kilometers of county road (kilometers)[a]	Length immediately adjacent and parallel to county road (kilometers)[a]	Length where new linear feature could cause moderate contrast (kilometers)[a]
Garden Valley 1	15	3	12
Garden Valley 2	22	3	19
Garden Valley 3	18	0	18
Garden Valley 8	21	11	11

a. To convert kilometers to miles, multiply by 0.62137.

Views toward Garden Valley alternative segment 2 and Garden Valley alternative segment 8 from the key observation points on top of a structure within *City* would show weak contrast of the rail line against the landscape (see Figure 4-10 and simulations shown in Figures D-43 through D-50 in Appendix D). Because of distance, views toward Garden Valley alternative segment 1 would show weaker contrast and, toward Garden Valley alternative segment 3, no contrast (see simulations in Figures D-38 through D-42). None of the alternative segments would be visible from portions of the sculpture that are below grade. Garden Valley alternative segments 1, 2, and 8 would be more noticeable along the nearby flat lands of Garden Valley and less so in the more distant flat lands and the more variegated foothills to the east and west. Passage of a train would create a greater degree of contrast between the rail line and the surrounding landscape, especially along the nearby flat lands, but this would be an infrequent, short-duration contrast. The resulting contrast ratings of weak to none for Garden Valley alternative segment 1, 2, and 8, and none for Garden Valley alternative segment 3 would meet BLM Class II management objectives.

4.2.3.4 Impacts under the Shared-Use Option

Impacts to aesthetic resources during the construction phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.2.3.3.1). Construction of additional sidings or short spurs would create small impacts to the visual setting because of the short duration of construction.

Figure 4-10. Simulation of train along Garden Valley alternative segment 2 and track along Garden Valley alternative segment 8 in view slightly northeast from key observation point 18 on top of a *City* structure.

Impacts to the visual setting during the operations phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.2.3.3.1). Under the Shared-Use Option, there would be three additional round-trip trains per week, but this would not substantially increase the assumed three trains per day DOE used to establish visual contrast ratings under the Proposed Action without shared use.

4.2.3.5 Summary

Table 4-35 summarizes potential impacts to aesthetic resources from constructing and operating the proposed railroad along the Caliente rail alignment.

Table 4-35. Summary of potential impacts to aesthetic resources – Caliente rail alignment.[a]

Location (county)	Construction impacts[b]	Operations impacts
Rail alignment		
Impacts common to all portions of the Caliente rail alignment	Small impact. Weak to moderate contrast in the short term from dust and exhaust; lighting, temporary power poles, construction camps, and material laydown yards; operation of supply trains. Small to large impact. Weak to strong contrast in the short term from visible construction equipment either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads. Small to large impact. Weak to strong contrast in the long term from scars on rock from cuts, and from access roads.	Small to moderate impact. No to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Small impact. No to strong contrast in the short term from passing trains.
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Small to large, but temporary, impact. Weak to strong contrast in the short term, which would not meet BLM management objectives for Class II visual resources.	Small impact. Track on some parts of Garden Valley alternative segments 1, 2, 3, and 8 could create a new linear feature. Vegetated earthwork berms would mask the linear feature and reduce the contrast to levels consistent with Class II.
Operations support facilities		
Staging Yard, Caliente-Indian Cove option (Lincoln County)	Moderate, but temporary, impact. Moderate contrast during the installation and construction of the facility, consistent with surrounding non-BLM-administered lands treated as Class III, but inconsistent with BLM management objectives for Class II visual resources on the BLM lands at the north end of the yard.	Moderate impact. Moderate contrast from the operation of the facility in the Class III non-BLM lands, weak contrast from the track on BLM Class II lands at the north end; in each area, consistent with applicable BLM management objectives.
Quarries		
Caliente quarry (CA-8B) (Lincoln County)	Moderate impact. Moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93, consistent with surrounding non-BLM-administered lands treated as Class III.	No impact under the Proposed Action; conveyor would be removed at end of construction phase.

a. Unless noted otherwise, impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.2.4 AIR QUALITY AND CLIMATE

This section describes potential impacts to ***air quality*** from constructing and operating a railroad along the Caliente rail alignment. Section 4.2.4.1 describes the methodology DOE used to assess potential impacts; Section 4.2.4.2 discusses conformity with the appropriate State Implementation Plan(s); Section 4.2.4.3 describes potential construction and operations impacts; Section 4.2.4.4 describes potential impacts under the Shared-Use Option; and Section 4.2.4.5 summarizes potential impacts to air quality.

Section 3.2.4.1 describes the region of influence for the air quality impacts analysis.

4.2.4.1 Impact Assessment Methodology

DOE examined emissions inventories to determine county-level increases in air pollutant emissions, and performed air quality simulations to determine potential changes in air pollutant concentrations at specific receptors (population centers). Appendix E, Air Quality Assessment Methodology, is a more detailed description of the approach DOE used to perform the air quality assessment.

For areas along the Caliente rail alignment for which no local air quality data are available, DOE compared projected emissions under the Proposed Action with the U.S. Environmental Protection Agency county-level emissions data in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all). DOE compared emissions from proposed railroad construction and operations in Lincoln, Nye, and Esmeralda Counties to existing emissions in three categories: highway emissions, off-highway emissions, and all area sources. Section 4.2.4.3.1 describes projected emissions associated with construction of the proposed railroad and Section 4.2.4.3.2 describes emissions from railroad operations.

To assess potential impacts to air quality in the region of influence, DOE modeled air quality at two population centers that would be near the proposed railroad (Caliente in Lincoln County and Goldfield in Esmeralda County) and compared the modeling results to the Nevada and National ***Ambient Air Quality Standards*** (NAAQS). These two standards are nearly identical (Section 3.2.4 explains differences), but DOE primarily references the NAAQS in this section with noted exceptions. The Department also modeled air quality to assess potential impacts for railroad construction and operations (using both minimum and maximum rail line lengths in each county) and railroad facilities for locations in Caliente and for construction-related activities at potential quarry site CA-8B northwest of Caliente and potential quarry site NN-9B in South Reveille Valley. Appendix E provides a detailed description of the air quality modeling methodology and assumptions.

There would be an adverse impact to air quality if the Proposed Action:

- Would conflict with or obstruct implementation of a state or regional air quality management plan
- Would violate a NAAQS primary standard or contribute to existing or projected violations

4.2.4.2 The Conformity Rule

Section 176(c) of the Clean Air Act (42 U.S.C. 7401 *et seq.*) requires that federal actions conform to the appropriate State Implementation Plan. The final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (called the Conformity Rule) is codified in 40 CFR Parts 6, 51, and 93. This Conformity Rule established the conformity criteria and procedures necessary to ensure that federal actions conform to the State Implementation Plans and meet the provisions of the Clean Air Act. In general, this rule ensures that all emissions of ***criteria air pollutants*** and ***volatile organic compounds*** are specifically identified and accounted for in the State Implementation Plan's attainment or maintenance demonstration, and conform to the State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

The provisions of the Conformity Rule apply only where the action is undertaken in a federally classified ***nonattainment*** or maintenance ***area***. Apart from Clark and Washoe Counties, the rest of the State of Nevada is classified as ***in attainment*** for all criteria air pollutants. There are no nonattainment or maintenance areas in the proposed rail alignment's host counties of Lincoln, Nye, and Esmeralda. Hence, the provisions of the Conformity Rule do not apply to the Proposed Action.

4.2.4.3 Impacts to Air Quality

4.2.4.3.1 Construction Impacts

Potential impacts to air quality from construction of a rail line and railroad construction and operations support facilities along the Caliente rail alignment would include (1) exhaust emissions from construction equipment and (2) fugitive dust ***particulate matte***r emissions resulting from construction activities. These impacts would be small, except in the vicinity of potential South Reveille quarry NN-9B.

Appendix E describes the modeling approach and methodology DOE used to estimate emissions and air quality impacts that would result from these activities.

DOE evaluated emissions and air quality impacts by county because the most complete and comprehensive annual emissions data available from the U.S. Environmental Protection Agency National Emission Inventory are at the county level (DIRS 177709-MO0607NEI2002D.000). DOE assessed emissions impacts by comparing construction/design emissions with 2002 annual county-wide emissions for ***nitrogen oxides*** (NO_x), particulate matter with aerodynamic diameters equal to or less than 10 micrometers (***PM_{10}***) and 2.5 micrometers (***$PM_{2.5}$***), ***sulfur dioxide*** (SO_2), ***carbon monoxide*** (CO), and volatile organic compounds (VOCs). DOE assessed air quality impacts by comparing resulting concentrations of these air pollutants against NAAQS.

Nye, Esmeralda, and Lincoln Counties are all in attainment for ***ozone(O_3)***. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with rail line construction would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not be anticipated to cause a violation of the ozone standard.

Sections 4.2.4.3.1.1 through 4.2.4.3.1.3 describe potential exhaust emissions and air quality impacts from constructing the proposed rail line and railroad construction and operations support facilities along the Caliente rail alignment in Lincoln, Nye, and Esmeralda Counties.

4.2.4.3.1.1 Lincoln County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.2.1 provides additional detail on the Lincoln County emissions inventory.

Table 4-36 compares the highest modeled annual total emissions under a 4-year construction schedule in Lincoln County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Table 4-36. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Caliente rail alignment through Lincoln County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Construction exhaust	440	410	3,270	2,970	3,790	3,440	230	210	220	200	3	2
Construction fugitive dust	-	-	-	-	-	-	2,720	2,590	550	530	-	-
Totals	440	410	3,270	2,970	3,790	3,440	2,950	2,800	770	730	3	2
Off highway (2002)[e]	34		192		706		20		18		42	
Highway vehicles (2002)[e]	402		4,356		352		12		9		9	
All county sources (2002)[e]	504		4,684		1,068		1,880		310		56	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Estimated construction-related emissions for VOCs, CO, and SO_2 are less than the county's 2002 annual emissions for these air pollutants. PM_{10} emissions during the construction phase would be approximately 1,070 metric tons (1,800 tons) per year higher than the 2002 county-wide emissions and $PM_{2.5}$ 460 metric tons (507 tons) per year higher, while emissions of NO_x would be 2,700 metric tons (3,000 tons) per year greater than the 2002 county-wide emissions. However, these emissions would be distributed over the entire length of the rail alignment in Lincoln County (132 to 148 kilometers [82 to 92 miles]) and would not lead to a localized problem; thus, no air quality standard would be exceeded, as shown below for construction near Caliente.

As shown in Table 4-36, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 40 percent (or 1,510 metric tons [1,660 tons] per year) of this amount; while construction of the Interchange Yard would contribute about 1 percent, construction camps 1, 2, 3, 4, and 5 would contribute about 0.4 percent each, and all of the wells less than 1 percent.

Air Quality Impacts, Construction Activities DOE modeled air quality to determine how construction of the proposed railroad would be likely to impact air pollutant concentrations in Caliente, Nevada. Air quality modeling efforts included the impact from constructing the rail line and the Interchange Yard in Caliente. Because the Staging Yard would be outside town, either at Indian Cove, Upland, or Eccles-North, the Department did not model air quality for the Staging Yard. Appendix E, Section E.2.1.2.2.1, summarizes the modeling methodology DOE used to assess construction-related air quality impacts in Lincoln County.

Table 4-37 shows the modeled maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted during the construction phase. DOE modeled a 3-year period using 3 years of actual meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations during the construction phase in Caliente would be below the NAAQS for all air pollutants. The modeled maximum fraction of the NAAQS was 40 percent for $PM_{2.5}$.

Table 4-38 shows the modeled maximum concentrations at any receptor point of criteria air pollutants that would be emitted over the 3-year modeling period and that would result from construction of the Interchange Yard. The table also shows the highest background concentration since 1991 (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from construction of the Interchange Yard at Caliente would be below NAAQS for all air pollutants. Figure 4-11 shows the predicted 24-hour PM_{10} concentration near the proposed site of the Interchange Yard in Caliente to illustrate construction-related air pollutant concentrations in this area. The modeled maximum fraction of the NAAQS would be 36 percent for $PM_{2.5}$.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than construction of the rail line and the Interchange Yard and would be expected to show even lower concentrations; therefore, emissions would be well below NAAQS for all air pollutants.

Table 4-37. Maximum air pollutant concentrations during the construction phase along the Caliente rail alignment near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.41	0.61	35	2
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	0.07	0.27	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	5.5	45	150	30
	$PM_{2.5}$	$\mu g/m^3$	12	1.4	13	35	38
	SO_2	ppm	0.002	0.005	0.007	0.14	5
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	6
	PM_{10}	$\mu g/m^3$	12	2.1	14	50[e]	28
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.6	4.2	15	28
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-38. Maximum air pollutant concentrations from construction of the proposed Interchange Yard in Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[c]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.18	0.38	35	1
3-hour	SO_2	ppm	0.002	0.002	0.004	0.5	1
8-hour	CO	ppm	0.2	0.03	0.23	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	2	41	150	27
	$PM_{2.5}$	$\mu g/m^3$	12	1	13	35	36
	SO_2	ppm	0.002	0.003	0.005	0.14	4
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	5
	PM_{10}	$\mu g/m^3$	12	1.2	13	50[d]	26
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.37	4	15	26
	SO_2	ppm	0.002	0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers ; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. NAAQS = National Ambient Air Quality Standards.
d. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

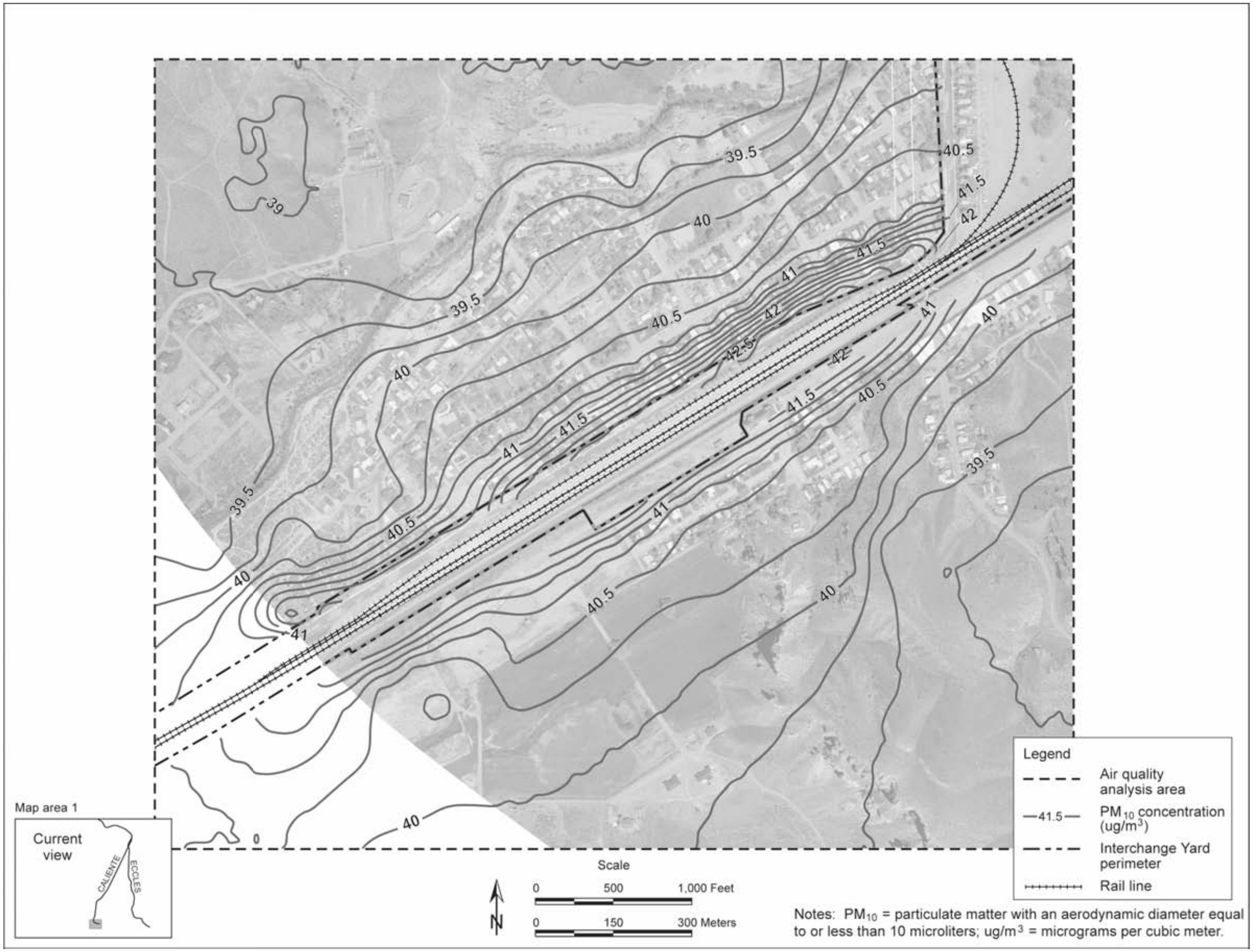


Figure 4-11. Maximum 24-hour PM_{10} concentration (maximum background plus modeled maximum project impact) from construction of the proposed Interchange Yard in Caliente, Nevada.

Air Quality Impacts, Quarry Activities DOE also performed simulations to determine potential impacts to air quality associated with activity at potential quarry site CA-8B northwest of the City of Caliente (DIRS 180922-Nevada Rail Partners 2007, Appendix A; DIRS 176182-Shannon & Wilson 2006, pp. 43 to 45). Appendix E, Section E.2.1.2.2.2, describes the methodology DOE used to simulate quarry-related impacts to air quality.

Table 4-39 shows the modeled maximum concentrations at any receptor point of criteria air pollutants that would be emitted over the 3-year period and that would result from quarry-related activities. The table also shows the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The modeled maximum fraction of the NAAQS would be 45 percent for PM_{10}.

Table 4-39. Maximum air pollutant concentrations from construction and operation of potential quarry CA-8B near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.43	0.64	35	2
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	less than 1
8-hour	CO	ppm	0.2	0.11	0.31	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	26[e]	65	150	44
	$PM_{2.5}$	$\mu g/m^3$	12	1.2[f]	13	35	38
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.0001	0.002	0.053	4
	PM_{10}	$\mu g/m^3$	12	2.6	15	50[g]	29
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.38	4	15	27
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. Maximum second highest high over any 1-year period.
f. Maximum 3-year average of the 98th percentile of 24-hour concentrations.
g. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

For all air pollutants and all averaging periods, the peak concentrations under conservative modeling assumptions (see Appendix E, Section E.1) would be below the NAAQS levels, with most values well below NAAQS.

4.2.4.3.1.2 Nye County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.3 provides additional detail on the Nye County emissions inventory.

Table 4-40 compares the modeled highest annual total emissions during the 4-year construction phase in Nye County (including construction of the Rail Equipment Maintenance Yard and Maintenance-of-Way Trackside Facility) with the county's 2002 National Emission Inventory database emissions

Table 4-40. Maximum and minimum peak annual emissions anticipated during the construction phase along the Caliente rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Construction exhaust	1,110	950	8,060	6,950	9,530	8,200	570	490	550	470	7	6
Construction fugitive dust	-	-	-	-	-	-	5,580	5,060	1,160	1,050	-	-
Totals	1,110	950	8,060	6,950	9,530	8,200	6,150	5,550	1,710	1,520	7	6
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3,324		650		237	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county, and increased equipment activity that would be necessary for construction in rugged terrain.

Construction-related emissions of VOCs, CO, and SO_2 would be less than half the county's 2002 annual emissions of these air pollutants. During the construction phase, emissions of $PM_{2.5}$ and PM_{10} could increase by as much as 1,060 and 2,800 metric tons (1,168 and 3,086 tons) per year, respectively, over the 2002 county annual emission values, and NO_x emissions could be as much as 8,100 metric tons (8,900 tons) per year over the county's 2002 annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Nye County (342 to 398 kilometers [213 to 247 miles] and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Nye County.

As shown on Table 4-40, construction fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with construction of the rail line. Access roads (including the alignment access roads) fugitive dust construction emissions would contribute about 40 percent (or 2,230 metric tons [2,460 tons] per year) of this amount; while construction of the Maintenance-of-Way Trackside Facility would contribute about 1 percent, the Rail Equipment Maintenance Yard and Cask Maintenance Facility would contribute less than 1 percent, construction camps 6, 7, 8, 10, 11, and 12 about 0.4 percent each, and all of the wells less than 1 percent.

Air Quality Impacts, Quarry Activities DOE performed simulations to determine potential impacts to air quality associated with construction and operations activity at potential quarry site NN-9B in South Reveille Valley (DIRS 176182-Shannon & Wilson 2006, pp. 35 and 36; DIRS 180922-Nevada Rail Partners 2007, Appendix C). Appendix E, Section E 2.1.3.2.1, describes the methodology DOE used to simulate quarry-related air quality impacts.

Table 4-41 lists the maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted from quarry-related activities (or peak 3-year average 98^{th} percentile values for $PM_{2.5}$ and the maximum second highest high over a 1-year period for PM_{10}). The maximum concentrations from operation of the potential South Reveille quarry occurs during the construction of the quarry. DOE modeled two consecutive 3-year periods using 4 years of meteorological data. The table also lists the highest (second highest for 24-hour PM_{10}) background concentration of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

Under conservative modeling assumptions (see Appendix E, Section E.1) peak air pollutant concentrations would be below the NAAQS levels, except for 24-hour average PM_{10}. The 24-hour PM_{10} NAAQS would be met if the NAAQS level of 150 micrograms per cubic meter was not exceeded more than once a year. However, under the conservative modeling assumptions used here, in each modeled year at least one receptor beyond the quarry fence line had a 24-hour PM_{10} concentration greater than the NAAQS level of 150 micrograms per cubic meter; therefore, the NAAQS could be exceeded. However, under Nevada Administrative Code 445B.22037, DOE would be required to prepare a Surface Area Disturbance Permit Dust Control Plan, which would address in detail the best types of fugitive dust control methods to be used. Specifics about the best control methods would depend on the specific layout, operation, and activity level at the quarry. These details are not fully available at this time, but would be when DOE filed the Surface Disturbance Permit Dust Control Plan with the State of Nevada. More than one method to control fugitive dust could be necessary to prevent fugitive dust generation, and use of multiple methods to control fugitive dust must be addressed, if needed. The Permit Plan could require such measures as paving quarry access roads, cessation of operations when winds make control of fugitive dust difficult. DOE anticipates that these measures would greatly reduce the PM_{10} emissions, making an exceedance of the 24-hour PM_{10} NAAQS highly unlikely. During quarry operations, PM_{10} emissions would be more than 80 percent lower than during construction and no exceedance of the 24-hour PM_{10} NAAQS would be expected. Further, DOE could reduce this concern by acquiring additional land and moving public access (the fence line) farther away from the quarry activity (see Chapter 7, Best Management Practices and Mitigation).

Table 4-41. Maximum air pollutant concentrations from construction and operation of potential quarry NN-9B in South Reveille Valley.

Averaging period	Air pollutant[a]		Background[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	1.5	1.7	35	5
3-hour	SO_2	ppm	0.002	0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	0.29	0.49	9	5
24-hour	PM_{10}	$\mu g/m^3$	39	200[e]	239	150	160
	$PM_{2.5}$	$\mu g/m^3$	12	14[f]	26	35	74
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.001	0.003	0.053	6
	PM_{10}	$\mu g/m^3$	12	23	35	50[g]	71
	$PM_{2.5}$	$\mu g/m^3$	3.6	2.8	6.4	15	43
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. Maximum second highest high over any 1-year period.
f. Maximum 3-year average of the 98th percentile of 24-hour concentrations.
g. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Maintenance-of-Way Trackside Facility This facility would occupy about 0.06 square kilometer (15 acres) in Nye County (DIRS 180921-Nevada Rail Partners 2007, Appendix B, p. B-11), and would be located approximately 18 miles south from U.S. Highway 6 on AR 504 in Nye County (DIRS 180919-Nevada Rail Partners 2007, p. 7-10). DOE did not model air quality for construction of this facility because construction activities would be similar to those for the Interchange Yard modeled in Lincoln County. Because DOE would expect air pollutant concentrations resulting from construction of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from construction of the Maintenance-of-Way Trackside Facility, which would have greater restricted public access (enclosed fence), would exceed the NAAQS. Similarly, DOE did not perform air quality modeling for construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility inside the Yucca Mountain Site boundary, because the distance from the facilities to the nearest public access point would be more than 11 kilometers (7 miles). At that distance, emissions from construction of the facilities would be small. However, DOE performed this analysis for the Repository SEIS (DOE/EIS-0250F-51), and results are included in the combined impacts table in Chapter 5 of this Rail Alignment EIS.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, those emissions would be well below NAAQS for all air pollutants.

4.2.4.3.1.3 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.2.1.4.1 contains additional detail on the Esmeralda County emissions inventory.

For each air pollutant considered in this analysis, Table 4-42 compares the peak annual emissions associated with construction of the proposed rail line and railroad construction and operations support facilities in Esmeralda County with the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Esmeralda County, and increased equipment activity necessary for construction in rugged terrain.

Construction-related emissions of VOCs, CO, PM_{10}, $PM_{2.5}$, and SO_2 would be less than the 2002 county-level emissions estimates for each pollutant. The emissions of oxides of NO_x during the construction phase could increase emissions by 940 metric tons (1,040 tons) per year over the county's 2002 annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Esmeralda County (22 to 44 kilometers [14 to 27 miles]) and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Esmeralda County, as shown in Table 4-43 for Goldfield.

As shown in Table 4-42, rail line fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 40 percent (or 168 metric tons [185 tons] per year) of this amount; while construction of the Maintenance-of-Way Headquarters Facility would contribute less than 1 percent, construction camp 9 about 0.4 percent, and wells less than 1 percent.

Air Quality Impacts DOE modeled air quality to determine how construction would be likely to impact air pollutant concentrations at Goldfield, Nevada. Appendix E, Section E.2.1.4.2, describes the modeling methodology DOE used to assess construction-related air quality impacts in Esmeralda County.

Table 4-43 lists the maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted during the construction phase. DOE modeled two consecutive 3-year periods using 4 years of meteorological data. The table also lists the highest background concentration since 1991 (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration (or peak 3-year average 98^{th} percentile values for $PM_{2.5}$ and the maximum second highest high over a 1-year period for PM_{10}) as a fraction of the NAAQS. In all cases, the maximum concentrations during the construction phase near Goldfield would be below NAAQS for all air pollutants. The maximum fraction of the NAAQS would be 87 percent for PM_{10}.

DOE did not model the Maintenance-of-Way Headquarters Facility south of Tonopah in Esmeralda County because construction emissions associated with this facility would be much smaller (less than 1 percent) than the Interchange Yard in Lincoln County. Because DOE expects air pollutant concentrations resulting from construction of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from construction of the Maintenance-of-Way Headquarters Facility would exceed the NAAQS.

Table 4-42. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Caliente rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Construction exhaust	130	60	920	450	1,090	540	60	40	60	30	1	0
Construction fugitive dust	-	-	-	-	-	-	420	200	90	50	-	-
Totals	130	60	920	450	1,090	540	480	240	150	80	1	0
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-43. Maximum air pollutant concentration from construction of a railroad along the Caliente rail alignment near Goldfield, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	2.5	2.7	35	8
3-hour	SO_2	ppm	0.002	0.003	0.005	0.5	1
8-hour	CO	ppm	0.2	0.32	0.52	9	6
24-hour	PM_{10}	$\mu g/m^3$	39	92	131	150	87
	$PM_{2.5}$	$\mu g/m^3$	12	14	26	35	74
	SO_2	ppm	0.002	0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.006	0.008	0.053	15
	PM_{10}	$\mu g/m^3$	12	23	35	50[e]	70
	$PM_{2.5}$	$\mu g/m^3$	3.6	4.9	9	15	57
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, these emissions would be well below NAAQS for all air pollutants.

4.2.4.3.2 Railroad Operations Impacts

Exhaust emissions during the operations phase would impact air quality. However, these impacts would be small.

Appendix E describes the modeling approach and methodology DOE used to estimate operations exhaust emissions and impacts to air quality.

DOE evaluated exhaust emissions and impacts to air quality by county because the most complete and comprehensive emissions data are available only at the county level. To assess emissions impacts, DOE compared modeled operations emissions with 2002 annual county-wide emissions for NO_x, PM_{10}, $PM_{2.5}$, SO_2, CO, and VOCs. To assess impacts to air quality, DOE compared modeled concentrations of these air pollutants to NAAQS. Nye, Esmeralda, and Lincoln Counties are all in attainment for ozone. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of

VOCs (a precursor to ozone formation) associated with the operations phase would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not cause a violation of the ozone standard.

Sections 4.2.4.3.2.1 through 4.2.4.3.2.3 detail the potential emissions and air quality impacts during the railroad operations phase in Lincoln, Nye, and Esmeralda Counties.

4.2.4.3.2.1 Lincoln County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Appendix E, Section E 2.2.2.1, provides additional detail on the Lincoln County emissions inventory.

Table 4-44 compares the modeled highest annual total emissions during operation of the rail line and Facilities at the Interchange with the Union Pacific Railroad Mainline in Lincoln County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000, all). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Lincoln County.

The projected operations-related emissions for all air pollutants considered in this analysis would be less than 20 percent of the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Lincoln County (132 to 148 kilometers [82 to 92 miles]; thus, no air quality standard would be exceeded.

Air Quality Impacts DOE modeled air quality to determine how railroad operations would be likely to impact air pollutant concentrations at Caliente. Air quality modeling efforts included the impact from operation of (1) the rail line and (2) the Interchange Yard in Caliente. Because the Staging Yard would be outside town, either at Indian Cove, Upland, or Eccles-North, the Department did not model air quality for the Staging Yard. Appendix E, Section E.2.2.2.2, describes the modeling methodology DOE used to assess operations-related impacts to air quality in Lincoln County.

Table 4-45 lists the maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted during operation of the proposed rail line. DOE modeled a 3-year period using 3 years of meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from operation of the proposed railroad near Caliente would be well below NAAQS for all air pollutants. The maximum fraction of the NAAQS would 34 percent for $PM_{2.5}$.

DOE modeled emissions from operation of the 0.06-square-kilometer (15-acre) Interchange Yard (DIRS 180919-Nevada Rail Partners 2007, p. 4-2) in the City of Caliente, Nevada. Table 4-46 lists the maximum resulting concentrations for all criteria air pollutants at any receptor in the modeled domain during all modeled years as a result of operating this facility. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from operation of the Interchange Yard at the Caliente, Nevada, site would be well below NAAQS for all air pollutants. The maximum fraction of the NAAQS would be 36 percent for $PM_{2.5}$. Figure **4-12** shows the modeled 24-hour PM_{10} concentration in the vicinity of the Interchange Yard in Caliente to illustrate the air pollutant impacts in this area.

Table 4-44. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Lincoln County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Operations exhaust	13	12	50	50	180	170	6	5	5	5	< 1	< 1
Off highway (2002)[e]	34		192		706		20		18		42	
Highway vehicles (2002)[e]	402		4,356		352		12		9		9	
All county sources (2002)[e]	504		4,684		1,068		1,880		310		56	
Percent increase (projected emission/ county emission multiplied by 100)	2.6	2.4	1	1	17	16	< 1	< 1	1.6	1.6	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not given by the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-45. Maximum air pollutant concentrations from operation of the proposed railroad near Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	< 0.001	0.2	35	1
3-hours	SO_2	ppm	0	< 0.001	0.002	0.5	< 1
8-hours	CO	ppm	0.2	< 0.001	0.2	9	2
24-hours	PM_{10}	$\mu g/m^3$	39	0.01	39	150	26
	$PM_{2.5}$	$\mu g/m^3$	12	0.01	12	35	34
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	< 0.0001	0.002	0.053	4
	PM_{10}	$\mu g/m^3$	12	0.01	12	50[e]	24
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.01	3.6	15	24
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-46. Maximum air pollutant concentrations from operation of the proposed Interchange Yard in Caliente, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.11	0.31	35	1
3-hours	SO_2	ppm	0.002	< 0.0001	0.002	0.5	< 1
8-hours	CO	ppm	0.2	0.03	0.23	9	3
24-hour	PM_{10}	$\mu g/m^3$	39	1	40	150	27
	$PM_{2.5}$	$\mu g/m^3$	12	0.65	13	35	36
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.002	0.004	0.053	7
	PM_{10}	$\mu g/m^3$	12	0.44	12	50[e]	25
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.4	4	15	27
	SO_2	ppm	0.002	< 0.001	0.002	0.03	6

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

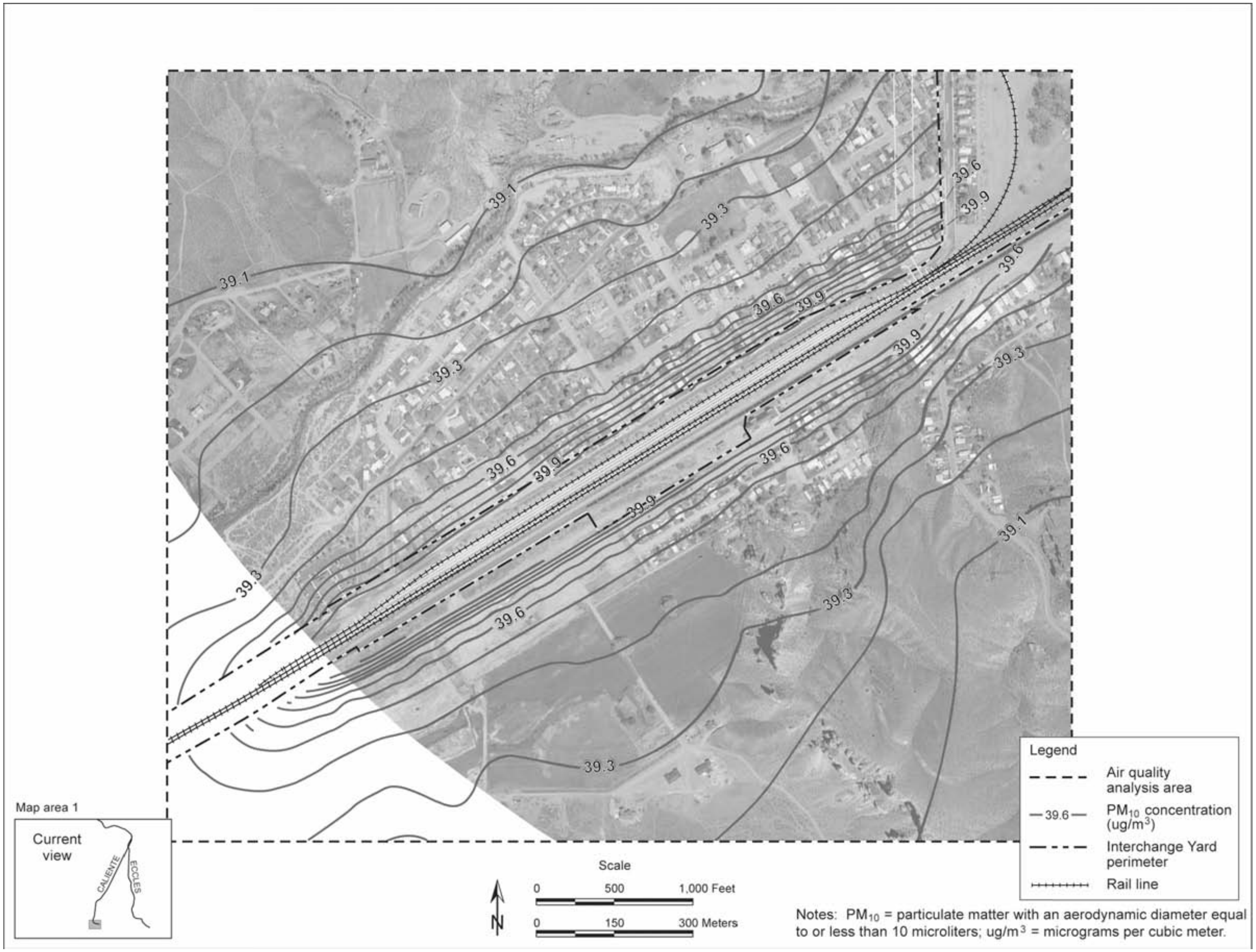


Figure 4-12. Maximum 24-hour PM_{10} concentration (maximum background plus modeled maximum project impact) from operation of the proposed Interchange Yard in Caliente, Nevada.

4.2.4.3.2.2 Nye County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.2.2.3.1 provides additional detail on the Nye County emissions inventory.

Table 4-47 compares the modeled highest annual total emissions during operation of the proposed rail line, the Rail Equipment Maintenance Yard, and the Maintenance-of-Way Trackside Facility in Nye County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). Project-related emissions are presented as a maximum and minimum range according to the possible lengths of the rail alignment through Nye County. Operations-related emissions for all air pollutants considered in this analysis represent a fraction of the county's 2002 annual emissions. The highest percentage increase is projected for NO_x at between 36 and 37 percent over the county's 2002 annual emissions. However, these emissions increases would not be expected to cause an exceedance of any air quality standard because most of the emissions would be distributed over the 342- to 398-kilometer (213- to 247-mile) length of the rail line through Nye County.

Air Quality Impacts The Maintenance-of-Way Trackside Facility would occupy about 0.06 square kilometer (15 acres) in Nye County, about 30 miles southeast of Tonopah (DIRS 180919-Nevada Rail Partners 2007, pp. 7-1 and 7-10). DOE did not model air quality for the operation of this facility because the Department expects that emissions associated with operation of this facility would be similar to those for the Interchange Yard in Lincoln County. Because DOE expects that air pollutant concentrations resulting from operation of the Interchange Yard would be well below the NAAQS, air pollutant concentrations resulting from operation of the Maintenance-of-Way Trackside Facility, which would have greater restricted public access (enclosed fence), would not be likely to exceed the NAAQS.

Similarly, DOE did not perform air quality modeling for operation of the Cask Maintenance Facility and Rail Equipment Maintenance Yard within the Yucca Mountain Site boundary, because the distance from those facilities to the nearest point of public access would be more than 11 kilometers (7 miles). At that distance, there would be no to small impacts on air quality from operation of the facilities.

4.2.4.3.2.3 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions under the Proposed Action. Section E.2.2.4.1 provides additional detail on the Esmeralda County emissions inventory.

Table 4-48 compares the annual total emissions during the railroad operations phase in Esmeralda County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). Project-related emissions are presented as a maximum and minimum range according to the possible lengths of the rail alignment through the county. The highest percentage increase is projected for NOx at between 3 and 6 percent over the county's 2002 annual emissions. However, these emissions increases would not be expected to cause an exceedance of any air quality standard because most of the emissions would be distributed over the 22- to 44-kilometer (14- to 27-mile) length of the rail line through Esmeralda County.

Air Quality Impacts DOE modeled air quality to determine how the operations phase would be likely to impact air pollutant concentrations at Goldfield, Nevada, because a portion of Goldfield alternative segment 4 (see Figure 2-7 in Chapter 2) would pass to the south and west of Goldfield. Appendix E, Section E.2.2.4.2, summarizes the modeling methodology DOE used to assess operations-related impacts to air quality in Esmeralda County.

Table 4-47. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Operations exhaust	47	46	180	170	490	470	15	15	14	13	1	1
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3324		650		237	
Percent increase (projected emission/ county emission multiplied by 100)	2	2	1	1	37	36	0	0	2	2	0	0

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-48. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Caliente rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Operations exhaust	1	< 1	2	1	10	5	< 1	< 1	< 1	< 1	< 1	< 1
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	
Percent increase (projected emission/ county emission multiplied by 100)	0.4	< 0.4	0.2	0.1	6	3	< 0.1	< 0.1	< 0.5	< 0.5	< 2	< 2

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-49 lists the maximum concentrations at any receptor point of the criteria air pollutants that would result from operation of the proposed railroad near Goldfield. DOE modeled a 4-year period using 4 years of actual meteorological data. The table also lists the highest background concentration since 1991 of each air pollutant (see Section 3.2.4 for the basis of the background concentration), the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations during the operations phase near Goldfield would be below NAAQS for all air pollutants. The modeled maximum fraction of the NAAQS was 34 percent for $PM_{2.5}$. DOE did not model the Maintenance-of-Way Headquarters Facility south of Tonopah in Esmeralda County because the operations emissions associated with this facility would be much smaller (less than 1 percent) than for operation of the Interchange Yard in Lincoln County. Because DOE expects air pollutant concentrations resulting from operation of the Interchange Yard to be below the NAAQS, the Department considers it unlikely that air pollutant concentrations resulting from operation of the Maintenance-of-Way Headquarters Facility would exceed the NAAQS.

4.2.4.4 Shared-Use Option

Impacts to air quality along the Caliente rail alignment under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

Under the Shared-Use Option, commercial entities could construct additional sidings of 300 meters (980 feet) in length at a number of locations along the rail alignment in Lincoln and Nye Counties. Operationally, the Shared-Use Option would consist of up to 60 railcars pulled by three or four locomotives at a frequency of up to three round trips per week.

Table 4-49. Maximum air pollutant concentrations from operation of the proposed railroad near Goldfield, Nevada.

Averaging period	Air pollutant[a]		Background[b] concentration	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	< 0.001	0.2	35	1
3-hour	SO_2	ppm	0.002	< 0.0001	0.002	0.5	< 1
8-hour	CO	ppm	0.2	< 0.001	0.20	9	2
24-hour	PM_{10}	$\mu g/m^3$	39	0.06	39	150	26
	$PM_{2.5}$	$\mu g/m^3$	12	0.05	12	35	34
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	1
Annual	NO_2	ppm	0.002	< 0.0001	0.002	0.053	4
	PM_{10}	$\mu g/m^3$	12	0.02	12	50[e]	24
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.02	3.6	15	24
	SO_2	ppm	0.002	< 0.000001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.

b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; CFR 50.4 through 50.11.

c. < = less than

d. NAAQS = National Ambient Air Quality Standards.

e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

The additional sidings would be placed parallel to track within the construction right-of-way and would not require additional rail roadbed foundation, only additional laying of track. Overall, additional construction-related emissions in Lincoln and Nye Counties would be very small. Appendix E, Section E.2.3, describes the rationale for not conducting additional emissions inventory calculations or air quality simulations to assess construction-related impacts under the Shared-Use Option.

Appendix E, Section E.2.3, also describes the methodology DOE used to calculate potential emissions that would result from the three additional round trips per week of commercial train activity associated with the Shared-Use Option.

For Lincoln County, Nye County, and Esmeralda County, Tables 4-50 through 4-52 compare the maximum annual incremental emissions expected from operation of commercial trains under the Shared-Use Option with each county's 2002 National Emission Inventory database emissions (DIRS 177709-MO0607NEI2002D.000). Also shown is the range of peak county-wide emissions that would result from the Proposed Action, as discussed in Section 4.2.4.3, and the resulting range of peak emissions totals by county. In both Lincoln and Esmeralda counties and for all air pollutants, the Shared-Use Option would increase emissions by less than 20 percent over the Proposed Action. The relative increase in Nye County would be larger (as much as 41 percent). However, both the Proposed Action and Shared-Use Option still would produce a relatively small increase over 2002 county-wide emissions totals. In all cases, after adding emissions associated with the Shared-Use Option to those predicted for the Proposed Action, emissions associated with railroad operations under the Shared-Use Option would remain less than 50 percent of 2002 county-wide emissions for all air pollutants in all counties.

As shown in Tables 4-50, 4-51, and 4-52, under the Shared-Use Option, total emissions would be increased marginally (as discussed above) beyond those associated with railroad operations under the Proposed Action. Likewise, the maximum air pollutant concentrations expected under the Shared-Use Option would be marginally increased. These levels have been shown to be low (see Tables 4-45, 4-46, and 4-49). Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for the Shared-Use Option.

4.2.4.5 Summary

Potential impacts to air quality from construction and operation of the proposed railroad along the Caliente rail alignment would be as follows:

- The project would not cause conflicts with state or regional air quality management plans.
- The highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities.
- Air pollutant concentrations would not exceed the NAAQS during the construction or operation phase, with the possible exception of the 24-hour NAAQS for PM_{10} that could be exceeded from quarry operations in South Reveille Valley during the construction phase. However, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan prior to quarry development and it would be likely that this would greatly reduce fugitive dust emissions, thus reducing the possibility of NAAQS exceedances.
- The highest increase in air pollutant emissions would occur during the construction phase.
- The highest increase in emissions would be for NO_x in Nye County, where construction emissions could be as much as 8,100 metric tons (8,900 tons) per year over the county's 2002 annual NO_x emissions.
- The Shared-Use Option would result in a slightly higher increase in air pollutant emissions and air pollutant concentrations than the Proposed Action.

Table 4-50. Maximum and minimum peak annual emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Lincoln County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Commercial trains/shared-use operations exhaust	1	1	3	3	16	15	1	1	1	1	< 1	< 1
Proposed railroad operations exhaust	13	12	50	50	180	170	6	5	5	5	< 1	< 1
Totals	14	13	53	53	196	185	7	6	6	6	< 1	< 1
Off highway (2002)[e]	34		192		706		20		18		42	
Highway vehicles (2002)[e]	402		4,356		352		12		9		9	
All county sources (2002)[e]	504		4,684		1,068		1,880		310		56	
Percent increase (projected emission/ county emission multiplied by 100)	2.8	2.6	1.1	1.1	18	17	< 1	< 1	2	2	< 2	< 2

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lincoln County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lincoln County would be 132 kilometers (82 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-51. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Nye County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Commercial trains/shared use operations exhaust	2	2	8	7	40	40	2	1	2	1	< 1	< 1
Proposed railroad operations exhaust	47	46	180	170	490	470	15	15	14	13	1	1
Totals	49	48	188	177	530	510	17	16	16	14	1	1
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3,324		650		237	
Percent increase (projected emission/county emission multiplied by 100)	2.2	2.1	1.1	1	37	36	< 1	< 1	2.5	2.2	< 1	< 1

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 398 kilometers (247 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 342 kilometers (213 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-52. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Caliente rail alignment under the Shared-Use Option through Esmeralda County, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length	Max.[c] length	Min.[d] length
Commercial trains/shared-use operations exhaust	< 1	< 1	1	< 1	5	2	< 1	< 1	< 1	< 1	< 1	< 1
Proposed railroad operations exhaust	1	< 1	2	1	10	5	< 1	< 1	< 1	< 1	< 1	< 1
Totals	1	< 1	3	1	15	7	< 1	< 1	< 1	< 1	< 1	< 1
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	
Percent increase (projected emission/ county emission multiplied by 100)	< 1	< 0.1	< 1	< 0.1	10	5	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023; < = less than.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 44 kilometers (27 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 22 kilometers (14 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the NAAQS, except possibly during quarry operations in South Reveille Valley. Therefore, the projected impacts throughout the region of influence, during both the construction and operations phases, would be small, except in the vicinity of the quarry. Under the Shared-Use Option, there would be an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small. Table 4-53 summarizes impacts to air quality.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 1 of 3).

County/rail line segment/facility	Construction impacts	Operations impacts
Lincoln County		
Caliente alternative segment; Eccles alternative segment; common segment 1; Garden Valley alternative segments 1, 2, 3, and 8; and common segment 2	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, and VOCs. PM_{10}, $PM_{2.5}$, and NO_x would each have increases greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 20 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Caliente showed no air pollutant would exceed 40 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Caliente showed no air pollutant would exceed 40 percent of the NAAQS for any averaging period.
Nye County		
Common segment 1, Garden Valley alternative segments 1, 2, and 3; common segment 2; South Reveille alternative segments 2 and 3; common segment 3; Goldfield alternative segments 1, 3, and 4; common segment 4; Bonnie Claire alternative segments 2 and 3; common segment 5; Oasis Valley alternative segments 1 and 3; and common segment 6	Construction activities would add less than the 2002 county-wide burden of VOCs, CO, and SO_2. $PM_{2.5}$, PM_{10}, and NO_x would each have an increase greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 40 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
Construction and operations support facilities		
Esmeralda County		
Goldfield alternative segments 1 and 4; common segment 4	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, VOCs, PM_{10}, and $PM_{2.5}$. NO_x would have an increase greater than the 2002 county-wide burden. However, emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than 6 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 2 of 3).

County/rail line segment/facility	Construction impacts	Operations impacts
Construction and operations support facilities (continued)		
	Modeling of emissions from construction of the rail line near Goldfield showed no air pollutant would exceed 90 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Goldfield showed no air pollutant would exceed 34 percent of the NAAQS for any averaging period.
<u>Lincoln County</u>		
Access roads (including alignment access road)	About 40 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Interchange Yard	Modeling of emissions from construction at the Interchange Yard in Caliente showed no air pollutant would exceed 36 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the Interchange Yard in Caliente showed no air pollutant would exceed 36 percent of the NAAQS for any averaging period.
Quarries	Using conservative modeling assumptions, no exceedances of the NAAQS would be expected at potential quarry CA-8B, with most values expected to be well below the NAAQS.	Quarries would be reclaimed following rail line construction and would have no emissions during the operations phase.
Other facilities	Construction dust and exhaust emissions would be very small.	Operations would result in very small emissions from other facilities.
Construction camps 1, 2, 3, 4, and 5	Only about 2 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for less than 1 percent of the fugitive dust emissions. In no case would construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of construction to serve as the water source for facility operations.
Access roads (including alignment access road)	About 40 percent of fugitive dust emissions would be from the access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Trackside Facility	Construction of the Maintenance-of-Way Trackside Facility would account for less than 1 percent of fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	The Maintenance-of-Way Trackside Facility would be responsible for less than 1 percent of the operations emissions in Nye County.
Rail Equipment Maintenance Yard and Cask Maintenance Facility	Combined, construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility would account for less than 1 percent of fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	Combined, the Rail Equipment Maintenance Yard and Cask Maintenance Facility would be responsible for about 84 percent of the operations emissions in Nye County.

Table 4-53. Summary of potential impacts to air quality – Caliente rail alignment[a,b] (page 3 of 3).

County/rail line segment/facility	Construction impacts	Operations impacts
Quarries	Modeling of emissions from potential quarry NN-9B indicates that the 24-hour PM_{10} NAAQS could be exceeded. However, the required Surface Disturbance Permit would greatly reduce PM_{10} emissions, making an exceedance of the NAAQS unlikely.	Quarries would be reclaimed following the construction phase and would have no emissions during the operations phase.
Nevada Railroad Control Center and National Transportation Operations Center	Construction dust and exhaust emissions would be very small.	Operation of these facilities would result in very small emissions.
Construction camps 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12	Only about 2 percent of the fugitive dust emissions would be from construction camps. In no case would this be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for about 2 percent of fugitive PM_{10} emissions. In no case would this be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the construction phase to serve as the water source for facility operations.
<u>Esmeralda County</u>		
Access roads (including alignment access road)	About 40 percent of fugitive dust emissions would be from the access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Headquarters Facility	Construction emissions associated with the Maintenance-of-Way Headquarters Facility would account for less than 1 percent of the construction fugitive dust emissions. In no case would the Headquarters Facility construction emissions be expected to cause an exceedance of any air quality standards.	Operation of the Maintenance-of-Way Headquarters Facility would result in very small emissions from the facility.
Construction camp 9	Only about 0.4 percent of the fugitive dust emissions would be due to construction of this construction camp. In no case would the construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for less than 1 percent of the fugitive PM_{10} emissions. In no case would construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the construction phase to serve as the water source for facility operations.

a. Impacts to air quality under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds; NAAQS = National Ambient Air Quality Standards.

4.2.5 SURFACE-WATER RESOURCES

This section describes potential impacts to surface-water resources (***washes***, playas, ***floodplains***, and ***wetland*** areas) from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.5.1 describes the methodology DOE used to analyze potential impacts; Section 4.2.5.2 describes potential construction impacts; Section 4.2.5.3 describes potential operations impacts; Section 4.2.5.4 describes potential impacts under the Shared-Use Option; and Section 4.2.5.5 summarizes potential impacts to surface-water resources.

4.2.5.1 Impact Assessment Methodology

As described in Section 3.2.5.1, the region of influence for surface-water resources would be limited in most cases to the nominal width of the rail line construction right-of-way. In some cases the region of influence would extend beyond the construction right-of-way. Construction and operations activities along the rail line could impact a larger area in cases where surface-water drainages could carry pollutants (such as petroleum-based lubricants and fuels) and eroded soil downstream of the rail line or in cases where floodwaters backed up on the upstream side of the rail line.

DOE evaluated potential impacts to surface-water resources based on a series of criteria, as listed in Table 4-54. There would be an impact if railroad construction and operations would cause any of the conditions listed in Table 4-54. To avoid or limit adverse impacts to surface-water resources, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Most importantly, careful pre-planning of construction and operations activities would allow the Department to assess and minimize potential impacts before they occurred (see Section 2.1).

The areas where surface-water impacts would be greatest and where DOE would implement direct controls (such as erosion and sedimentation controls) would be within the construction right-of-way. The Department expects that the numbers and types of surface-water features within the construction right-of-way would have a direct relationship to the degree of impacts within this area. To evaluate potential impacts to surface water, the Department identified areas where there are drainage channels, floodplains, springs, and wetlands along the rail alignment (including those it would cross or cover) and identified the activities associated with construction or operations that would have the potential to impact these surface-water resources.

Table 4-54. Impact assessment criteria for surface-water resources (page 1 of 2).

Resource criteria	Basis for assessing adverse impact
Stormwater drainage	Would railroad construction or operations: • Alter stormwater discharges, which could adversely affect drainage patterns, flooding, and/or erosion and sedimentation • Alter ***infiltration*** rates, which could adversely affect (increase or decrease) the volume of surface water that flows downstream • Conflict with applicable stormwater management plans or ordinances
Surface-water quality	Would railroad construction or operations: • Contaminate public water supplies and other surface waters, exceeding water quality criteria or standards established in accordance with the Clean Water Act, state regulations, or permits • Conflict with regional water quality management plans or goals

Table 4-54. Impact assessment standards for surface-water resources (page 2 of 2).

Resource criteria	Basis for assessing adverse impact
Surface-water availability and uses	Would railroad construction or operations: • Alter the capacity of available surface-water resources, such that human health, the environment, or personal property would be adversely affected • Conflict with established water rights or regulations protecting surface-water resources for future beneficial uses
Wetlands and waters of the United States	Would railroad construction or operations: • Cause filling of wetlands or otherwise alter drainage patterns such that wetlands or waters would be adversely affected
Floodplains and floodwaters	Would railroad construction or operations: • Alter floodway or floodplain or otherwise impede or redirect flows such that human health, the environment, or personal property would be adversely affected • Conflict with applicable flood management plans or ordinances
Springs	Would railroad construction or operations: • Reduce or eliminate access to springs such that human health, the environment, or personal property would be adversely affected

4.2.5.2 Construction Impacts

Section 3.2.5 describes surface-water resources along the Caliente rail alignment. Table 4-55 lists the numbers of surface-water features within the nominal width of the rail line construction right-of-way and support facilities. The table includes estimates of the number of drainage channels the Caliente rail alignment alternative segments and common segments would cross. DOE identified drainage channels using the National Hydrological Dataset, a U.S. Geological Survey dataset of hydrologic features. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.2.5.2.1. The second subset is the washes DOE classified as waters of the United States during field studies in support of this Rail Alignment EIS.

This section also addresses impacts to surface-water quality, and water availability and usage. Springs are also evaluated because they are a significant source of surface water within and near the Caliente rail alignment region of influence.

Floodplains and wetlands are two other important surface-water features the Department evaluated as part of this analysis. Appendix F, Floodplain and Wetlands Assessment provides additional information on wetlands and floodplains the Caliente rail alignment could encounter. Appendix F includes figures showing the locations of these surface-water features and provides more detail on their characteristics.

4.2.5.2.1 Impacts Common to the Entire Rail Alignment

The following sections describe common impacts identified and assessed for activities associated with construction of the proposed railroad along the Caliente rail alignment. DOE would minimize impacts through the engineering design (see Section 2.2) and the implementation of best management practices (see Chapter 7).

4.2.5.2.1.1 Stormwater Drainage. Construction of the proposed railroad could result in both direct and indirect impacts to surface-water resources. Direct impacts would result from the temporary or permanent grading, dredging, rerouting, or filling of ***ephemeral*** or ***intermittent streambeds***. Indirect impacts would include increases in ***nonpoint source pollution*** resulting from runoff from construction areas where surface grades and characteristics had been changed (such as the rail roadbed, facilities, and access roads).

Table 4-55. Summary of drainages the rail line and support facilities would cross – Caliente rail alignment.

Rail line segments/facilities	Total[a]	Notable drainages[b]	Waters of the United States[c]
Caliente alternative segment	15	10	9
Staging Yard (Indian Cove option)	10	7	1 (bridged)
Staging Yard (Upland option)	13	9	1 (bridged)
Potential quarry CA-8B	0	0	3 (siding)
Eccles alternative segment	15	8	11
Interchange Yard	1	0	1
Staging Yard (Eccles-North)	10	7	4
Caliente common segment 1	144	33	17
Garden Valley alternative segment 1	25	13	0
Garden Valley alternative segment 2	19	13	0
Garden Valley alternative segment 3	28	12	0
Garden Valley alternative segment 8	18	10	0
Caliente common segment 2	35	12	0
South Reveille alternative segment 2	9	5	0
South Reveille alternative segment 3	11	6	0
Caliente common segment 3	92	31	0
Maintenance-of-Way Trackside Facility	1	1	0
Goldfield alternative segment 1	25	9	0
Goldfield alternative segment 3	15	6	0
Goldfield alternative segment 4	26	6	0
Maintenance-of-Way Headquarters Facility	1	0	0
Caliente common segment 4	9	1	0
Bonnie Claire alternative segment 2	31	11	0
Bonnie Claire alternative segment 3	23	9	0
Common segment 5	124	84	0
Oasis Valley alternative segment 1	24	15	2 (bridged)
Oasis Valley alternative segment 3	28	11	1 (bridged)
Common segment 6	43	20	14
Rail Equipment Maintenance Yard	1	0	0

a. All drainages identified in National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
b. Only includes drainages with stream order equal to or greater than two from the National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
c. Source: DIRS 180914-PBS&J 2006, Figures 3A through 3E.

Cut and fill operations during rail line construction would cause the alteration of natural drainage patterns and runoff rates in some areas that could affect downgradient resources. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the track platform and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and movement of equipment to the construction initiation points. Depending on site conditions, construction could include regrading so that a number of minor drainage channels would collect in a single ***culvert*** or pass under a single bridge, resulting in water flowing from a single location on the downstream side rather than across a broader area. As a result, there would be some localized changes in drainage patterns.

Regrading and rerouting washes through channelization, including the installation of culverts and stabilization of existing stream banks, could increase the flow rate in relation to natural flow conditions. Culverts and improved channels would provide less resistance to flow so that the flow rate of runoff could increase as it passed through such a structure. The speed by which water flows through a drainage structure (a culvert, a bridge, or a stream channel) affects the erosive potential of the flow; therefore, the design of drainage structures must account for the potential for scour and erosion and incorporate outlet protection and velocity-dissipating devices that calm the flow and lessen its erosive potential. Without such protective measures, scour might occur, especially around bridge piers and abutments, where water flowing past a pier or abutment could erode the supporting soil and sediment around these structures. As the speed of flow increased, the chances for the entire streambed and bank to be exposed to scour and erosion would increase.

DOE would incorporate hydraulic modeling into the final design process to ensure that crossings are properly engineered so that they would not contribute to erosion and sediment pollution, and impacts to surface-water resources downstream of the rail line would be greatly minimized. Therefore, impacts associated with surface-water drainage patterns from rail line construction would be small.

DOE would employ standard engineering design practices to size and place culverts to move runoff water from one side of the track to the other. These culverts or other means of runoff control would be put in place as part of subgrade construction to prevent water from backing up. Preliminary rail line design includes various structures to accommodate drainage features the rail line would cross (DIRS 176166-Nevada Rail Partners 2006). These structures include slab bridges with multiple piers spaced at 4-meter (13-foot) intervals; double cell bridges with multiple piers spaced at 10-meter (33-foot) intervals; shaft-supported bridge structures with spans between end shafts of 14 to 24 meters (45 to 80 feet); precast reinforced concrete box culverts with a maximum cross-section size of 3.7 meters by 3.7 meters (12 feet by 12 feet); and corrugated metal pipe culverts of various diameters.

Except in areas where drainage structures would cross a Federal Emergency Management Agency designated 100-year floodplain, hydraulic design would be based on typical Class 1 freight railroad standard design criteria. Floodplain crossings are described in Section 4.2.5.2.1.6. Class 1 freight railroad standard criteria require that the ***50-year flood*** should not come into contact with the top (crown) of the culvert or the lowest point of the bridge, whichever is applicable. For the ***100-year flood***, these criteria require that the floodwaters should not rise above the ***subgrade elevation*** at the structure. To conform to these standards, DOE would use circular culverts where flow rates would be small (less than 4 cubic meters per second [140 cubic feet per second]). For larger flows (up to 28 cubic meters per second [1,000 cubic feet per second]), DOE would use box culverts. The Department would construct bridges where flows were larger and where the rail surface would not be tall enough to accommodate a sufficiently sized culvert, and

50-year flood is a flood that has a 2-percent chance of being equaled or exceeded in any given year.

100-year flood is a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

500-year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any given year.

Ballast is crushed stone used to support the railroad ties and provide drainage.

Subballast is a layer of crushed gravel that is used to separate the ***ballast*** and roadbed for the purpose of load distribution and drainage.

Subgrade elevation of the rail line is the elevation of the top of the ***subballast***.

would install the culverts with ***riprap*** around the exposed ends to protect the fill material from erosion (DIRS 176166-Nevada Rail Partners 2006, p. ii). Bridge abutments and piers would be similarly protected. In some places, training dikes or berms would be required to redirect flow and ensure that the flow would be conveyed through the structure. In places, channel improvements might be necessary for a short distance upstream and downstream of the rail line to intercept and effectively redirect flows through drainage structures.

DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible. Where there would be very wide and shallow depths of flow during a 100-year flood, or the flow would be divided into multiple natural channels that would cross the rail line, the Department would use a series of multiple culverts, potentially in concert with small bridges to span the main flow channel. In locations where there were very high fill conditions, it would be more economical to use multiple culverts than to construct a bridge (DIRS 176166-Nevada Rail Partners 2006, p ii). Because DOE would design stormwater conveyance systems to safely convey design floods (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater conveyance associated with construction of the rail line would be small.

Construction activities that disturbed the land surface, such as grading, excavation, or stockpiling, would have the potential to alter the rate at which water could infiltrate the disturbed areas. Depending on the type of disturbance, the infiltration rate could increase (for example, in areas with loosened soil) or decrease (for example, in areas where construction activities had compacted the soil or involved the installation of impermeable surfaces like asphalt pads, concrete surfaces, or buildings). Most of the land disturbance during the construction phase would result in surfaces with lower infiltration rates; that is, the surfaces would be less permeable than natural soil conditions and would cause an increase in runoff. The change in the amount of runoff that would actually reach the drainage channels would be minor, because construction would affect a small amount of the overall natural drainage area (DIRS 155970-DOE 2002, p. 4-24). Therefore, adverse impacts associated with changes in stormwater infiltration and runoff rates would be small.

DOE would construct two access roads (each up to 7.3 meters [24 feet] wide) along most of the rail line within the rail line construction right-of-way (one on each side of the rail line) to support operations. Additional access roads could be needed to provide access to the construction support facilities, such as construction camps, wells, and quarries. DOE would improve all access roads as necessary in accordance with the parameters for rural roads as defined by the Nevada Department of Transportation and the American Association of State Highway and Transportation Officials (DIRS 180922-Nevada Rail Partners 2007, p. 4-20). The Department would excavate roadside ditches on both sides of the roadway as necessary to direct stormwater to drainage features and washes. Most access roads would likely have gravel surfaces, except for those to wells. Dip sections (depressions in a road that allow stormwater to flow across the road surface) would be used to convey ephemeral flows across the road surfaces (DIRS 176172-Nevada Rail Partners 2006, p. 4-19).

DOE would locate most wells along the two alignment access roads or adjacent to existing roads; however, construction of new access roads to distant wells might be required in four cases (total distance of less than 5.5 kilometers [3.5 miles]). These roads would be needed to reach the well sites and to accommodate temporary pipelines constructed to convey water to the construction right-of-way. DOE would construct temporary pipelines on top of the ground next to an existing road or a new access road (DIRS 176172-Nevada Rail Partners 2006, p. 4-11). The Department would position the temporary pipelines so they would not obstruct or redirect surface runoff or natural drainage channels. Therefore, there would be no adverse impacts to surface-water resources from construction of temporary pipelines.

Water would be required for compaction of fill material to construct the embankment areas of the rail roadbed. Compaction of fill would require approximately 6.8 billion liters (1.8 billion gallons) of water (DIRS 180922-Nevada Rail Partners 2007, p. 4-10). To stay within the plastic limits of the soil, fill would not be completely saturated, and runoff will be intentionally avoided. DOE would use standard erosion-control practices during compaction activities. Water would also be required for dust control along roads used to access the rail alignment during construction activities. Approximately 250 million liters (65 million gallons) of water would be required for dust control over a 3-year period. DOE would use standard construction dust-control measures. Water quantities used for dust suppression in these areas would not be expected to result in runoff.

DOE would minimize construction impacts to stormwater drainage through engineering design (see Section 2.2) and implementation of best management practices (see Chapter 7). A National Pollutant Discharge Elimination System General Construction Permit would be required for construction activities. In accordance with this permit, construction contractors would be required to prepare and submit a Stormwater Pollution Prevention Plan, which would be prepared consistent with state and federal standards for construction activities and would detail the best management practices that would be employed to minimize soil loss and degradation to nearby water resources. Design of the best management practices program would be based on practices listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all) and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all).

Best management practices are structural and nonstructural controls that would be used to control nonpoint source pollution such as sedimentation and stormwater runoff. Structural controls are those best management practices that need to be constructed (such as detention or retention basins). Nonstructural controls refer to best management practices that typically do not require construction, such as planning, education, revegetation, or other similar measures. Stormwater runoff and sedimentation are typically addressed through the use of temporary and permanent best management practices, including techniques such as grading that would induce positive drainage; silt fences; and revegetation to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite. Best management practices would be implemented, inspected, and maintained to minimize the potential for adverse impacts to downstream water quality. Chapter 7 describes best management practices in more detail.

4.2.5.2.1.2 Surface-Water Quality. Construction activities could adversely impact surface-water quality due to increased sedimentation because rail line construction activities would result in the potential for erosion and sediment during precipitation events. Sediment would generally be contained onsite through the use of best management practices, including erosion- and sedimentation-control measures. Therefore, the potential for off-site impacts to surface water from increased sediment loads would be small.

Water quality impacts are also possible from potential release and spread of contaminants (materials potentially harmful to human health or the environment), which could be released through an accidental spill or discharge. These types of releases could be localized if there was a small spill or widespread if precipitation or intermittent runoff carried contaminants away from the site of the spill. For the areas of the Caliente rail alignment near surface-water bodies, contaminants could be released directly to surface water; however, there are only a few places where there are surface-water bodies along the rail alignment.

Section 4.2.12, Hazardous Materials and Waste, describes construction materials that could be mishandled (spilled), including petroleum products (such fuels and lubricants) and coolants (such as antifreeze). Incidental spills could also include solvents used for cleaning or for degreasing equipment.

The construction camps would include some bulk storage of hazardous materials, and supply trucks would routinely bring new materials and remove used materials and wastes (such as lubricants and coolants) from the construction sites (see Section 4.2.12). These activities would present some potential for incidental spills and releases, the significance of which would depend largely on the nature and volume of the material spilled and its location. A release or spill of pollutants to a stream or river, or stormwater runoff carrying pollutants to such receptors, would have the greatest potential to adversely impact surface-water quality.

The potential for such impacts during the construction phase would be small because the environment along the Caliente rail alignment is arid and there is little flowing water. Also, construction contractors would be required to comply with regulatory requirements for spill-prevention measures, reporting and remediating spills, and properly disposing of or recycling used materials (as described in Chapter 7). Common stormwater pollution control practices mandate that hazardous materials be stored inside facilities or have secondary containment or other protective devices and that spill control and containment equipment be stationed close to hazardous material (for example, fuel) storage.

Sanitary sewage generated at construction camps would be treated onsite or collected and trucked to a wastewater treatment plant. A portable wastewater treatment facility could be installed at each construction camp. As a water conservation measure, the Department would use treated wastewater effluent (***gray water***) produced at the camps for dust suppression and soil compaction. These water conservation measures would help reduce the demands placed on groundwater wells. The portable wastewater treatment plants would be designed and operated so that generated effluent would not adversely impact the quality of surface water with which it comes in contact; therefore, impacts to surface-water quality from wastewater treatment operations during the construction phase would be small. There would be no on-site discharges of industrial wastewater during the construction phase.

The wastewater treatment process would result in the production of biosolids (sludge). DOE would store biosolids on the sites and allow them to dry until the conditions specified in federal regulations (40 CFR Part 503) and state regulations are met. DOE would dispose of biosolids at a licensed facility in accordance with all applicable state and federal laws (DIRS 176172-Nevada Rail Partners 2006, p. 4-6).

4.2.5.2.1.3 Surface-Water Availability and Uses. See Section 4.2.2, Land Use and Ownership, for a discussion of impacts to manmade water systems.

4.2.5.2.1.4 Waters of the United States. Jurisdictional ***waters of the United States*** subject to Section 404 of the Clean Water Act include interstate waters and intrastate waters with a connection to interstate commerce, tributaries to such waters, and wetlands that are adjacent to waters of the United States. The Section 404 permitting program prohibits discharge of dredged or fill material into jurisdictional waters if a practicable alternative exists that would be less damaging to the aquatic environment, or if the Nation’s waters would be significantly degraded. In other words, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts and that potential impacts on waters of the United States have been minimized and mitigation is provided for any remaining unavoidable impacts (if required). See Chapter 6, Statutory, Regulatory, and Other Applicable Requirements, for further discussion of the Clean Water Act Section 404 permitting requirements.

The U.S. Army Corps of Engineers is responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. On June 5, 2007, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released interim guidance that addresses the jurisdiction over waters of the United States under the Clean Water Act. Based on this guidance, it is likely that many of the drainages along the rail alignment that DOE currently considers to be waters of the United States might not be considered as such. If DOE selected the Caliente rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the rail alignment before beginning construction.

Estimates for potential fill area and quantity of fill are provided in this section to support Section 404 permitting requirements (see Table 4-56). These estimates were calculated based on the depth and width of the water body that would be crossed and the type of engineered structure planned for each crossing. For crossings with culverts, DOE assumed that culverts would be extended 12 meters (40 feet) on either side of the cut/fill boundary for the rail roadbed. For bridges over waters of the United States having a width of less than 3 meters (10 feet), DOE assumed that no fill would be placed in the channel. For bridges over wider channels, DOE assumed that there would be one bridge pier every 6 meters (20 feet) and that each pier would cover a surface area of 1.9 square meters (20 square feet). Fill estimates calculated for these crossings depend on channel depths. These fill estimates represent an upper bound estimate, because the drainages currently identified during this analysis as waters of the United States might not be considered waters of the United States under the new U.S. Army Corps of Engineers guidance.

Table 4-56. Summary of waters of the United States – Caliente rail alignment.[a]

Rail line segments/facilities	Crossings[b]	Fill area (square meters)[c]	Fill volume (cubic meters)[d]
Caliente alternative segment	9	9.3	2.8
Staging Yard (Indian Cove option)	1 (bridged)	0	0
Staging Yard (Upland option)	1 (bridged)	0	0
Potential quarry CA-8B	3 (siding)	1,800	120
Eccles alternative segment	11	850	41
Interchange Yard	1	33,000	10,060
Staging Yard (Eccles-North)	4	120	11
Caliente common segment 1	17	560	22
Oasis Valley alternative segment 1	2 (bridged)	0	0
Oasis Valley alternative segment 3	1 (bridged)	0	0
Common segment 6	14	560	37

a. Source: DIRS 180914-PBS&J 2006, Figure 3A through 3E.
b. Any water of the United States within 12 meters (40 feet) of the construction footprint is considered to be crossed.
c. To convert square meters to acres, multiply by 2.4711.
d. To convert cubic meters to cubic feet, multiply by 35.314.

If DOE constructed the railroad along the Caliente rail alignment, there would be no practicable alternative to crossing some ephemeral streams in the Meadow Valley Wash and Amargosa River drainage systems that are waters of the United States. In those areas, there are numerous ephemeral waters of the United States that flow perpendicular to the general direction of the rail line, and the rail line would have to cross them. DOE would construct bridges across many of the ephemeral waters of the United States along the rail line, and very little or no fill in regulated stream channels would be required for those crossings. The Department would place culverts in the smaller ephemeral streams. Because the size of these regulated channels is generally less than 1 to 2 meters (3.3 to 6.6 feet), the area filled per crossing would typically be less than about 100 square meters (0.03 acres). The crossings would be designed so that they would not alter stream flow, and the Department would implement best management practices (see Chapter 7) to minimize sedimentation during and after construction.

4.2.5.2.1.5 Wetlands. Executive Order 11990, *Protection of Wetlands*, requires that federal agencies "…take action to minimize the destruction, loss, or degradation of wetlands…" The Executive Order requires consideration of all wetlands regardless of whether they are regulated under Section 404 of the

Clean Water Act. DOE regulations at 10 CFR Part 1022 direct that impacts to wetlands be avoided wherever possible and minimized to the extent practicable during construction projects. In accordance with Executive Order 11990 and 10 CFR Part 1022, this Rail Alignment EIS examines impacts to all wetlands regardless of whether they are considered jurisdictional under Section 404 of the Clean Water Act.

Under 10 CFR 1022, the Department is required to preserve and enhance the natural and beneficial values of wetlands. The values of wetlands are a function of the importance or worth of the functions that wetlands serve to society. Functions of wetlands include storage of water (floodwater protection), water filtration (wetlands can trap nutrients, sediment, and pollutants), and biological productivity (plant and animal ***habitat***). Impacts to these functions can eliminate or diminish the value of wetlands (DIRS 176797-EPA 2001, p. 1). Temporary or permanent filling or draining of wetlands would result in direct impacts to those resources. Actions in and around wetlands could result in indirect impacts, such as potential degradation of water quality and disruption of water flow.

To meet the requirements of 10 CFR Part 1022, Appendix F, Floodplain and Wetlands Assessment, includes a detailed analysis of wetlands and wetland functions. Specifically, this appendix includes a more detailed presentation of the data sources the Department used to identify wetlands and floodplains along the Caliente rail alignment, a discussion of potential impacts (repeated in this section), and an alternatives analysis. The discussion of impacts in this section and Appendix F is limited to the water storage and filtration functions of wetlands. Section 4.2.7, Biological Resources, addresses impacts to the biological-productivity functions of wetlands.

DOE would minimize filling of wetlands by keeping the rail line footprint to a minimum and incorporating avoidance into rail line engineering and design to the extent practicable. DOE would mitigate loss of wetlands, as required under Section 404 of the Clean Water Act, by enhancing existing wetlands adjacent to or near the rail line that have been degraded by grazing and other impacts, or by creating new wetlands adjacent to or near the rail line. The exact acreage of wetlands to be enhanced or created would be determined in coordination with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency and would be based in part on the amount of wetlands that would have to be filled to construct the rail line, the function and quality of the wetlands that would be lost, and the likelihood of success of the methods used to enhance or replace wetlands. This section describes impacts to wetlands in the segment-specific sections.

4.2.5.2.1.6 Floodplains and Floodwaters. DOE has prepared a floodplain assessment (see Appendix F) for the area along the Caliente rail alignment in accordance with the requirements of 10 CFR Part 1022. Appendix F includes figures that show the Federal Emergency Management Agency floodplain maps that cover the Caliente rail alignment region of influence. DOE obtained floodplain data from the Agency, which has published Flood Insurance Rate Maps that, depending on the combination of alternative segments, cover between 58 and 62 percent of the Caliente rail alignment. The Agency has not mapped areas that are uninhabited. These floodplain maps depict, as applicable, the lateral boundaries or spread of water that could be expected in drainage channels or around collection basins from a 100-year and a ***500-year flood***.

DOE overlaid a map of the Caliente rail alignment on the available floodplain maps and estimated the crossing distances for each alternative segment and common segment. Table 4-57 lists the crossing distances and the percentage of the area for which floodplain map coverage is available. Areas with little or no floodplain map coverage could contain floodplains not listed in the table. Appendix F discusses floodplains in more detail.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 1 of 3).

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (kilometers)[a]		Floodplain description
		Mapped	Additional estimated	
Caliente alternative segment	28	2.6	2.6	Starting from the southern end of the alternative segment with the Clover Creek floodplain to its junction with the Meadow Valley Wash floodplain and up the alternative segment approximately 4 kilometers. No FEMA floodplain map available above Caliente city limit. Used shaded relief map to extend floodplain and estimate additional floodplain. Crossing distance for Meadow Valley Wash is based on the width of the floodplains further south where there is floodplain map coverage.
Eccles alternative segment	0	0	1.0	FEMA floodplain map coverage is not available for the Eccles alternative segment. Estimated the crossing distance from the width of the 100-year floodplain along Clover Creek near its confluence with Meadow Valley Wash where there is floodplain map coverage.
Caliente common segment 1	14	0	2.0	Floodplain of Dry Lake Playa estimated using shaded relief maps.
Garden Valley alternative segment 1	0	0	3.9	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 2	0	0	9.5	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 3	0	0	3.9	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 8	0	0	9.5	No FEMA floodplain map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Caliente common segment 2	26	0	0	No floodplains identified.
South Reveille alternative segment 2	100	23	0	Reveille Valley braided wash floodplain extending from Railroad Valley around southern tip of Reveille Range.
South Reveille alternative segment 3	100	0	0	No floodplains identified.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 2 of 3).

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (kilometers)[a] Mapped	Additional estimated	Floodplain description
Caliente common segment 3	79	28	0	The floodplain extends from Mud Lake Playa up through Ralston Valley Wash, Saulsbury Wash, Willow Creek (also called Stone Cabin Creek), and a tributary of Willow Creek and a western tributary of Mud Lake Playa. There are no floodplain maps for parts of eastern common segment 3-west; however, the topography in that area suggests that it is not in floodplain.
Goldfield alternative segment 1	58	1.0	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up minor tributaries of Mud Lake Playa and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 3	55	1.0	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up minor tributaries of Mud Lake Playa and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 4	43	1.5	0	Floodplains from Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat extending up minor tributaries of Mud Lake Playa, tributaries of Big Wash, and tributaries of Jackson Wash and China Wash, respectively. There is no floodplain map coverage for Alkali Lake Playa.
Caliente common segment 4	100	1.3	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.9	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.3	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	1.1	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.4	0	Floodplain of the Amargosa River within Thirsty Canyon.

Table 4-57. Floodplains the Caliente rail alignment would cross (page 3 of 3).

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (kilometers)[a] Mapped	Additional estimated	Floodplain description
Common segment 6	55	0.1	0	Beatty Wash floodplain extending from Amargosa River Floodplain.
		0.23[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (rail line would cross wash and tributaries).

a. To convert kilometers to miles, multiply by 0.62137.
b. FEMA = Federal Emergency Management Agency.
c. There are no FEMA floodplain maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of floodplain crossings in this area are from DIRS 155970-DOE 2002, Figure 3-12 floodplain mapping efforts.

Construction activities would affect floodplains, either through direct alteration of the stream-channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain. Based on Federal Emergency Management Agency floodplain maps and flood studies completed in the area of the Yucca Mountain Site, the Caliente rail alignment would cross more than 20 floodplains.

Construction impacts associated with these floodplains would be similar to any other identified drainage areas (the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas could reduce the area through which floodwaters would naturally flow, which could cause water levels to rise on the upstream side of crossings. Sedimentation would be likely to occur on the upstream side of crossings in areas where the flow of water was restricted enough to cause ponding. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, p. 6-79). Therefore, impacts to floodplains from construction of the rail line that result in restrictions in flow and sedimentation would be small.

Construction within floodplains would cause direct impacts to floodplains. The Caliente rail alignment would be in a region where flash flooding is the primary concern. Although such flooding can be violent and hazardous, it is generally limited in its extent and duration, limiting the potential for impacts associated with the proposed railroad; that is, any damage would be expected to be confined to a small portion of the rail line.

Although DOE would generally design rail line features to accommodate 100-year floods, based on typical Class 1 freight railroad standard design criteria (see Section 4.2.5.2.1.1), the final design process could also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2 c). In areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, DOE would design the bridge to comply with Agency standards and appropriate county regulations. Federal Emergency Management Agency standards require that floodway surcharge (the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. These standards are designed to limit the impacts of floodwater to structures built in or adjacent to floodplains (DIRS 176166-Nevada Rail Partners 2006, p. ii). By adhering to these standards, the Department would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

Bridge constructing usually involves placing a portion of the bridge abutment in the floodplain (called encroachment). For this reason, the abutment can have some impact on the height of floodwaters upstream of the bridge. Excessive encroachment can result in increased scour potential at the abutments, piers, and the stream bottom through the bridge opening due to increases in flow velocities. Based on the conceptual design for the Caliente rail alignment, there could be encroachments up to 30 percent of the floodplain width, which could result in an approximately 0.3 meter (1-foot) increase in water-surface elevation at the upstream side of the bridge where the floodplain is wide and shallow (DIRS 176166-Nevada Rail Partners 2006, p. ii).

DOE would reduce impacts to floodplains and the resources close to the floodplains by adhering to the design standards that limit the degree to which floodwaters would be allowed to rise. The Department would incorporate hydraulic modeling into the engineering design process to ensure that all crossings were designed to limit impacts to nearby populations and resources.

4.2.5.2.1.7 Springs. DOE designed the rail line to avoid springs and other surface-water resources whenever practicable. In the few cases where there would be springs within the construction right-of-way, the Department would incorporate avoidance into final engineering and design of the rail line to the extent practicable. To minimize temporary impacts, springs would be marked prior to construction and avoided where possible. Therefore, impacts to springs from construction activities would be small. Section 4.2.6, Groundwater Resources, addresses impacts to springs from a groundwater-supply perspective.

4.2.5.2.2 Impacts along Alternative Segments and Common Segments

4.2.5.2.2.1 Interface with the Union Pacific Railroad Mainline. DOE would construct the Interchange Yard, the Staging Yard, a Satellite Maintenance-of-Way Facility, train crew facilities, and possibly the Nevada Railroad Control Center and National Transportation Operations Center at the Interface with the Union Pacific Railroad Mainline. DOE is considering two options for siting the Staging Yard along the Caliente alternative segment (Indian Cove and Upland) (see Figure 3-61). Section 4.2.5.2.3 addresses facilities. The starting points for both the Caliente and the Eccles alternative segments would either cross or be close to surface-water features, specifically Clover Creek and Meadow Valley Wash (see Table 4-55). This section describes site-specific impacts related to construction activities along the Caliente alternative segment or the Eccles alternative segment.

Caliente Alternative Segment The Caliente alternative segment would cross playas, washes, and streams, several of which are waters of the United States, as described in Section 3.2.5.3.1.1 and summarized in Table 4-55. In total, this segment would cross nine waters of the United States, including Meadow Valley Wash, Clover Creek, and Bennett Springs Wash, and drainage channels of these waters. Common impacts from surface-water crossings are addressed in Section 4.2.5.2.1.1. Of the nine waters of the United States the Caliente alternative segment would cross, the amount of fill would range from no fill for the smallest drainage to 1.1 cubic meters (40 cubic feet) for the two largest drainages. The total amount of fill for waters of the United States the Caliente alternative segment would cross would be 2.8 cubic meters (100 cubic feet).

DOE proposes to construct the Caliente alternative segment over the abandoned Union Pacific rail roadbed in part to minimize filling wetlands. The total area of wetlands within 30 meters (100 feet) of the rail line (the area delineated by DOE) would be 0.28 square kilometer (68 acres). DOE would minimize impacts to wetlands in this area by reducing the construction footprint to approximately 21 meters (70 feet), which would reduce the area of wetlands to be filled to 0.05 square kilometer (12 acres). Although DOE evaluated the use of vertical retaining walls and other methods to further reduce the construction footprint and the amount of wetlands filled, those methods would be impractical due to cost (DIRS 180916-Nevada Rail Partners 2007, Appendix F). DOE could modify the final design of the rail line to avoid additional wetlands, such as those adjacent to the old rail roadbed along Meadow Valley Wash, by using a slightly narrower construction footprint; however, this would only slightly reduce the area of wetlands that would be filled. Section 4.2.5.2.1.5 addresses common impacts to wetlands that would be crossed by and adjacent to the rail line and mitigation for wetlands.

The Federal Emergency Management Agency has performed detailed studies of Meadow Valley Wash, Antelope Canyon Wash, and Clover Creek Wash within the corporate limits of the City of Caliente and for some portions of Lincoln County, using detailed methods. The Agency has established 100-year floodwater surface elevations and regulatory floodways for these watercourses within the area studied. Encroachment into the floodway is prohibited unless it can be determined that encroachment into the floodway portion of the floodplain would not cause more than a 0.3-meter (1-foot) increase in the water-surface elevations for these watercourses. Table 4-57 lists floodplain information for the Caliente alternative segment. Federal Emergency Management Agency floodplain mapping extends from Caliente to the southern end of a meadow at Indian Cove. The Agency has mapped the southern portion of the meadow as a 100-year floodplain. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

Caliente Hot Springs would be within the construction right-of-way 16 meters (52 feet) from the rail line, but outside of the cut and fill area (7.7 meters [25 feet] outside the toe of slope). The hot spring itself is inside a hotel located in the City of Caliente. Therefore, there would be no impacts to water quality. There could be short-term adverse impacts to this spring in relation to reduced access for use by the public during the construction phase. Section 4.2.5.2.1.7 describes common impacts to springs in the vicinity of the rail line.

Construction camp 1 would be along the Caliente alternative segment, but the camp would not impact surface-water features. There are no waters of the United States or wetlands in the area of construction camp 1.

Eccles Alternative Segment The Eccles alternative segment would cross several surface-water features (see Section 3.2.5.3.1.2). DOE would construct a large bridge at the beginning of the Eccles alternative segment to span Clover Creek. To construct the 300-meter (1,000-foot) bridge, the Department would have to install piers across the confluence of Clover Creek and an unnamed tributary to Clover Creek that flows from the north and joins Clover Creek in the area just to the north of the proposed bridge. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Table 4-55 lists crossings of waters of the United States. These waters include Clover Creek and four of its tributaries and four tributaries of Meadow Valley Wash (DIRS 180914-PBS&J 2006, Figures 3A and 3B). Of the 11 waters of the United States the Eccles alternative segment would cross, the amount of fill would range from none for the smallest drainage to 26 cubic meters (930 cubic feet) for the largest drainage. The total amount of fill for waters of the United States the Eccles alternative segment would cross would be 41 cubic meters (1,400 cubic feet).

The Eccles alternative segment would cross wetlands associated with Meadow Valley Wash approximately 1.6 kilometers (1 mile) south of its intersection with Caliente common segment 1 (DIRS 180914-PBS&J 2006, Figure 4R). DOE would use a bridge to cross Meadow Valley Wash and its associated wetlands, which is comprised of a 9- to 10-meter (30- to 33-foot)-wide wetland area adjacent to the wash. There would be no permanent fill activities within this wetland; indirect impacts would still be possible, but such impacts, if any, would be minimized because of the best management practices the Department would use to prevent erosion, sedimentation, and incidental spills during construction of the bridge. Section 4.2.5.2.1.5 addresses common impacts to wetlands that would be crossed by and adjacent to the rail line and mitigation for wetlands.

There is no Federal Emergency Management Agency floodplain map coverage for the Eccles alternative segment. Although the Agency has not defined any floodplains in this area, the Eccles alternative segment would impact floodplains associated with Clover Creek and Meadow Valley Wash. Clover Creek and its associated floodplain, which encompasses Dutch Flat, ranges in width from 130 to 400 meters (430 to 1,300 feet) (see Appendix F). In January 2005, flooding in and around Clover Creek, Meadow Valley Wash, and Muddy River washed out and undermined portions of an existing rail line and worked out the rail bank in this area. DOE would minimize potential impacts from flooding through the use of erosion-control practices and hydraulic structural design standards (see Appendix F, Section F.4.4.3.4). Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and located adjacent to the rail line.

There are no springs along the Eccles alternative segment.

There are no construction camps planned along the Eccles alternative segment.

4.2.5.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would skirt the Coal Valley playa at its west end. The playa is expected to be an area subject to occasional flooding and standing water. Caliente common segment 1 would also cross several notable drainage features (see Section 3.2.5.3.2), including Coyote Wash and White River. Although the rail line would cross both of these features in areas where they are normally dry, bridges or culverts would be necessary to accommodate periods of high precipitation and runoff. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Before the rail line crossed Bennett Pass on its way to Dry Lake Valley, it would cross waters of the United States in Meadow Valley (DIRS 180914-PBS&J 2006, Figures 3C and 3D). Table 4-55 summarizes crossings of waters of the United States. Caliente common segment 1 would cross 17 drainage channels that qualify as waters of the United States (DIRS 180914-PBS&J 2006, Figure 3C). The amount of fill for crossing these waters of the United States would range from no fill for the smallest drainage to 7.5 cubic meters (260 cubic feet) for the largest drainage. The total amount of fill for waters of the United States that common segment 1 would cross would be 22 cubic meters (790 cubic feet). Construction activities would require work in these channels, including such actions as installing culverts or bridges and filling portions of the channel. In total, the preliminary rail line design includes bridges, culverts, and permanent fill used in these crossings. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

Caliente common segment 1 would pass within 600 meters (2,000 feet) of a small group of three isolated wetlands in the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east). These isolated, nonjurisdictional wetlands were delineated in the field survey conducted in support of this Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figure 4S). These wetlands, resulting from the development of an unnamed spring north of Black Rock Spring, would be uphill of and outside the rail line construction right-of-way; therefore, there would be no direct or indirect impacts to these wetlands.

There is no Federal Emergency Management Agency floodplain map coverage for most of Caliente common segment 1. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are six springs within the region of influence of Caliente common segment 1, with distances ranging from 620 to 1,400 meters (2,000 to 4,600 feet) from the rail line. All of these springs would fall at least 300 meters (1,000 feet) outside the construction right-of-way; therefore, there should be no impacts to these springs. However, there could be temporary disruptions in access to these springs during the construction phase. Water quality impacts are not expected due to distance, but these springs would still be marked and avoided during rail line construction activities. Some of the springs would be downgradient of construction activities, and flooding and sedimentation resulting from extreme weather events could result in short-term, direct adverse impacts to water quality. Straw bale barriers or silt fences would be placed around downstream springs to reduce the potential for erosion and runoff of sediments toward them. Section 4.2.5.2.1.7 describes common impacts to springs in the vicinity of the rail line.

Construction camps 2 and 3 would be along Caliente common segment 1, as described in Section 3.2.5.3.2. No surface-water features would be affected during construction of construction camp 2. However, there is one drainage channel that would cross the footprint of construction camp 3. The presence and location of this feature would be incorporated into the final design of the construction camp; however, the potential would exist for direct, long-term impacts. The range of potential adverse impacts is unknown without specific information regarding the facilities and their location at the construction camp; however, potential impacts include possible fill of the channel and impacts to water quality from increased sedimentation. The installation of appropriate drainage structures (such as culverts) or bridges would be used to minimize impacts, and DOE would implement erosion-control measures to reduce sediment loading into the drainage channel. Common impacts from surface-water crossings are described in Section 4.2.5.2.1.1. There would be no waters of the United States or wetlands within the footprints of construction camps 2 or 3.

4.2.5.2.2.3 Garden Valley Alternative Segments. There would be potential playa crossings along Garden Valley alternative segments 1, 2, 3, and 8. All four of these alternative segments would cross through the Golden Gate Range, but at two different locations. For the southerly alternative segments (Garden Valley 2 and 8), Water Gap is the surface-water outlet and the northerly alternative segments (Garden Valley 1 and 3) would cross an unnamed wash approximately 7.2 kilometers (4.5 miles) north of Water Gap. A bridge would be used for this crossing, and no use of fill is anticipated. These surface-water features are described in Section 3.2.5.3.3. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

No waters of the United States or wetlands were identified in the Garden Valley area (DIRS 180914-PBS&J 2006, pp. 6-9 and 11-14).

There are two springs in the vicinity of Garden Valley alternative segments 1, 3, and 8. These springs would be outside the construction right-of-way 460 meters (1,500 feet), 1,300 meters (4,300 feet) and 420 meters (1,400 feet) from the rail line, respectively. Common impacts to springs in the vicinity of the rail line are discussed in Section 4.2.5.2.1.7.

Construction camp 4, as described in Section 3.2.5.3.3, would be within the construction right-of-way near the junction of the Garden Valley alternative segments with Caliente common segment 2 and would be crossed by one drainage feature. The camp would not cross any waters of the United States or wetlands. Section 4.2.5.2.1.1 addresses common impacts from surface-water crossings.

4.2.5.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Caliente common segment 2 would cross Davis Creek and Quinn Canyon Wash and several unnamed washes. These features are described in Section 3.2.5.3.4. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along Caliente common segment 2 (DIRS 180914-PBS&J 2006, all).

There are no floodplains identified along common segment 2 in the limited area where there is floodplain map coverage; however, a floodplain is shown for an unnamed wash that would be parallel to the rail line.

Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are two springs along Caliente common segment 2, both significantly outside the rail line construction right-of-way. McCutcheon Spring would be 1,000 meters (3,400 feet) and Upper McCutcheon Spring 1,200 meters (4,000 feet) from the rail line. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

Construction camp 5, as described in Section 3.2.5.3.4, would be within the construction right-of-way. The camp would not overlie any surface-water features and would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.5 South Reveille Alternative Segments. South Reveille alternative segments 2 and 3 would run adjacent to and cross unnamed washes. These features are described in Section 3.2.5.3.5. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

No wetlands or waters of the United States were identified along these short alternative segments that would be affected by rail line construction (DIRS 180914-PBS&J 2006, all).

South Reveille alternative segment 2 would cross floodplains associated with several tributaries of an unnamed wash, as indicated in Table 4-57. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are no springs identified or construction camps planned along the South Reveille alternative segments.

4.2.5.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Caliente common segment 3 would cross numerous drainage channels. These features are described in Section 3.2.5.3.6. Common impacts to drainages are addressed in Section 4.2.5.2.1.1. Notably, Caliente common segment 3 would cross Willow Creek and six unnamed washes and skirt along the northern and western boundaries of Mud Lake Playa.

There are no waters of the United States along Caliente common segment 3 (DIRS 180914-PBS&J 2006, all).

The National Wetland Inventory lists Mud Lake Playa as a wetland; however, DOE field studies in support of this Rail alignment EIS confirmed that there are no ***hydric soils***, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 3). These studies support the determination that Mud Lake Playa is not designated as wetlands.

There is no Federal Emergency Management Agency floodplain map coverage or identified floodplains for Caliente common segment 3. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

Black Spring would be outside but adjacent to the construction right-of-way, 300 meters (1,000 feet) from the rail line. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

Construction camps 6, 7, and 8 (see Section 3.2.5.3.6) would be within the construction right-of-way and would not cross any surface-water features, waters of the United States, or wetlands.

4.2.5.2.2.7 Goldfield Alternative Segments. The Goldfield alternative segments would cross numerous drainages. These features are described in Section 3.2.5.3.7. Common impacts to drainages are addressed in Section 4.2.5.2.1.1. Goldfield alternative segment 3 would cross within 1.4 kilometers (0.87 mile) of Mud Lake Playa; therefore, it is possible that construction activities could indirectly impact the water quality of this playa.

There are no wetlands or waters of the United States along any of the Goldfield alternative segments. (DIRS 180914-PBS&J 2006, all).

There are several springs within the regions of influence of all three Goldfield alternative segments. The spring nearest to the rail alignment would be Willow Spring, which would be within 96 meters (320 feet) of the rail alignment. Willow Spring would be inside the construction right-of-way, but outside the cut and fill area; therefore access to the spring for wildlife and the public could be adversely affected. The other springs would be outside the construction right-of-way and long-term impacts would not be expected; however, there could be temporary disruptions to access during the construction phase. Common impacts to springs that would be near the rail line are discussed in Section 4.2.5.2.1.7.

4.2.5.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Caliente common segment 4 would skirt two playas, Stonewall Flat Playa to the east and Alkali Flat Playa to the southwest, and cross seven drainage channels. These features are described in Section 3.2.5.3.8. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States along Caliente common segment 4 (DIRS 180914-PBS&J 2006, all).

The National Wetland Inventory lists Stonewall Flat Playa as a wetland; however, DOE field studies in support of this Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-Potomac Hudson Engineering 2007, p. 6). There are no wetlands along Caliente common segment 4. These studies support the determination that Stonewall Flat Playa is not designated as wetlands.

Federal Emergency Management Agency floodplain maps show a floodplain associated with the Stonewall Flat Playa drainage path, as indicated in Table 4-57. Section 4.2.5.2.1.6 addresses common impacts to floodplains that would be crossed by and adjacent to the rail line.

There are no springs identified along Caliente common segment 4.

Construction camp 9, as described in Section 3.2.5.3.8, would be within the construction right-of-way and would not cross any surface-water features, waters of the United States, or wetlands.

4.2.5.2.2.9 Bonnie Claire Alternative Segments. Both of the Bonnie Claire alternative segments would cross an unnamed drainage channel that drains the area of Stonewall Mountain. Bonnie Claire alternative segment 3, the southwestern alternative segment, would also cross the Alkali Flat Playa. These features are described in Section 3.2.5.3.9. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along the Bonnie Claire alternative segments (DIRS 180914-PBS&J 2006, p. 7 and Table 3).

Floodplain maps of the area show floodplains associated with the unnamed drainage channel that drains the area of Stonewall Mountain and Alkali Flat Playa; however, map coverage of the unnamed wash terminates just downstream (southwest) of Bonnie Claire alternative segment 3. The coverage stops at an old boundary of the Nevada Test and Training Range, but is close enough to the alternative segment that a reasonable estimate of the crossing distance could be made and included in Table 4-57. The area where Bonnie Claire alternative segment 2, the northeastern alternative segment, would cross the unnamed wash is far enough away from the limit of the floodplain map coverage that a crossing distance was difficult to estimate, which is why no value is shown in Table 4-57. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are no springs identified or construction camps planned along the Bonnie Claire alternative segments.

4.2.5.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross numerous drainage channels, including Tolicha Wash and several unnamed washes, and would skirt playa areas of Sarcobatus Flat. These features are described in Section 3.2.5.3.10. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

There are no waters of the United States or wetlands identified along common segment 5 (DIRS 180914-PBS&J 2006, all).

Where common segment 5 would cross the floodplain associated with Tolicha Wash, a drainage structure would be required that would not result in more than a 0.3-meter (1-foot) increase in water-surface elevations upstream of the crossing. Playa areas near common segment 5 would be subject to occasional flooding and standing water, but the Federal Emergency Management Agency floodplain maps do not show that 100-year flood levels would reach this rail line segment. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are no springs identified along common segment 5.

Construction camp 10, as described in Section 3.2.5.3.10, would be within the construction right-of-way and would overlie two small ephemeral washes and three notable drainages. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross several washes and both would cross the Amargosa River, which is an ephemeral stream in this area. The northeastern alternative segment, Oasis Valley 3, would run within approximately 0.24 kilometer (0.15 mile) from Colson Pond. These features are described in Section 3.2.5.3.11. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

DOE field surveys of these areas identified two drainage channels along Oasis Valley alternative segment 1 and one drainage channel along Oasis Valley alternative segment 3 that would qualify as waters of the United States (DIRS 180914-PBS&J2006, Figure 3D). Crossings of waters of the United States are summarized in Table 4-55. However, DOE likely would use bridges for these crossings. Therefore, the total amount of fill for waters of the United States the Oasis Valley alternative segments would cross would be very small. Common impacts to waters of the United States are addressed in Section 4.2.5.2.1.4.

DOE field surveys also identified a small isolated wetland, WT-15 (74 square meters [800 square feet]), that would be just outside the construction right-of-way, approximately 160 meters (530 feet) north of Oasis Valley alternative segment 1 (DIRS 180914-PBS&J 2006, Table 6 and Figure 4T). There would be no direct impacts to this wetland during the construction phase because it would be outside the construction right-of-way and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible. Common impacts to wetlands are addressed in Section 4.2.5.2.1.5.

As shown in Table 4-57, both of these alternative segments would cross floodplains associated with Thirsty Canyon. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

There are 25 springs within the region of influence of the Oasis Valley alternative segments, all of which would be outside the construction right-of-way. Oasis Valley alternative segment 3 would run within 200 to 520 meters (640 to 1,700 feet) of two unnamed springs. Oasis Valley alternative segment 1 would run within 480 to 610 meters (1,600 to 2,000 feet) of seven springs. Because the springs would be downstream of the rail line, there would be the potential for impacts from erosion and sedimentation during the construction phase. Common impacts to springs are addressed in Section 4.2.5.2.1.7.

Construction camp 11, as described in Section 3.2.5.3.11, would be within the Oasis Valley 1 construction right-of-way and would overlie one small ***ephemeral wash*** and two notable ***drainages***. The camp would not cross any waters of the United States or wetlands. Common impacts from surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.2.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross several drainage features, including Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash (also known as Dune Wash), and unnamed tributaries of the Amargosa River and Drill Hole Wash. These features are described in Section 3.2.5.3.12. Common impacts to drainages are addressed in Section 4.2.5.2.1.1

Common segment 6 would cross 14 channels that qualify as waters of the United States, including two tributaries of the Amargosa River, Beatty Wash, seven tributaries to Beatty Wash, and four tributaries to Fortymile Wash. Of the 14 waters of the United States that common segment 6 would cross, the amount of fill would range from none for the smallest drainage to 9.9 cubic meters (350 cubic feet) for the largest drainage. The total amount of fill for waters of the United States common segment 6 would cross would be 37 cubic meters (1,300 cubic feet).

There are no wetlands along common segment 6 (DIRS 180914-PBS&J 2006, p. 11, Table 4).

Federal Emergency Management Agency floodplain maps provide coverage for the western portion of common segment 6, but the coverage terminates at approximately the point where the rail line would reach the Yucca Mountain Site boundary. In the areas covered by floodplain maps, the only floodplain along common segment 6 is one associated with Beatty Wash. The maps also show a floodplain associated with the unnamed wash from Crater Flat, but it does not extend up the wash as far as where common segment 6 would cross. DOE would build a large (370-meter [1,200-foot]-long) special-condition railroad bridge across Beatty Wash. Although the floodplain maps do not provide coverage for the area of the repository site on the east side of Yucca Mountain, there have been flood studies performed on several washes in that area, as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-38 and 3-39). If the Caliente rail alignment is overlain on the figure of the floodplains in the Yucca Mountain FEIS (see Figure F-15 in Appendix F of this Rail Alignment EIS), it can be seen that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash before it terminated just prior to crossing a floodplain associated with Midway Valley Wash (also known as Sever Wash). Table 4-57 lists the estimated crossing distances for Beatty Wash, Busted Butte Wash, and Drill Hole Wash. Common impacts to floodplains and floodwaters are addressed in Section 4.2.5.2.1.6.

No springs have been identified along common segment 6.

Construction camp 12, as described in Section 3.2.5.3.12, would be within the common segment 6 construction right-of-way and would overlie one small ephemeral wash. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.2.5.2.1.1.

4.2.5.2.3 Impacts from Constructing Facilities

4.2.5.2.3.1 Interchange Yard.

Caliente Alternative Segment Interchange Yard The Interchange Yard on the Caliente alternative segment would be in the City of Caliente, directly across from the former Union Pacific Railroad Caliente Station within the area of the former Union Pacific Railroad yards. Table 4-55 lists drainage crossing information for the Caliente Interchange Yard. Section 4.2.5.2.1.1 addresses impacts to drainages common to the entire Caliente rail alignment.

There would be no waters of the United States or wetlands within the footprint of the Interchange Yard at Caliente.

Federal Emergency Management Agency floodplain maps for this area show that a 240-meter (790-foot) section of the Interchange Yard would sit in a 100-year floodplain and the rest would be within a 500-year floodplain. Floodwaters from Meadow Valley Wash flow through the center of Caliente to the south where they merge with the runoff from three dry washes that flow to the southwest. In the area where the Interchange Yard would intersect the 100-year floodplain, DOE calculated that the floodwater depth would be 0.90 meter (3 feet) during the 100-year storm event (DIRS 176806-FEMA 1985, all). Because the interchange tracks would be in an area already occupied by an existing Union Pacific siding, the yard would not be likely to obstruct the flow of floodwaters to the point that floodwater depths would increase. Section 4.2.5.2.1.6 addresses impacts to floodplains and floodwaters common to the entire Caliente rail alignment.

There would be no springs within the footprint of the Interchange Yard.

Eccles Alternative Segment Interchange Yard The Interchange Yard on the Eccles alternative segment would be immediately adjacent to the Union Pacific Railroad Mainline within the confines of Clover Creek approximately 8 kilometers (5 miles) east of Caliente. Clover Creek is an ***ephemeral creek*** classified as a water of the United States and drains an area of about 970 square kilometers (240,000 acres) east of the site. Drainage through the site is from east to west, toward Meadow Valley Wash and Caliente. Table 4-55 lists drainage crossing information for the Eccles Interchange Yard. Construction of the Interchange Yard at Eccles would require portions of Clover Creek to be filled to elevate the site out of the floodplain. For a length of approximately 1,400 meters (4,600 feet) along the ephemeral creek bed, for the construction of the interchange tracks, the fill would extend approximately 7.6 to 15 meters (25 to 50 feet) into the ephemeral creek bed. For a length of approximately 900 meters (2,900 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks, for the construction of the interchange siding, the fill would extend approximately 8 meters (25 feet) into the creek. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres). Common impacts to drainages are addressed in Section 4.2.5.2.1.1; however, filling a long section of a stream bank has the potential to create greater adverse impacts than simply crossing a stream, because the structure of the stream itself would be modified to a much greater extent than for a bridge crossing or culvert that would have less presence within the steam channel. It is likely that Clover Creek would be disturbed along the entire length of the Interchange Yard, which could result in a permanent alteration of the localized hydraulic conditions. Such alterations to the hydraulic conditions of the stream bed would have the potential to increase flow velocity and result in a higher potential for erosion during flood events.

Field surveys identified three small wetland areas (see Appendix F) associated with Clover Creek within 300 meters (980 feet) of the existing railroad embankment. DOE would not expect direct impacts to these wetlands during the construction phase because they would be outside the construction right-of-way for the Eccles Interchange Yard and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible; however, DOE would expect those impacts to be small because of the best management practices the Department would use to prevent construction-related impacts. DOE would use appropriate protection measures (such as lining the fill with riprap) along the entire length of the Interchange Yard to stabilize and protect the structure from floodwaters. Section 4.2.5.2.1.6 addresses impacts to floodplains and floodwaters common to the entire Caliente rail alignment.

No springs have been identified that would be within the boundary of the Eccles Interchange Yard.

4.2.5.2.3.2 Staging Yard.

Caliente Staging Yard There are two options for siting the Staging Yard along the Caliente alternative segment. One would be approximately 1.6 kilometers (1 mile) northeast of Caliente (the Indian Cove option); the other would be 6.4 kilometers (4 miles) northeast of Caliente (the Upland option). At Indian Cove, the Staging Yard would be constructed in a meadow that is a floodplain of Meadow Valley Wash on the east side of U.S. Highway 93, roughly midway between the City of Caliente and Indian Cove.

Construction of the Staging Yard at Indian Cove would require the wetland meadow area to be drained and built up above the level of the floodplain. It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. Meadow Valley Wash drainage through the site is from north to south toward the City of Caliente. Drainage of the site would be accomplished by constructing a channel along the eastern edge of the facility. The channel around the site would be approximately 1,680 meters (5,500 feet) long. The Department would determine final channel dimensions during final design of the Staging Yard. It is very likely that a system of drains would have to be constructed under the Staging Yard tracks. Fill could be needed to elevate portions of the site out of the floodplain. These actions would require permits from the U.S. Army Corps of Engineers, and compliance with Section 404 of the Clean Water Act for stormwater runoff control measures.

The Staging Yard at Indian Cove would require filling an area of wetlands and the associated plant and animal habitat (see Section 4.2.7 for a discussion of impacts to biological resources). DOE was unable to delineate wetlands in this area because it is private property; however, much of this meadow is believed to be wetlands. Assuming that the entire meadow is wetlands, the Staging Yard at Indian Cove would require up to 0.19 square kilometer (47 acres) of wetlands to be filled. The filling of up to 0.19 square kilometer of wetlands in Indian Cove for the Staging Yard would have a large impact on the functions of the wet meadow, such as its ability to support wildlife, retain flood flows, and filter water.

The Staging Yard at Upland, also in Meadow Valley, approximately 5 kilometers (3 miles) north of Indian Cove would cross one water of the United States within the Staging Yard area; however, DOE would build a bridge in that location, and no use of fill is anticipated. There are no wetlands in the area of the Staging Yard location at Upland; therefore there would be no impacts (see Section 4.2.5.2.1.1).

Eccles Staging Yard A Staging Yard on the Eccles alternative segment (Eccles-North) would be approximately 13 kilometers (8 miles) north of Eccles about 910 meters (3,000 feet) east of U.S. Highway 93. There are no wetlands or floodplains in this area; however, the southern portion of the Staging Yard would cross one unnamed wash, identified as a water of the United States (DIRS 180914-PBS&J 2006, Figure 3A). This is the only wash that would be within the fenceline of the Eccles-North Staging Yard.

4.2.5.2.3.3 Maintenance-of-Way Facilities. The Maintenance-of-Way Trackside Facility would be on the north side of Caliente common segment 3 approximately 18 kilometers (11 miles) east of its junction with the Goldfield alternative segments. There is one notable drainage in the proposed location for the facility.

DOE could construct the Maintenance-of-Way Headquarters Facility in the Tonopah area. Depending on the location the Department selected, ephemeral washes could be encountered in this area. Impacts on drainage patterns or changing erosion and sedimentation rates or locations associated with construction of the rail line would be small. DOE would minimize any potential impacts from the storage of hazardous materials at the Maintenance-of-Way Headquarters Facility through the implementation of a Spill Prevention, Control, and Countermeasures Plan and best management practices related to the storage, use, and proper disposal of such products. Based on these conditions, impacts to surface-water quality from accidental spills of hazardous substances during rail line construction would be small.

4.2.5.2.3.4 Rail Equipment Maintenance Yard. Because there are no perennial surface waters in the area where the rail line would end at Yucca Mountain, potential impacts to surface-water features from the construction of rail line facilities in that area would be small (similar to the common impacts already described in Section 4.2.5.2.1.1). The Rail Equipment Maintenance Yard would overlie one ephemeral wash, but would not cross any waters of the United States. The Yard construction area would also include the train crew quarters, and could be the location for the Nevada Railroad Control Center and National Transportation Operations Center, and the Cask Maintenance Facility. Construction of the operations support facilities would include stormwater runoff control, as necessary, which would minimize the potential for contaminated runoff to reach any of the washes in the area; therefore, impacts related to construction of the Rail Equipment Maintenance Yard would be small.

4.2.5.2.4 Quarries

Each quarry facility would be comprised of three primary components: an operations plant, the quarry and production area, and possibly a railroad siding. The operations plant would include an office and administration complex, parking areas, services for fueling and maintenance, and sanitary facilities. Portable sanitary systems would be provided onsite; no water supply or ***wastewater treatment*** facilities would be provided at the quarry sites. The quarries would be close enough to construction camps that on-site residential facilities would not be necessary.

Ballast quarry operations would require the use of water, primarily to wash excavated rock during crushing and screening operations. Water usage quantities would vary depending on the specific quarry process selected to wash the rock during these operations. It is estimated that approximately 140,000 liters (38,000 gallons) of water would be needed per operational day at each quarry site (DIRS 180922-Nevada Rail Partners 2007, p. 3-2). Water used during these activities would also be used for dust suppression in quarry operational areas. The wash water would be contained and recirculated through settling ponds. Relatively small quantities of water would also be used for dust suppression during drilling and blasting, truck loading and unloading, ballast stockpile and waste rock pile operations, and along access roads and in the quarry pit to suppress dust from truck and heavy equipment operations. Water used for dust suppression in these areas would not be expected to result in runoff from the quarry operational areas.

Overburden and waste rock removed from quarry areas would be stockpiled and later used for reclamation of the quarry sites. These piles would be stabilized or, if necessary, covered (for example, with mulch, netting, or synthetic stabilizer) to reduce the potential for erosion and runoff of sediments from these areas. Other best management practices that would be implemented include filter berms, straw-bail barriers, silt fences, or revegetation, as necessary. The change in the amount of runoff that would actually reach drainage channels would be minor, because construction would affect a small amount of the overall natural drainage areas.

Three separate programs established by the Clean Water Act are significant when reviewing activities associated with potential quarries. These include the establishment of water quality standards pursuant to Section 303(c) of the Clean Water Act, National Pollutant Discharge Elimination System permit requirements set forth in Section 402 of the Clean Water Act, and dredge and fill permit requirements set forth in Section 404 of the Clean Water Act. General National Pollutant Discharge Elimination System permits would require that best management practices (including inventorying, assessment, prioritization, and identification and implementation of best management practices) be employed to meet water quality standards. It is expected that any discharges associated with quarry operations would be managed with appropriate stormwater control systems that would effectively minimize off-site impacts from stormwater drainage. Thus, impacts to surface-water features associated with quarry operations would be small.

Worth particular mention is potential quarry CA-8B, which would be along the Caliente alternative segment. Although the quarry itself would not intersect any waters of the United States or wetlands, the quarry siding would be within a wetland area (non-delineated). Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.

4.2.5.3 Railroad Operations Impacts

Potential impacts during the operations phase are addressed in relation to the impact assessment standards for surface-water resources identified in Table 4-54, including stormwater drainage and surface-water quality. Section 4.2.5.2.1 addresses surface-water availability, and floodplains and wetlands.

4.2.5.3.1 Operations Impacts Common to the Entire Rail Alignment

Operation of the proposed railroad would result in a small impact to surface waters beyond the permanent drainage alterations from construction. The rail roadbed would be expected to have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas within the overall drainage system, the impact on overall runoff quantities would be small. Thus, impacts related to stormwater increases would be limited to those localized areas where drainage patterns would be altered to convey storm flows.

Rail line maintenance would require periodic inspections of flood-prone areas (particularly after flood events) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. If the eroded areas had to be repaired often, that would be an indication that flow patterns had been changed and sediment was being moved as the water was cutting out a new channel. Regular inspection and maintenance of the rail line would help ensure that erosion and sedimentation problems were identified and addressed in a timely manner so that they did not contribute to upstream or downstream impacts. Therefore, impacts during the operations phase from sediment buildup and floodwater activity would be small.

The primary sources of potential surface-water contamination during the operations phase would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and implementing best management practices.

4.2.5.3.2 Facility Operations

The primary sources of potential surface-water contamination during operation of facilities would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and leaks implementing best management practices. Activities at the facilities (including quarries) would adhere to a Spill Prevention, Control, and Countermeasures Plan to comply with environmental regulations and would also include a number of best management practices. The plan would describe the actions the Department would take to prevent, control, and remediate spills of fuel or lubricants. It would also describe the reporting requirements that would accompany the identification of a spill (DIRS 155970-DOE 2002, p. 4-23). Therefore, impacts to surface waters from facilities operations would be small.

Sanitary sewage generated at facilities would be contained and removed, sent to treatment facilities, or in some cases, disposed of through on-site septic systems. No industrial wastewater discharges would be expected from the operation of facilities. All wastewater collection and transfer systems would be designed and operated such that untreated wastewater would not be released to the environment; therefore, impacts to surface-water resources from facilities operations would be small.

4.2.5.3.3 Quarry Operations

Quarries would be reclaimed following the construction phase, and would not be used during the operations phase. Therefore, there would be no impacts from quarry operations.

4.2.5.4 Shared-Use Option

Construction impacts to surface-water resources under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. The Shared-Use Option would involve the construction of additional sidings, which would be approximately 300 meters (980 feet) long and would be aligned parallel to the rail line within the construction right-of-way. Construction of these additional sidings would involve the same types of land disturbance as for the Proposed Action without shared use, but with minor additive impacts. As for the Proposed Action without shared use, potential impacts would be the release and spread of contaminants by precipitation or intermittent runoff events or, for portions of the rail line near surface-water bodies, possible release to the surface water; the alteration of natural drainage patterns or runoff rates that could affect downgradient resources; and the need for dredging or filling of perennial or ephemeral streams. However, the adverse impacts to surface-water resources from constructing additional sidings under the Shared-Use Option would add little to potential impacts described for the Proposed Action without shared use, because the same control measures would be in effect. Because construction of these additional sidings would not be a DOE action and there are uncertainties regarding the exact locations of needed commercial-use facilities, specific impacts of the Shared-Use Option to surface-water features were not analyzed.

Operations impacts under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Use of a completed rail line from Caliente to Yucca Mountain, including additional sidings, would result in small impacts to surface waters beyond the permanent drainage alterations that would result from construction. The rail roadbed would likely have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas in a single drainage system, the impact from shared-use operations on overall runoff quantities would be small.

Maintenance of the rail line and shared-use sidings would require periodic inspections of flood-prone areas (particularly after floods) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. Therefore, impacts from rail line maintenance related to sedimentation and erosion under the Shared-Use Option would be small.

General freight shipped on the proposed rail line could include mineral products, petroleum, agricultural products, or other commodities shipped or received by private companies. Spills of oil or hazardous substances carried on the rail line as general freight could affect surface-water resources. If a spill occurred, the potential for contamination to enter flowing surface water would present the greatest risk of a large contaminant migration until spills were contained and remediated. If there was no routinely flowing surface water, as is the condition for most areas along the Caliente rail alignment, it is expected that released materials would not travel far or affect critical resources before corrective action could be taken. Compliance with regulatory requirements on reporting and remediating spills would result in a small probability of spills and, with specific regard to rail line operations, the overall risk of a transportation ***accident*** that could result in a release of a hazardous substance is considered to be small, as discussed in Section 4.2.10, Occupational and Public Health and Safety. Therefore, impacts to surface-water resources from potential accidental releases of contaminants from commercial rail shipments during operations under the Shared-Use Option would be small.

4.2.5.5 Summary

4.2.5.5.1 Impacts Common to the Entire Caliente Rail Alignment

Construction and operation of a railroad along the Caliente rail alignment could result in both direct and indirect impacts to surface-water resources (see Table 4-58). Direct impacts would include temporary or permanent grading, dredging, rerouting, or filling of surface-water resources. Indirect impacts would potentially increase or impede surface flow. Also, nonpoint source pollution could result from runoff from areas where surface grades and characteristics were changed (such as the rail roadbed and access roads). Overall, impacts to surface-water resources from railroad construction and operations would be small.

To evaluate potential impacts to surface-water resources, DOE identified areas where there are surface-water resources along the rail alignment (including those that would be crossed, filled, or covered) and identified the activities associated with construction or operations that would have the potential to affect these surface-water resources. Because of their importance in influencing the types and magnitude of potential impacts, Table 4-55 summarizes the numbers of surface-water features the Caliente rail alignment would encounter. The table includes estimates of the total number of surface-water features the rail line, facilities, and quarries would cross. Such features include drainage channels, floodplains, and wetlands. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.2.5.2.1, and the second includes drainage channels that would be classified as waters of the United States.

In all instances where the alignment would cross or come close to a surface-water feature, that feature could be affected to some degree by railroad construction and operation; however, impacts would be substantially minimized through the engineering design process and the implementation of best management practices prior to, during, and after construction. DOE would incorporate hydraulic modeling into the engineering design process to ensure that crossings were properly engineered so they would not contribute to erosion and sediment pollution. The design of drainage structures would account for scour and erosion and incorporate outlet protection and velocity-dissipating devices that would calm the flow and diminish its erosive potential. Because conveyance systems would be designed to safely convey increased flow during storm events (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater drainage conveyance from construction of the rail line would be small. DOE would minimize impacts to surface-water resources through the implementation of engineering design standards (as described above) and best management practices (see Chapter 7). Best management practices would include erosion control measures, such as the use of silt fences and flow-control devices to reduce flow velocities and minimize erosion. Further, the Department would minimize filling of surface-water resources by incorporating avoidance into final engineering and design of the rail line, to the extent practicable. DOE would use a minimum-width rail line footprint whenever possible.

Table 4-58. Summary of impacts to surface-water resources – Caliente rail alignment (page 1 of 2).

Rail line segment/facility (county)	Proposed Action[a]	
	Construction impacts[b,c]	Operations impacts
All alternative segments and common segments (Lincoln, Esmeralda, and Nye Counties)	Potential for increases in nonpoint source pollution, alteration of natural drainage patterns and runoff rates, temporary blockage of surface drainage channels, localized changes in drainage patterns, and increases in the flow rate in relation to natural flow conditions. Potential for release and spread of contaminants through an accidental spill or discharge. Potential impact from erosion and sediment loading and reduction of floodwater area flow.	Potential for fuel spills or release of contaminants. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Staging Yard and Maintenance-of-Way Facilities (Lincoln, Nye, and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential for fuel spills or release of contaminants.
Potential quarries (Nye and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential impact from erosion and sediment loading.
Rail Equipment Maintenance Yard; Cask Maintenance Facility; Nevada Railroad Control Center and National Transportation Operations Center (Nye County)	Potential impact from erosion and sediment loading.	Potential for fuel spills during fueling; fuel transfer; or storage tank failure. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Caliente alternative segment (Lincoln County)	0.05 square kilometer (12 acres) of wetlands would be filled to construct the rail line. Temporary elimination of access to Caliente Hot Springs.	Permanent loss of wetlands. Long-term reduced and potentially eliminated access to Caliente Hot Springs.
Eccles alternative segment (Lincoln County)	Wetland fill would be very small; crossing would be bridged.	No additional surface-water impacts would be anticipated.
Goldfield alternative segment 3 (Nye County)	Reduced temporary access to several springs; temporary or long-term eliminated access to Willow Springs.	Long-term reduced and potentially eliminated access to Willow Springs.
Staging Yard – Indian Cove (Lincoln County)	0.19 square kilometer (47 acres) of wetlands would be filled.	Permanent loss of wetlands.
Interchange Yard at Eccles (Lincoln County)	0.033 square kilometer (8.2 acres) of Clover Creek would be filled.[e]	Permanent loss and rerouting after filling of Clover Creek.
Potential quarry CA-8B (Lincoln County)	0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.	Permanent loss of wetlands.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. Wetland filling estimates are based on the assumption that the construction right-of-way would be 21 meters (70 feet) wide.
c. Floodplain crossing distance is given as a range. The minimum crossing distance is represented by the length of the rail line crossing Federal Emergency Management Agency mapped floodplains. The maximum value represents the minimum value in addition to the estimated crossing distance over floodplains that have not been mapped.

DOE would avoid surface-water resources by increasing the slope of the rail roadbed or bridging across wetlands and not constructing access roads in wetlands. In areas where the Department could not completely avoid wetlands (such as the areas along the Caliente alternative segment), DOE would reduce the rail line footprint to a minimum of 21 meters (70 feet). Also, the final position of the rail line could be shifted to avoid filling wetlands and other surface-water resources whenever practicable. By incorporating avoidance of these resources into final rail line engineering and design, adverse impacts to wetlands (and the functions of wetlands) and other surface-water resources from rail line construction would be small.

4.2.5.5.2 Alternative Segment-Specific Impacts

The Caliente alternative segment is adjacent to wetlands and some wetland fill would be unavoidable. DOE proposes to construct the Caliente alternative segment over the abandoned Union Pacific rail roadbed in part to minimize filling wetlands. Of the 0.28 square kilometer (68 acres) of wetlands delineated along the alignment, only 0.05 square kilometer (12 acres) would be filled to construct the rail line. DOE could modify the final design of the rail line to avoid additional wetlands, such as those adjacent to the old rail roadbed along Meadow Valley Wash, by using a slightly narrower construction footprint; however, this would only slightly reduce the area of wetlands that would be filled.

Another area where a potentially large quantity of fill could be needed is potential quarry CA-8B, which would be along the Caliente alternative segment. Although the quarry itself would not intersect any waters of the United States or wetlands, the quarry siding would be within a non-delineated wetland area. Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the siding.

Construction of the Staging Yard at Indian Cove would require filling an area of wetlands. The wetland meadow area would be drained and built up above the level of the floodplain. Constructing an active drainage system and a channel around the site to keep the area dry and in a stable condition might also be necessary. The proposed channel around the site would be approximately 1,680 meters (5,500 feet) long.

These actions would require permits from the U.S. Army Corps of Engineers, and compliance with Section 404 of the Clean Water Act for stormwater runoff control measures. Approximately 0.19 square kilometer (47 acres) of wetlands would be filled to construct the Staging Yard at Indian Cove.

The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. For a length of approximately 1,400 meters (4,600 feet) along the bed of this ephemeral creek, for the construction of the interchange tracks, the fill would extend approximately 7.6 to 15 meters (25 to 50 feet) into the creek bed. For a length of approximately 900 meters (2,900 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks, for the construction of the interchange siding, the fill would extend approximately 8 meters (25 feet) into the creek. The total area that would be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres).

Construction of Goldfield alternative segment 3 would adversely affect Willow Spring. The spring is within 96 meters [315 feet] of the alternative segment, which would be inside the construction right-of-way, but outside the cut and fill area. Willow Spring would be fenced or flagged during the construction phase; however, there could be long-term adverse impacts to public access to this spring due to its proximity to the rail line.

4.2.6 GROUNDWATER RESOURCES

This section describes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment. To analyze potential impacts, DOE considered whether constructing and operating the railroad would result in:

- Possible damage to existing wells as a result of construction work
- Possible declines in groundwater levels or groundwater production rates at existing groundwater production wells
- Possible changes in discharge rates at existing springs
- Possible changes in infiltration rates in disturbed areas
- Possible changes in groundwater quality at wells, springs, or in shallow groundwater
- Potential subsidence of the ground surface

Section 4.2.6.1 and Appendix G describe the methods DOE used to assess potential impacts to existing groundwater resources; Section 4.2.6.2 describes potential construction; Section 4.2.6.3 describes potential impacts of railroad operations; Section 4.2.6.4 describes potential impacts under the Shared-Use Option; and Section 4.2.6.5 summarizes potential impacts to groundwater resources.

Section 3.2.6.1 describes the region of influence for groundwater resources. The section includes a discussion of existing wells and springs that fall within the Caliente rail alignment region of influence that could be affected by new groundwater wells that would furnish water to support construction and operation of the proposed rail line.

4.2.6.1 Impact Assessment Methodology

DOE considered a variety of methods for obtaining water that would be needed to support construction and operation of the proposed rail line and railroad construction and operations support facilities. These methods include, but are not limited to, construction of new water wells; purchasing water from municipalities or other existing water-rights holders; or importing water from other groundwater ***hydrographic areas***. A combination of such methods could reduce potential impacts to groundwater resources. However, the acquisition of all required water from new wells would place the greatest amount of increased water demand on existing groundwater resources. Therefore, to develop a conservative analysis or upper bound estimate of potential impacts to groundwater resources, DOE assumed that it would obtain all water required for construction and operation of the rail line and railroad construction and operations support facilities from newly constructed wells. This Rail Alignment EIS does not analyze the impacts of obtaining water through other methods.

In this Rail Alignment EIS, DOE evaluates the potential impacts associated with the following types and categories of new water wells that would be installed and utilized to obtain water required for construction and operation of the proposed rail line and associated facilities:

- Construction water wells – These temporary wells (DIRS 176189-Converse Consultants 2006, Section 2.1 and Table 2-2) would furnish approximately 90 percent of the total project water demand. Wells in this category include wells that would provide water for earthwork compaction during rail roadbed construction and wells that would supply water for temporary construction camps. Nearly all water obtained from wells to support rail roadbed construction within each hydrographic area would be pumped within a 1-year period within that area. The average groundwater withdrawal (usage) rate for these wells would vary according to location. Water wells at construction camps would have average withdrawal rates of 76 liters (20 gallons) per minute.

- Quarry water wells – These wells would supply water to support start-up and operation of quarry operations, with each quarry being in operation over an estimated period of about 2 years, following an initial startup period. The average withdrawal rate for these wells would be approximately 91 liters (24 gallons) per minute.

- "Permanent" water wells – These wells would supply water to meet water requirements for rail sidings and railroad operations facilities and provide water for fire protection purposes. Average withdrawal rates for these wells would be very low (less than 3.8 liters [1 gallon] to approximately 16 liters (4.2 gallons) per minute). DOE would use these new wells during the 50 years of railroad operations.

DOE would install most of the new water wells adjacent to new access roads that would be constructed on either side of the rail roadbed and within the rail line construction right-of-way. DOE assumes that if it could not obtain adequate volumes of water from any of these new wells because of limited ***aquifer*** productivity (less then the required productivity for that location based on the water demand at the associated construction location) it would obtain the additional water required from other new wells proposed for installation either within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way or from one or more of the proposed new wells situated outside of that right-of-way. In these cases, the water would either be transported by truck or pumped through a temporary above-ground pipeline. Wells installed outside the construction right-of-way would be installed as near as reasonably possible to the right-of-way, based on ***hydrogeologic*** criteria, except for wells installed at the proposed quarry sites, which might or might not be at more remote locations.

DOE considered a number of factors to evaluate potential adverse impacts to groundwater resources. There could be an adverse impact if construction and operation of the rail line and railroad construction and operations support facilities would cause any of the conditions listed in Table 4-59.

Table 4-59. Impact assessment considerations for groundwater resources.

Resource criteria	Basis for assessing adverse impact
Groundwater availability and uses	• Adversely affect an existing aquifer. Adverse effects would include substantial depletion of groundwater supplies on a scale that would affect available capacity of a groundwater source for use by existing water-rights holders within the hydrographic area where groundwater withdrawal would occur or in any downgradient hydrographic area, interfere with groundwater recharge, or reduce discharge rates to existing springs or seeps. • Conflict with established water rights, allotments, or regulations protecting groundwater resources.
Ground subsidence	• Cause subsidence of the ground surface (as a result of groundwater withdrawals).
Groundwater quality	• Contaminate a public water supply aquifer and exceed federal, state, or local water-quality criteria.

To evaluate potential impacts to groundwater resources DOE considered:

- Potential changes to infiltration rates, with consequent changes to percolation rates of surface water to the groundwater system, that could be caused by the same disturbances evaluated in the surface-water impact analysis (also see Section 4.2.5, Surface-Water Resources).

- Potential changes to groundwater quality due to groundwater withdrawals or from accidental spills or releases

- Potential impacts to aquifer users and uses resulting from withdrawal of groundwater from new wells to support water needs for construction and operation of the rail line and railroad construction and operations support facilities. DOE focused the impact analysis on aquifers and the existing groundwater users who withdraw water from the groundwater hydrographic areas that would serve as sources of water for construction and operation of the rail line. DOE compared the amount of water that would be required for construction and operation of the railroad to the availability and existing uses of groundwater in those groundwater hydrographic areas. Existing groundwater resources addressed in these evaluations include existing wells, springs, and groundwater seeps. DOE considered potential impacts resulting from the following actions: (1) pumping from new wells to obtain water needed for rail roadbed construction (including water needed for earthwork, dust control, and construction camps) and (2) pumping from new wells installed to support quarry operations, rail sidings, and other railroad facilities.

- Potential for damage to existing wells from construction activities or potential ground subsidence as a result of the proposed groundwater withdrawals

4.2.6.2 Construction Impacts

4.2.6.2.1 Construction Impacts Common to the Entire Rail Alignment

Impacts to groundwater or the land surface during the construction phase could include: (1) potential changes in infiltration rates in disturbed areas, with consequent changes in percolation rates of surface water to groundwater (addressed in Section 4.2.5, Surface-Water Resources); (2) reduced flow to springs or a reduction in available flow rates to one or more existing wells within the ***radius of influence*** of, or the radius of the ***cone of depression*** surrounding, proposed new wells; (3) possible damage to, or loss of, use of existing wells within the construction right-of-way; (4) degradation of groundwater quality resulting from groundwater withdrawals; or (5) potential ground subsidence.

As described in Section 4.2.5, construction of the rail line and construction and operations support facilities would result in land-surface disturbance such as grading, excavation, or stockpiling that would alter the rate at which water could infiltrate the disturbed areas. Construction activities would disturb and temporarily loosen the ground, which could produce temporarily higher near-surface infiltration rates (see Section 4.2.5). This situation would typically be short lived; the rail roadbed materials and disturbed areas associated with railroad facilities and ballast areas would become compacted and less porous, with most of the land disturbance during railroad and facilities construction likely resulting in surfaces with lower infiltration rates causing an increase in runoff. Even in the short term, localized changes in infiltration would likely cause no large-scale change in the amount of groundwater percolation ***recharge*** because the disturbed areas would be a very small percentage of the overall surface area of a hydrographic area (see Section 4.3.5). Therefore, changes to infiltration rates in the region where construction would take place would be small, and adverse impacts associated with changes in storm-water infiltration rates would be small.

Most recharge to aquifers in the region is derived from precipitation falling in the higher parts of the inter-basin mountain ranges (see, for example, DIRS 103136-Prudic, Harrill, and Burbey 1993, pp. 2, 58, 84, and 88). The climate in the region through which DOE would construct the Caliente rail alignment is generally arid. These factors combine to produce a deficit of shallow groundwater beneath many parts of the rail alignment, such as several valley floors it would cross. Estimated depths to groundwater beneath most of the hydrographic areas the rail line would cross range from approximately 30 to 100 meters (100 to 330 feet) or more below ground, with the shallowest groundwater at 3 to 15 meters (10 to 50 feet) below ground in the Meadow Valley Wash and Oasis Valley areas (DIRS 176600-Converse Consultants 2005, Plates 4-1 through 4-15; DIRS 176189-Converse Consultants 2006, Appendix B). Available hydrogeologic information suggests that shallow groundwater would occur infrequently, and on a localized basis, beneath the Caliente rail alignment.

Other potential impacts include degradation of groundwater quality due to new sources of ***contamination*** that could come into direct contact with, or migrate to, groundwater. Construction-related materials that would be used in this arid environment, that could contaminate groundwater if spilled, include petroleum products (such as fuels and lubricants) and coolants (such as antifreeze) necessary to operate construction equipment. The infrequent occurrence of shallow groundwater beneath the Caliente rail alignment (see Section 3.2.6) indicates that the probability of ***contaminants*** reaching underlying groundwater would be low; therefore, DOE would not expect impacts to groundwater quality resulting from spills of hazardous or nonhazardous materials.

As discussed in Section 4.2.11, Utilities, Energy, and Materials, sanitary wastes from the construction camps would be disposed of in accordance with all applicable regulatory requirements. By complying with regulatory requirements, DOE expects that wastewater-related impacts to groundwater resources in these areas would be minimized.

Railroad construction activities might occur near one or more existing wells. However, based on the available data, DOE does not anticipate that construction activities would disturb any existing wells. In the unlikely event that wells are identified prior to rail roadbed construction that could be disturbed by construction activities, DOE would take steps to minimize impacts to those wells, such as advising well owners of planned activities and discussing with the owners measures needed to protect the well head (the portion of the well above the ground surface) during construction.

An estimated total of approximately 7.5 million cubic meters (6,100 ***acre-feet***) of water could be required to construct the rail line and railroad construction and operations support facilities (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.1). This estimate updates the estimate of 880,000 cubic meters (710 acre-feet) given in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 6-4). DOE would use water for earthwork compaction, control of excavation dust, workforce needs, and ballast production (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.2). As discussed in Chapter 2, Proposed Action and Alternatives, DOE is considering a 4- to 10-year railroad construction schedule.

The typical groundwater pumping scenario for rail roadbed construction wells assumes a 9-month effective pumping period with 3 months of lost production for each construction well because of adverse weather conditions or other factors such as equipment repairs. This provides for a conservative or upper bound estimate of groundwater withdrawal rates that would result in the largest potential impacts (greatest amounts of drawdown) to groundwater resources and existing groundwater users potentially situated within the region of influence of the proposed water wells. If the construction schedule were lengthened (for example, up to 10 years), the same amount or less water would be required to support construction activities in any given year, thereby resulting in the same or reduced groundwater withdrawal rates and the same or reduced impacts to groundwater resources and existing groundwater users. Section 4.2.6.2.2 further describes the approach and methods DOE used to quantitatively evaluate potential site-specific impacts to groundwater resources.

Table 4-60 lists the proposed Caliente rail alignment alternative segments and common segments and summarizes the estimated total construction-related water requirements (demands) within each hydrographic area. The table lists a range of water demand values for hydrographic areas associated with more than one alternative segment or common segment (Coal Valley, Garden Valley, Alkali Spring Valley, Stonewall Flat, and Lida Valley areas). Figure 4-13 depicts the Caliente rail alignment, hydrographic areas the rail line would cross, and the range of estimated total water demands associated with construction within each hydrographic area.

As described in Section 3.2.6, Table 3-35 identifies hydrographic areas considered to be ***designated groundwater basins***, and lists information about total annual committed resources and ***pending annual duty*** amounts in the listed hydrographic areas. Six of the 19 hydrographic areas are designated groundwater hydrographic areas. Comparison of the estimated water demands within each hydrographic area the Caliente rail alignment would cross with information presented in Table 3-35 indicates that water demands in some hydrographic areas could, depending on the alternative segment selected (areas 144 and 145), or would (area 229), exceed the estimated ***perennial yield*** value for that hydrographic area. It should be noted that, for all hydrographic areas crossed, approximately 90 percent of the groundwater withdrawals would be temporary withdrawals, occurring within 1 year or less, rather than long-term withdrawals. For evaluating potential impacts from the proposed groundwater withdrawals, it is also noteworthy that although available groundwater resources in some hydrographic areas might be deemed to be currently "overcommitted" as a whole (hydrographic areas 203, 204,170, 173A, 149, 146, 228, and 229), one or more particular aquifers within a hydrographic area might not be overcommitted. Additionally, all water-rights appropriations might not be in service simultaneously.

Tables 3-35 and 4-60 suggest that the selection of one alternative segment over another would make no notable difference in the amount of water needed to support construction when compared to the annual committed resources and pending annual duty amounts for each hydrographic area, with the following exceptions:

- Goldfield alternative segment 3 would not cross and, therefore, would not require any groundwater withdrawals, within hydrographic area 142 (Alkali Spring Valley). Construction of either Goldfield alternative segment 1 or 4 through hydrographic area 142 would result in groundwater demands representing approximately 5 percent or 19 percent, respectively, of the estimated annual perennial yield and approximately 5 percent or 21 percent, respectively, of the total annual committed resources of the hydrographic area.

- Construction of Goldfield alternative segment 3 within hydrographic area 145 (Stonewall Flat) would result in a groundwater demand representing approximately 460 percent of the estimated annual perennial yield and approximately 38 times the total committed resources of the hydrographic area. Construction of either Goldfield alternative segment 1 or 4 through hydrographic area 145 would result in groundwater demands representing approximately 290 percent or 40 percent, respectively, of the estimated annual perennial yield and approximately 24 times or 36 times, respectively, of the total committed resources of the hydrographic area.

Construction of Goldfield alternative segment 4, Caliente Common Segment 4, and Bonnie Claire alternative segment 4 within hydrographic area 144 (Lida Valley), would result in the highest groundwater demand, approximately 108 percent of the estimated annual perennial yield and approximately 525 percent of the total annual committed resources of the hydrographic area. Construction of Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Claire alternative segment 3 would result in the lowest groundwater demand, approximately 44 percent of the estimated annual perennial yield and approximately 216 percent of the total annual committed resources of the hydrographic area. Construction of Caliente common segment 4 and other combinations of alternative segments within hydrographic area 144 would result in total water demands between the high and low demands associated with the two combinations described above.

Construction of Oasis Valley alternative segment 1 and common segments 5 and 6 within hydrographic area 128 (Oasis Valley) would result in a groundwater demand equaling approximately 41 percent of the estimated annual perennial yield and approximately 31 percent of the total annual committed resources of the hydrographic area.

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 1 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
204 - Clover Valley	1000	3,787/0	Caliente alternative segment	16
			Eccles alternative segment	80
203 – Panca Valley*	9,000	31,367/0	Caliente alternative segment and Caliente common segment 1	454
			Eccles alternative segment and Caliente common segment 1	566
181 – Dry Lake Valley	2,500	57/21,824	Caliente alternative segment 1	468
208 – Pahroc Valley	21,000	30/0	Caliente alternative segment 1	919
207 – White River Valley	37,000	31,819/42,512	Caliente alternative segment 1	81
171 – Coal Valley	6,000	38/33,071	Caliente common segment 1 and Garden Valley alternative 1	79
			Caliente common segment 1 and Garden Valley alternative 2	133
			Caliente common segment 1 and Garden Valley alternative 3	80
			Caliente common segment 1 and Garden Valley alternative 8	113
172 – Garden Valley	6,000	559/12,224	Caliente common segment 1 and Garden Valley alternative 2	274
			Caliente common segment 2 and Garden Valley alternative 2	149
			Caliente common segment 2 and Garden Valley alternative 2	203
			Caliente common segment 8 and Garden Valley alternative 2	146
170 - Penoyer Valley*	4,000	14,461/11,888	Caliente common segment 2	145

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 2 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
173A – Railroad Valley (Southern Part)	2,800	3,867/0	Caliente alternative segment 2, South Reveille alternative segment 2, and Caliente common segment 3	197
			Caliente common segment 2, South Reveille alternative segment 3, and Caliente common segment 3	169
156 – Hot Creek Valley	5,500	4,231/0	Caliente common segment 3	416
149 – Stone Cabin Valley*	2,000	11,532/6,400	Caliente common segment 3	197
141 – Ralston Valley*	6,000	4,330/1	Caliente common segment 3 and Goldfield alternative segment 1	519
			Caliente common segment 3 and Goldfield alternative segment 3	573
			Caliente common segment 3 and Goldfield alternative segment 4	129
142 – Alkali Spring Valley	3,000	2,596/0	Goldfield alternative segment 1	141
			Goldfield alternative segment 4	550
145 – Stonewall Flat	100	12/0	Goldfield alternative segment 1	291
			Goldfield alternative segment 3	458
			Goldfield alternative segment 4	43

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 3 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
144 – Lida Valley	350	72/0	Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Clair alternative segment 2	378
			Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Clair alternative segment 2	245
			Goldfield alternative segment 1, Caliente common segment 4, and Bonnie Clair alternative segment 3	156
			Goldfield alternative segment 3, Caliente common segment 4, and Bonnie Clair alternative segment 2	257
			Goldfield alternative segment 3, Caliente common segment 4, and Bonnie Clair alternative segment 3	168
			Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Clair alternative segment 3	289
146 – Sarcobatus Flat*	3,000	3,591/0	Bonnie Clair alternative segment 2	336
			Bonnie Clair alternative segment 3	449
228 – Oasis Valley*	1,000	1,299/0	Common segment 5, Oasis Valley alternative segment 1, and common segment 6	401
			Common segment 5/Oasis Valley alternative segment 3. common segment 6	574
229 – Crater Flat	220	1,147/82	Caliente common segment 6	256
227A – Fortymile Canyon, Jackass Flats	880[g]	58/5	Caliente common segment 6	572

Table 4-60. Estimated water requirements for rail line construction by hydrographic area – Caliente rail alignment (page 4 of 4)

Hydrographic area[a] number and name	Perennial yield for hydrographic area[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
Total approximate quarry water demand plus miscellaneous water demand				100[h]
Estimated lowest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 5,300
Estimated highest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 7,400
Current estimate of total water demand (acre-feet) - current best estimate (see text)				Approximately 6,100

a. Source: DIRS 106094-Harrill, Gates, and Thomas et al. 1988, Summary, Figure 3, with the proposed rail alignment map overlay. An asterisk (*) indicates that the State of Nevada considers the hydrographic area a designated groundwater basin (DIRS 177741-State of Nevada 2005, all).

b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12. The perennial yield value shown for area 228 is the lowest value in range of estimated values (1,000 to 2,000 acre-feet per year) presented by Thiel Engineering Consultants 1999.

c. To convert acre-feet to cubic meters, multiply by 1,233.5. To convert acre-feet to gallons, multiply by 3.259×10^5.

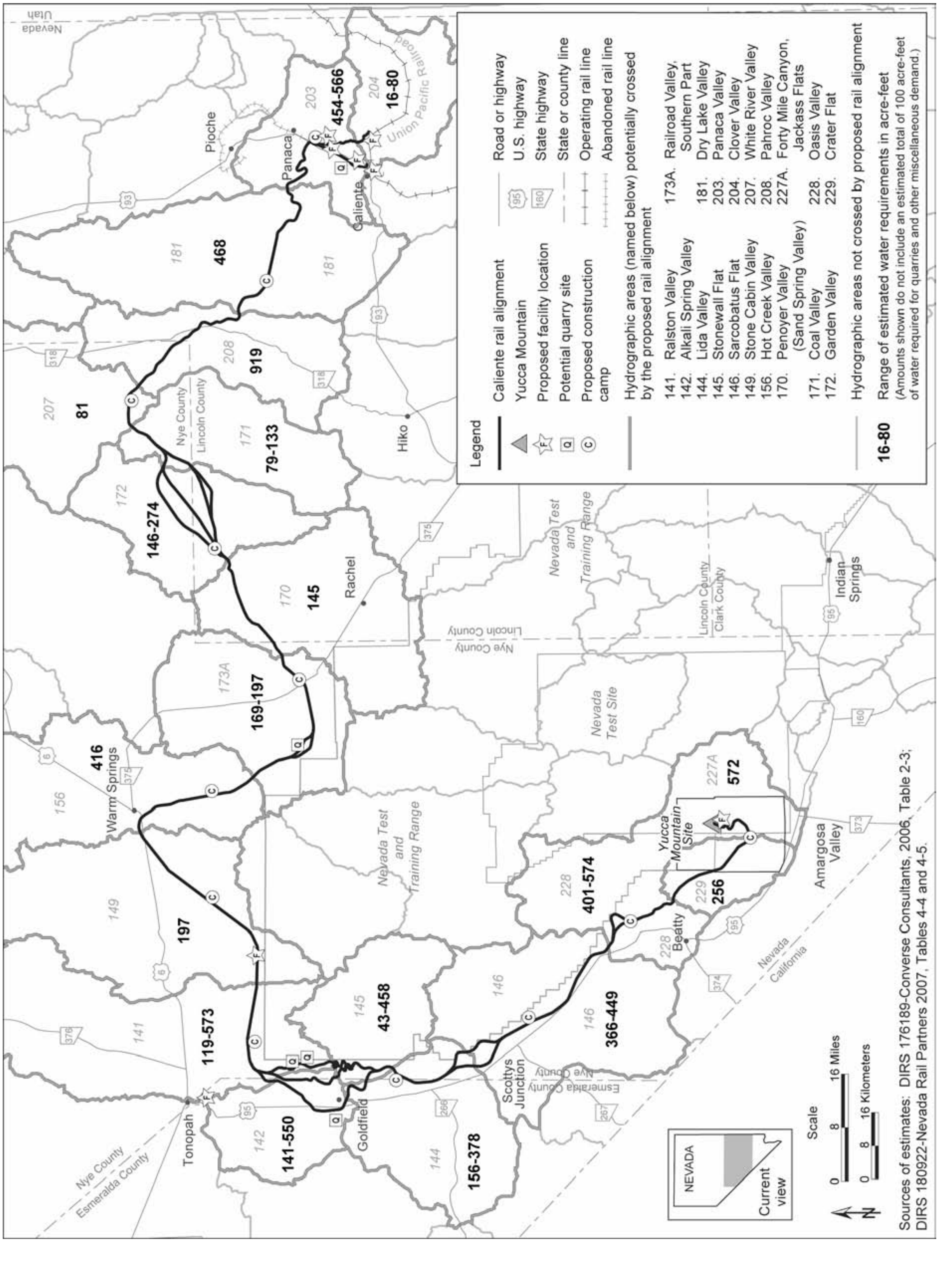
d. Data for committed groundwater resources and pending annual duties are current as of the dates described in section 3.2.6. Data for pending groundwater resources include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.

e. Figures 3-75 through 3-82 show the locations of the Caliente rail alignment alternative segments and common segments.

f. Water demand estimates are from DIRS 176189-Converse Consultants 2006, Table 2-3, with reference also to DIRS 180922-Nevada Rail Partners 2007, Tables 4-4 and 4-5.

g. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in area 227A. However, water-rights information from the NDWR indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 176600-Converse Consultants 2005, page 29 and Table 4-45). The perennial-yield value shown for area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, p. 8), for the entirety of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

h. Quarry and miscellaneous water demand values apply to all estimated water demand value cases. This total 100 acre-feet of water demand reflects a difference in the water demand calculation methodology used in DIRS 176189-Converse Consultants 2006, Table 2-3 versus DIRS 180922-Nevada Rail Partners 2007, Tables 4-4 and 4-5.



Sources of estimates: DIRS 176189-Converse Consultants, 2006, Table 2-3; DIRS 180922-Nevada Rail Partners 2007, Tables 4-4 and 4-5.

Figure 4-13. Estimated water requirements along the Caliente rail alignment.

Construction of Oasis Valley alternative segment 3 and common segments 5 and 6 through hydrographic area 128 would result in a groundwater demand equaling approximately 57 percent of the estimated annual perennial yield and approximately 44 percent of the total annual committed resources of this hydrographic area.

DOE evaluated potential impacts to existing groundwater resources assuming that it would apply for permits to appropriate water from 150 to 176 new construction water wells, including new quarry water wells, to furnish all the water required to support rail line construction, construction camps, quarry operations, and operation of railroad operations support facilities, including sidings (DIRS 176189-Converse Consultants 2006, Tables 3-2 and 2-3 and Appendix A; DIRS 180922-Nevada Rail Partners 2007, Section 3.1.4). Each construction camp would require approximately one new water well. The actual number of wells required would depend on the specific combination of alternative segments selected and flow rates achieved in installed wells.

New multiple-use water wells could be installed in each hydrographic area along the Caliente rail alignment, with the exception of area 227A. DOE assumed that each of the wells used to support rail roadbed construction would be pumped for a period not to exceed 1 year (for purposes of quantitative analysis, DOE assumed 9 months) (DIRS 176189-Converse Consultants 2006, Section 2.1). These wells would have the highest required water withdrawal rates. DOE could use quarry water wells, which would have lower production rates of approximately 91 liters (24 gallons) per minute, to support startup of quarries and during a quarry operational period of about 2 years. Wells to supply water for construction camps would be temporary and would have average withdrawal rates less than 76 liters (20 gallons) per minute. Wells supplying water for railroad operations support facilities and sidings would have the lowest average withdrawal rates (approximately 16 liters [4.2 gallons] per minute to less than 4 liters [1 gallon] per minute); these would be permanent wells (DIRS 180919-Nevada Rail Partners 2007, Table 3-B; DIRS 176189-Converse Consultants 2006, Section 2.1).

DOE would construct, and would subsequently decommission, all new water wells in accordance with applicable State of Nevada well-construction standards. After DOE completed construction of the rail line, some wells would remain in operation to supply water to railroad operations support facilities located near sidings, rail yards, or elsewhere along the rail line during the operations phase. DOE currently plans that wells not needed for operation of the rail line or for quarries would be abandoned in compliance with State of Nevada regulations, and the well sites and temporary access roads would be reclaimed (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4) in accordance with applicable requirements.

DOE assumed that proposed new well sites outside the typical maximum 300-meter (1,000-foot)-wide rail alignment construction right-of-way would consist of an approximately 5,800-square-meter (1.4-acre) drilling pad (DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4). Depending on water needs and well yields, DOE would install one or two wells on each drilling pad. Areas identified as potential locations for such well sites would be adjacent to documented existing land disturbances, including existing improved or unimproved roadways. If necessary, DOE would construct temporary access roads to accommodate 0.1- to 0.2-meter (4- to 6-inch)-diameter temporary aboveground pipelines that would transport water from these wells to the area of the construction right-of-way. Impacts that might result from the construction and temporary use of such water transfer pipelines are evaluated in the sections of this Rail Alignment EIS that address applicable resources or media (such as Biological Resources, Cultural Resources, and Land Use and Ownership). After construction of the rail line was complete, some wells would remain in operation to supply water to railroad operations support facilities near sidings, rail yards, or other locations along the rail alignment during the operations phase.

Well water would be piped through the temporary aboveground pipelines to temporary in-ground storage basins (reservoirs), inflatable bladders ("pillow tanks"), or rigid storage tanks within the construction right-of-way to provide storage capacity to meet daily construction needs. For planning purposes, DOE assumed that temporary water-storage reservoirs, if used, would be approximately 30 by 30 meters (100 feet by 100 feet) wide and approximately 3 meters (10 foot) deep, and would be used to store the daily water production from wells. Storage tanks or inflatable bladders, if used, could vary in their storage capacity up to approximately 190,000 liters (50,000 gallons) or more, depending on water demands and water withdrawal rates required for specific locations along the construction right-of-way. Open-storage basins or reservoirs, if used, would be surrounded by a fence to mitigate the potential to attract wildlife (see Section 4.2.7).

In determining the quantity of water that can be appropriated from a specific hydrographic area, requirements contained in the applicable State of Nevada statutes are considered. This authority includes the ability to grant appropriation requests in hydrographic areas that are designated groundwater basins or in cases where such appropriations would cause an exceedance of an area's estimated perennial yield.

DOE evaluated the potential impacts to groundwater resources using two withdrawal scenarios: (1) withdrawal of groundwater from the proposed new water well where each well is assumed to be pumped at its projected base-case average pumping rate (DIRS 176189-Converse Consultants 2006, Appendix A, fourth column); and (2) groundwater withdrawals from a number of wells considered in the first scenario but at an assumed withdrawal rate of up to 852 liters (225 gallons) per minute, or approximately 0.014 cubic meter (0.5 cubic foot) per second. In the second set of (sensitivity analysis) calculations, DOE varied the assumed groundwater pumping rates at higher values to determine how sensitive the radius of influence would be to groundwater withdrawal rates. The sensitivity analysis scenario also helped assess the degree of flexibility available for possibly utilizing some proposed new wells more than, or in lieu of, other proposed wells, based on potential differences in well productivity that might occur between the new wells.

Any groundwater withdrawal would decrease the availability of water within a portion of the aquifer in the region of influence surrounding a groundwater-withdrawal well. However, as described previously, DOE would obtain approximately 90 percent of all the water required for construction of the proposed rail line along the Caliente rail alignment from new temporary groundwater wells. The withdrawal of groundwater from new wells to support railroad construction would not be likely to result in long-term adverse impacts to the groundwater aquifers that are targeted for meeting project water demands because:

- For the proposed new groundwater withdrawals, analysis results (see Section 4.2.6.2.2 and Appendix G) show that short-term direct impacts on groundwater availability in aquifers resulting from proposed groundwater withdrawals where the new wells would be pumped at the projected base-case average required groundwater withdrawal rates would be limited in area (lateral) extent. Analytical results indicate that the maximum calculated lateral extent of the drawdown feature (the radius of influence of the cone of depression) that would be induced at any location within host aquifers from proposed groundwater withdrawals at the base-case production average rates would be approximately 0.8 kilometer (0.5 mile), and in most cases much less at the proposed well locations. With the exception of one location in the Oasis Valley hydrographic area (see Section 4.2.6.2.2.11) and one location in the Panaca Valley hydrographic area (see Section 4.2.6.2.2.1), withdrawals of groundwater from the proposed new water wells at the base-case average withdrawal rates would not be expected to impact existing groundwater users (owners of active pumping wells) or impact discharge rates or groundwater quality at nearby springs. Sections 4.2.6.2.2.1 and 4.2.6.2.2.11 describe one or more mitigation approaches that could be implemented in order to avoid potential impacts at these otherwise affected locations. In addition, Section 4.2.6.2.2.6 describes a possible mitigation approach for the selective use of proposed new wells in the Hot Creek Valley hydrographic area to avoid a potential impact on an existing spring.

- Results of sensitivity analyses (see Sections 4.2.6.2.2 and Appendix G) to evaluate potential impacts to existing wells and springs from a hypothetical increase in the withdrawal rate of groundwater from the proposed new water wells to up to 852 liters (225 gallons) per minute, or approximately 0.014 cubic meter (0.5 cubic foot) per second, indicate that, with the exception of four to possibly five locations in the Panaca Valley hydrographic area (Section 4.2.6.2.2.1), DOE expects no short-term direct impacts to groundwater resources resulting from such higher-rate groundwater withdrawals. Section 4.2.6.2.2.1 describes a possible approach for avoiding potential impacts at these potentially affected locations. In addition, Section 4.2.6.2.2.6 describes a possible approach for the selective use of proposed new wells in the Hot Creek Valley hydrographic area to avoid a potential impact on an existing spring.

- For areas where proposed new water wells would be near the boundary between adjacent hydrographic areas, groundwater withdrawals would not be likely to affect downgradient hydrographic areas because: (1) there are no identified existing well users in downgradient groundwater basins that are within 1.6 kilometers (1 mile) of any of these proposed well water withdrawal locations (see Figures 3-75 through 3-82), or (2) available hydrogeologic information indicates that there is no significant inter-basin groundwater (under)flow in the areas downgradient of the proposed well locations (see Figure 3-73).

- Long-term direct impacts to groundwater resources would not be likely because approximately 90 percent of the total project water demand would be used over a short period to support railroad construction. Most water demands within any given hydrographic area would occur over approximately 9 months under an assumed 4-year railroad construction schedule; therefore, long-term impacts resulting from their use would be small.

- Direct impacts to groundwater would not be likely for the reasons stated above; indirect impacts to groundwater resources in adjacent downgradient hydrographic areas also would not be likely.

New wells proposed to be installed outside the construction right-of-way of some rail alignment segments to support railroad construction or quarries would be either on grazing land or on Walker River Paiute Reservation land, or for one proposed quarry, partly on BLM-administered land and partly on Hawthorne Army Depot property (see Section 4.3.2). Direct or indirect impacts to private-property owners from construction and use of such wells would be expected to be small and capable of being minimized through the use of appropriate planning and mitigation measures, as required (see Section 4.3.2).

Several of the proposed railroad operations support facilities and sidings would overlie hydrographic areas that are designated groundwater basins. Construction-water demand for these facilities would be low compared to the amount of water required for railroad construction. These facilities include the Caliente-Indian Cove, Caliente-Upland, and Eccles-North Staging Yard optional locations for the proposed railroad in hydrographic area 204, the Maintenance-of-Way Trackside Facility northeast of Goldfield, the Maintenance-of-Way Headquarters Facility south of Tonopah in area 141, and proposed sidings in several hydrographic areas. Although the locations for the Staging Yard would not overlie a designated groundwater basin, the committed groundwater resources in area 204 exceed the estimated annual perennial yield. DOE assumed that water demand for constructing these railroad facilities and sidings would be met by installing new wells.

Details on the water requirements activity and groundwater impacts at the railroad operations facilities are provided in the *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 03*

(DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). These facilities would require only limited amounts of water, with water required for operations of most facilities estimated to range from approximately 9,500 to 23,000 liters (2,500 to 6,000 gallons) per day at the facilities, which is equivalent to 6.4 to 16 liters (1.7 to 4.2 gallons) per minute. DOE derived operations water requirements from estimated staffing and shift projections, a 190-liter (50-gallon) per day per capita use ratio, estimated shop process needs, and a multiplier of 1.5 to account for miscellaneous water needs (DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). Water needed for meeting emergency water storage capacity requirements (for fire safety) are estimated to range from 380,000 to 830,000 liters (100,000 to 220,000 gallons). The water demand for operation of the Cask Maintenance Facility is estimated at approximately 40,000 liters (10,500 gallons) per day, which is equivalent to approximately 7 gallons per minute (DIRS 104508-CRWMS M&O 1999, Table III-1). Water needs for meeting water storage requirements and facility operations needs at each facility could be readily met using a new low-productivity well. For this reason, the magnitude of short-term or long-term impacts on the host aquifer for the individual facility water wells would be small. For this reason, DOE did not perform quantitative impact analyses for water wells that would support facilities operations.

Water consumption rates during the period of use of construction camps during the peak output year have been estimated at approximately 76 liters (20 gallons) per minute, which is equivalent to approximately 110,000 liters (28,800 gallons) per day (DIRS 176189-Converse Consultants 2006, Table 2-1). Water consumption rates during the period of use of quarries have been estimated at approximately 91 liters (24 gallons) per minute, which is equivalent to 131,000 liters (34,560 gallons) per day (DIRS 176189-Converse Consultants 2006, Table 2-1). New wells proposed for supplying water to support construction camp and quarry operations were considered when performing the quantitative impact analyses. Construction of the Cask Maintenance Facility would require approximately 4,400 cubic meters (approximately 3.6 acre-feet, or 1.176 million gallons) of water, with construction estimated to occur over approximately 2 years (DIRS 104508-CRWMS M&O 1999, Table III-2). The amount of water needed to construct the other railroad facilities (Maintenance-of-Way Facilities and the Rail Equipment Maintenance Yard) would range from approximately 14,000 to 200,000 cubic meters, which is equivalent to 11.5 to 161.1 acre-feet, or 3.75 to 52.5 million gallons (DIRS 180919-Nevada Rail Partners 2007, Table 3-B). No additional water would be required for constructing the rail sidings (DIRS 180919-Nevada Rail Partners 2007, Table 3-B). When compared to the total annual committed groundwater resources listed in Table 3-35, the direct short-term impacts to groundwater resources in the respective hydrographic areas due to water withdrawals associated with construction of railroad facilities and sidings would be small, and long-term direct and indirect impacts on groundwater resources also would be small.

DOE also assessed the potential for the proposed groundwater withdrawals to cause ground subsidence in areas of the proposed withdrawals. Groundwater pumping-induced ground subsidence has been observed at some locations in the western United States, including the Las Vegas Valley of Nevada, the Santa Clara Valley and San Joaquin Valley areas of California, and other selected locations in Texas, New Mexico, and Arizona, and selected other locations overseas. The subsidence that has occurred is primarily related to prolonged groundwater withdrawal at rates that exceed the estimated annual recharge to the affected groundwater system. The estimated annual recharge to the aquifer systems in each of these localities is often less than approximately 50 percent of the total average annual groundwater pumped from these aquifers. In the Las Vegas Valley, groundwater withdrawals between 1955 and 1990 ranged from approximately 49.4 to 108.5 million cubic meters (40,080 to more than 88,000 acre-feet) per year, with the maximum groundwater withdrawal occurring in 1968 (108.9 million cubic meters [88,290 acre-feet]) (DIRS 181390-Bell et al. 2002, p. 156). Estimates of annual recharge rate to the Las Vegas Valley aquifer system range from approximately 30.6 to 72.2 million cubic meters (25,000 to 59,000 acre-feet) per year, indicating that groundwater withdrawal rates in the Las Vegas Valley have typically exceeded, sometimes by a factor of more than two, natural recharge rates over a period of decades (DIRS 181390-Bell et al. 2002, p. 156). Groundwater withdrawals of more than 12.1 billion cubic meters (9.8 million acre-feet) per year in the San Joaquin Valley resulted in withdrawal overdrafts of at least 4.93 billion cubic meters (4 million acre-feet) per year during the 1950s and 1960s (DIRS 181392-USGS, Poland, 1984, p. 264). Annual groundwater pumping rates in each of these areas have exceeded their respective annual groundwater recharge rates between the mid-1940s to 1950s and the 1990s.

Interbedded fine- and coarse-grained sediments underlie each of these areas. Where impermeable caliche horizons occur within alluvial fan deposits or poorly ***permeable*** clay horizons occur within fine-grained basin-fill materials, groundwater is under confined or partially confined conditions, frequently exhibiting artesian flow conditions (for example, Bell et al. 2002, p. 156 [DIRS 181390]). Continued groundwater pumping in excess of the yearly recharge has reduced the artesian pressures in these aquifer systems resulting in an increase in vertical loads, or effective stresses. The increased effective stresses result in the compaction of the underlying sediments and corresponding ground subsidence.

An evaluation of the proposed new groundwater withdrawal wells for the rail alignment indicates that the majority of the wells would be developed in unconsolidated alluvial sediments, with a remaining minority of wells completed in consolidated bedrock aquifers. Subsidence is not expected to be an issue in consolidated bedrock aquifers because as these aquifers are not susceptible to compaction during pumping.

Of the wells developed in unconsolidated alluvial sediments, a relatively small percentage would be developed in confined alluvial sediments. In general, subsidence is not expected to be an issue for pumping unconfined alluvial aquifers, because the major reported cases of land subsidence due to groundwater withdrawals involve pumping from confined aquifers.

Groundwater withdrawals from confined alluvial aquifers, at the withdrawal rates expected for this project, and if they exceed recharge rates, could, in theory, result in some small amount of subsidence within the radius of influence associated with each pumping well. However, no known subsidence effects have been documented for other pre-existing pumping wells situated in these hydrographic areas, many of which are being pumped at rates much higher than the range of pumping rates proposed for this project. Additionally, the area of disturbance within the radius of influence surrounding to each well represents an extremely small percentage of the total area of the host aquifer within each hydrographic area. Finally, the duration of pumping for approximately 90 percent of the proposed total groundwater withdrawals would be on the order of 1 year or less within each hydrographic area the alignment would cross. The pumping rates required, the total volume of groundwater that would be withdrawn from each hydrographic area, and the pumping timeframes involved are much smaller than the pumping rates, water volumes removed, and the prolonged periods of pumping that were involved at locations where ground subsidence has been observed, such as the Las Vegas Valley, Santa Clara Valley, and San Joaquin Valleys. For these reasons, the potential for ground subsidence to occur as a result of constructing and operating a railroad along the Caliente rail alignment would be expected to be low.

4.2.6.2.2 Construction Impacts for Specific Alternative Segments and Common Segments

DOE evaluated potential site-specific impacts to groundwater resources from constructing and operating a rail line along the Caliente rail alignment. This section summarizes the approach and methodologies DOE used to quantitatively evaluate the extent of potential hydrogeologic impacts from withdrawing groundwater to support construction of the rail line and railroad construction and operations support facilities. Appendix G provides a more detailed description of the approach and methodology. Section 3.2.6 summarizes the existing groundwater resources along each of the alternative segments and common segments.

To evaluate potential impacts of proposed groundwater withdrawals from new water wells on existing wells and springs, DOE reviewed proposed well locations, well construction details, estimated groundwater depths, and proposed groundwater withdrawal rates and timeframes (DIRS 176189-Converse Consultants 2006, all; DIRS 176172-Nevada Rail Partners 2006, Section 4.4). Unless noted otherwise, the sources for all spring and well data in this section are as follows:

- DIRS 176600-Converse Consultants 2005, all
- The Nevada Division of Water Resources (NDWR) water-rights database and water-well log database, and other data sets (DIRS 177292-MO0607NDWRWELD.000, all; DIRS 182288-NDWR 2007, all; DIRS 182898-NDWR 2007)
- Data from the U.S. Geological Survey (USGS) National Water Information System (NWIS) database (DIRS 176325-USGS 2006, all and DIRS 177294-MO0607USGSWNVD.000)
- Geographic Information Systems databases on springs and water bodies in Nevada (DIRS 176979-MO0605GISGNISN.000, all; DIRS 177712-MO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000, all)
- DIRS 177293-MO0607PWMAR06D.000, all

For initial screening purposes, if DOE identified an existing well or a spring within a 1.6-kilometer (1-mile) radius (buffer distance) of a proposed new water well, DOE selected that proposed well location as a candidate for conducting a groundwater hydrogeologic impacts evaluation. When DOE found no spring or existing well within this initial search radius, it identified the nearest spring or existing well within a 2.4-kilometer (1.5-mile) radius (buffer distance) of the proposed new water well, and determined its hydrogeologic and construction characteristics. In addition to the above screening processes, and before completing impacts analyses, for a selected set of new groundwater withdrawal well locations where the well was specifically targeted for installation within a fault zone or an extensive ***fracture*** zone, the locations of existing wells and springs up to 10 kilometers (6 miles) away from each such proposed well were identified. These larger search distances were considered to: (1) allow evaluation of potential simultaneous drawdown effects involving existing individual private wells having higher withdrawal rates that might be located in the general vicinity; and (2) assess the potential for a fault zone or extensive fracture zone present at the proposed new well location to act as a conduit for groundwater flow (possibly resulting in a groundwater drawdown effect over a larger distance).

DOE searched the NDWR water-rights database and well-log databases to confirm the identity, use, water rights status, and appropriated annual duty and diversion rate, if any, associated with each existing well located within these buffer distances. DOE included domestic wells and considered the appropriated annual duty and diversion rate for each well with a water right in hydrogeologic impacts analyses to estimate potential hydrogeologic impacts from groundwater withdrawals at the proposed well location. In some cases, using the available information, DOE could not positively correlate wells listed in the USGS NWIS database to any well listed in the NDWR water-rights database or the NDWR well-log database. For such wells, DOE did not perform quantitative impacts analyses for these wells. For impacts analysis purposes, DOE considered the locations of known domestic wells with respect to the proposed alignment and relative to proposed new well locations. Figures 3-75 to 3-82 show the approximate locations of existing wells, including domestic wells, and springs within the 1.6-kilometer (1-mile) screening level region of influence.

DOE reviewed available geologic and hydrogeologic information to confirm the hydrogeologic characteristics of known and potential aquifers in areas near proposed wells. Where applicable, for the closest existing well having a water right, DOE identified water appropriations information (annual appropriated groundwater duty, well use period, and authorized groundwater diversion rate) and documented the information for subsequent use in analysis.

DOE used the information obtained from the geologic and hydrogeologic data reviews to identify an appropriate analytical method or methods to determine the magnitude of drawdown that would be created in the host aquifer as a result of the proposed groundwater withdrawals, and determine the amount of simultaneous drawdown created, where applicable, due to groundwater production from the nearest existing pumping well. For purposes of analysis, fractured consolidated rock aquifers were treated as homogeneous, ***isotropic*** (identical in all directions), equivalent porous media. For a selected set of new groundwater withdrawal well locations where the well was determined to be in the vicinity of faults or extensive fracture systems or specifically targeted for installation within a major fault zone or an extensive fracture zone (DIRS 176189-Converse Consultants, 2006, Appendix B), additional evaluations of hydrogeologic data and/or additional analyses were performed.

In cases where a proposed well was determined to be located lateral to a mapped fault or fracture zone, the fault or fracture zone was treated as a potential no-flow ***barrier*** if it was located sufficiently close to the proposed new well to be within the region of influence from pumping at that well location. In such cases, the calculations included a specific method (image well method) to simulate the potential effects of the fault or fracture zone on groundwater flow behavior.

Hydraulic tests performed in faulted and fractured consolidated rock aquifers at a few wells in the region of the Nevada Test Site indicate that when a pumping well pumps groundwater from a high-***permeability*** zone associated with a fault, that fault zone might act as a conduit for transmitting hydraulic responses from the pumping well over larger-scale (on the order of kilometers) distances. Results from pump tests conducted at these wells often indicate that very complex hydrogeologic conditions, including heterogeneous hydraulic rock properties, the presence of complex structural systems controlling flow, and other non-isotropic conditions, exist at these test sites. For these reasons, where a proposed new well was identified as targeting a specific fault or fracture system that could act as a high-permeability conduit, DOE identified the locations of existing wells and springs up to 10 kilometers (6 miles) away from each such proposed well. In these cases, DOE reviewed available data on existing wells and springs and locations of known (mapped) faults and fracture zones within the 10 kilometer radius surrounding each new well location and compared these with the locations of the proposed well to estimate the likelihood of a hydraulic connection occurring between the proposed well and existing wells and springs beyond a distance of 2.4 km (1.5 miles) but within the approximately 10-kilometer distance. Additional details regarding the treatment of faults and extensive fracture systems as conduits (or barriers) to flow in the impacts analyses are described in Appendix G.

DOE calculated a region of influence for each well and determined how far from the well the aquifer would be affected by the drawdown. For analysis purposes, DOE assumed that (1) it would obtain all water for railroad construction from new groundwater wells, and (2) groundwater might be pumped at the nearest existing well with a water right simultaneously to groundwater withdrawal at the new well or wells. If existing wells were found to be farther away from the proposed new well than the sum of the radii of influence associated with both wells, DOE concluded that there would be no impacts to the nearest existing well. If the nearest spring was found to be beyond the calculated radius of influence of the proposed new well, DOE concluded that there would be no impacts to the spring.

For each sensitivity analysis completed, DOE assessed the potential impacts to existing wells from imposing a 852 liters (225 gallons) per minute pumping rate at each proposed well, considering the possibility of intersecting cones of depression from the simultaneous pumping of the nearest existing well and the proposed new well. The pumping rate assumed for the nearest well in nearly every case was the average withdrawal rate required to realize the total appropriated annual or seasonal duty value for that well, if that well had a formal appropriated water right, over the authorized period of use. The exceptions included existing wells for which the average pumping rate calculated based on the total appropriated duty value was very low and much smaller than the authorized (short-term) diversion rate for that well.

In those cases, to conservatively bound impact analysis results, DOE used the diversion rate to calculate the well's radius of influence.

Sections 4.2.6.2.2.1 to 4.2.6.2.2.12 describe potential impacts to existing springs or groundwater wells. Table 4-60 lists information about the hydrographic areas the rail line would cross and the estimated volume of water DOE would need to construct each set of Caliente rail alignment alternative and common segments across each hydrographic area.

4.2.6.2.2.1 Interface with Union Pacific Railroad Mainline. Both the Caliente and Eccles alternative segments would overlie hydrographic areas 203 and 204. The Caliente alternative segment would overlie a greater portion of area 203, approximately 16 kilometers (10 miles), than the Eccles alternative segment (approximately 12 kilometers [7.5 miles]). At present, there are no documented pending annual duties for either hydrographic area 203 or 204 (see Table 4-60).

DOE assumed that appropriations for new water wells represent a viable mechanism for obtaining all water required to support railroad construction in these two hydrographic areas. This approach does not predispose the final outcome of decisions regarding the approval or denial of such appropriation applications; however, the analysis assumes that such applications would, in theory, be accepted, and that that there would be groundwater withdrawals at the proposed new wells as designed. This analysis approach provides a conservative estimate of the potential impacts to groundwater resources resulting from groundwater withdrawals within the two hydrographic areas the Caliente or Eccles alternative segments would cross.

Caliente Alternative Segment Figures 3-75 and 3-76 show the approximate locations of proposed new water wells to meet water demands for constructing the Caliente alternative segment. The first step in assessing potential impacts to groundwater resources in this area involved the evaluation of the hydrogeologic impacts resulting from withdrawing (pumping) groundwater from the new water wells, assuming that each well would be pumped at its projected base-case average required groundwater withdrawal rate. Analysis results for the proposed well locations indicate that, with the exception of one proposed new well location (PanV25/PanV26), there would be no impacts to existing wells or springs in the vicinity of this alternative segment as a result of the proposed groundwater withdrawals. DOE anticipates that wells installed at location PanV26 would have to operate at a short-term (9 months) base-case average withdrawal rate of 76 liters (20 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). The nearest existing NDWR-listed water well is approximately 650 meters (2,141 feet) west of location PanV26 (see Figure 3-76). The appropriated seasonal (April to September) duty (980,000 cubic meters [797 acre-feet] per season) for this existing well is equivalent to an average withdrawal rate of 3,800 liters (1,002 gallons) per minute during the period of use of this well. The radius of influence calculated for this existing well varies between an estimated upper- and lower-bound value, depending on assumptions made regarding the saturated thickness of the water-bearing zone in the aquifer within that well. The radius of influence determined for the proposed well at location PanV26 when pumped at the proposed base-case average withdrawal rate is estimated to be approximately 76 meters (250 feet). Given the distance separating the proposed PanV26 well location and the existing irrigation well, the sum of the radii of influence for the proposed well and the existing well indicate the cones of depression generated around these wells could either intercept, or likely not, intercept each other for both the upper bound and lower bound scenarios evaluated for the existing well.

As previously stated, the water-rights permit for the existing well allows it to be pumped annually between April and September. Because of the large appropriated duty of the existing well, it appears that use of proposed well location PanV26 would not be a viable option if such use was during the same 6-month period of use as the existing well. If a new well at location PanV26 were pumped between about October and March, pumping operations at PanV26 would likely not impact irrigation operations at the existing well. Additional field evaluation of the precise location and details about the use of this existing well might provide additional information to support viability of this proposed well location.

DOE performed sensitivity analyses to evaluate potential impacts to existing wells and springs from imposition of groundwater pumping rates up to 852 liters (225 gallons) per minute at proposed new well locations along the Caliente alternative segment. The analysis indicated that, with two (or possibly three), exceptions, there would be no impacts to existing wells or springs in the vicinity of this alternative from groundwater withdrawals at higher pumping rates. The three (possibly four) exceptions are the proposed well location PanV26 previously described and the following proposed well locations:

- For the PanV6 base case scenario, the nearest known existing well is 1,120 meters (3,683 feet) north of proposed location PanV6. Because of the large appropriated duty of this existing well, and its authorized period of use is for the entire year, it appears that a new well at proposed location PanV6 could not operate at the 852 liter (225 gallon) per minute average withdrawal rate, would need to be restricted to an average withdrawal rate of no greater than 470 liters (125 gallons) per minute to not result in an impact at the existing well, if proposed well PanV6 were to be used contemporaneously with the existing well. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or install a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs to preclude impacts.

- PanV4 (possible impact) – Figures 3-75 and 3-76 show an existing NDWR well approximately 1.4 kilometers (4,700 feet) northeast, and a USGS NWIS well approximately 1,000 meters (3,500 feet) northwest, of the proposed well location. However, available information suggests these may be the same well even though NDWR and the USGS locations are plotted differently (see Figure 3-76). The reported appropriated annual duty for the NDWR well equates to an average pumping rate of approximately 1,200 liters (300 gallons) per minute when distributed over a 9-month use season. If the NDWR-plotted location of this well is correct, the cone of depression for proposed well location PanV4, if pumped at 852 liters (225 gallons) per minute, and the cone of depression for the NDWR well, if pumped at 1,100 liters (300 gallons) per minute, would not be expected to intersect if the wells were pumped simultaneously. However, if the USGS-plotted location is correct and the NDWR-plotted location is incorrect, and the existing water right is associated with the well at the USGS-plotted location, the cones of depression generated through simultaneous pumping at location PanV4 and the existing well at these same pumping rates would probably intersect.

- PanV5 – For the base-case scenario, the proposed well at PanV5 would be a permanent facility water well, with a base-case withdrawal rate of only 3.8 liters (1 gallon) per minute. No base-case analysis calculation was completed for this well location because of the very small pumping rate required under the base-case scenario. For the sensitivity analysis, the radius of influence determined for the proposed well at PanV5 pumping at 852 liters (225 gallons) per minute is approximately 500 meters (1,600 feet). The nearest known existing well with a water right is a quasi-municipal well approximately 320 meters (1,060 feet) southwest of location PanV5 (see Figure 3-76. Because the authorized period of use of this well is the entire year, it appears that a new well at proposed location PanV5 could not operate at an average withdrawal rate of greater than 230 liters (60 gallons) per minute without resulting in an impact at the existing well, if the wells were to be pumped simultaneously. Further field evaluation of the precise location and details pertaining to use of the existing well might provide additional information to support viability of this proposed well location.

For these locations, DOE could obtain additional data on actual locations and details regarding the use of existing nearby wells and perform additional analyses to determine maximum allowable groundwater withdrawal rates that could be imposed at the proposed well locations. This would preclude possible intersection of drawdown cones from those well locations and from the nearest existing wells, thereby precluding impacts to the existing nearby wells. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or install a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs to preclude impacts.

A quarry well, which could also provide water needed to support operation of potential quarry CA-8B, could be installed west of U.S. Highway 93 and approximately 6.9 kilometers (4.3 miles) northeast of Caliente (see location PanV23 on Figure 3-75), and would be approximately 0.32 kilometer (0.2 mile) northwest of an existing USGS NWIS well, and approximately 1.6 kilometer (1 mile) west of an NDWR domestic well.

The average required groundwater withdrawal rate at the new quarry well location would be approximately 91 liters (24 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendixes A and B). Analysis results (see Table 4-61) indicate that the nearest known existing wells and springs in the vicinity of the proposed quarry well would be outside the radius of influence induced by the proposed groundwater withdrawals at each of the wells. Because the quarry well would be situated well outside the typical maximum 300-meter (1,000-foot)-wide rail line construction right-of-way in primarily bedrock-dominated terrain, the groundwater withdrawal rate at this well would not be expected to exceed its projected required average withdrawal rate. Therefore, DOE did not perform sensitivity analyses for this well (or for any other quarry wells) to evaluate whether there would be increased impacts from higher groundwater withdrawal rates.

Table 4-61. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Caliente and Eccles alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
ClV2	> 1.60 (well)	0.38	NA[d]
PanV1	> 1.60 (well)	0.42	0.59
PanV2	> 1.60 (well)	0.33	0.54
PanV3/6	1.12 (well)	0.42	0.65
PanV4	1.44 (well)	0.35	0.72
PanV5	0.32 (well)	NA[d]	0.50
PanV23	1.59 (well)	0.27	NA[d]
PanV24	1.34 (well)	0.33	0.54
PanV25/26	0.65 (well)	0.08	0.28

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. NA = not applicable; no calculation was completed for reasons stated in text.

Eccles Alternative Segment Figures 3-75 and 3-76 show the approximate locations of new wells DOE could install to meet construction water demands along the Eccles alternative segment. Assuming DOE would pump each well at its projected base-case average groundwater production rate, analysis results indicate there would be no impacts to existing wells and springs near this alternative segment.

Results of sensitivity analyses (see Table 4-61) to evaluate potential impacts from withdrawing groundwater from proposed new wells in the rail line construction right-of-way at up to 852 liters (225 gallons) per minute indicate that, with two exceptions, there would be no impacts to existing wells or springs in the vicinity of this alternative segment. The exceptions are proposed new well locations PanV3/6 and PanV26, as previously described for the Caliente alternative segment. As discussed previously, proposed well PanV3/6 would not be viable above 470 liters (125 gallons) per minute if used contemporaneously with the nearest existing well. For these locations, DOE could obtain additional data on actual locations and details regarding the use of existing nearby wells to perform additional analyses to determine maximum allowable groundwater withdrawal rates, if any, that could be imposed at the proposed well locations. This would preclude possible intersection of drawdown cones from those well locations and from the nearest existing wells, thereby precluding impacts to the existing nearby wells. Alternatively, DOE could use existing wells to obtain the amount of water needed (that is, by purchasing water), use other proposed water-supply wells in the same general area, or installed a new well at an alternative location in the same general area at a sufficient distance from existing wells or springs to preclude impacts.

4.2.6.2.2.2 Caliente Common Segment 1 (Dry Lake Valley Area). Caliente common segment 1 would cross hydrographic areas 181, 208, 207, and 171. New wells in these hydrographic areas could be between 60 and 460 meters (200 and 1,500 feet) deep (DIRS 176189-Converse Consultants 2006, Appendix A).

Figures 3-75 through 3-77 show the approximate locations of proposed new wells along common segment 1. These new wells include a series of proposed wells within the Caliente common segment 1 construction right-of-way. These wells might also include wells installed at one or more proposed alternative well locations (DLV5, PahV3, PahV4, and PahV8) north of the common segment 1 construction right-of-way in the Dry Lake Valley hydrographic area or west of the construction right-of-way in the Pahroc Valley hydrographic area (see Section 3.2.6.3.2). These wells could be between 76 and 460 meters (250 and 1,500 feet) deep. The target aquifer for these wells would be alluvial valley-fill aquifers or a regional carbonate-rock aquifer underlying the alluvial valley fill in this area (DIRS 176189-Converse Consultants 2006, Appendixes A and B). Under a 4-year construction schedule, the total required groundwater withdrawal rate from proposed suites of new wells at the various locations to support construction work in this area could range from approximately 76 to 1,000 liters (20 to 270 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). Assuming proposed base-case average groundwater withdrawal rates at each proposed new well location, analysis results indicate that with the exception of proposed well location PanV7/PanV8, there would be no impacts to existing wells or springs near common segment 1 from pumping at the proposed well locations. The nearest existing NDWR well to PanV7/PanV8 is approximately 1,000 meters (3,288 feet) east-southeast of PanV7/PanV8 (see Figure 3-76). There is also an existing USGS NWIS-listed well approximately 880 meters (2,900 feet) southeast of PanV7/PanV8; however, this well could not be correlated to an NDWR well. Therefore, DOE did not analyze the radius of influence for this well. The appropriated annual duty (2.22 million cubic meters [1,797 acre-feet] per year) for the nearest existing NDWR well with a water right equates to an average withdrawal rate of approximately 4,200 liters (1,110 gallons) per minute. Because of the large appropriated duty for this existing well, it appears that use of proposed well location PanV7/PanV8 would not be viable as a ground water withdrawal well location if the nearest existing well with a water right to the northeast of that well is being pumped at the same time as the new well location.

The results of sensitivity analyses (Table 4-62) to evaluate potential impacts from increasing the groundwater withdrawal rate at any new well along this common segment to a maximum value of

852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells or springs in the vicinity from groundwater withdrawals at these higher potential withdrawal rates, with the exception of the previously described proposed new well location PanV7/PanV8.

For nine proposed new well locations associated with Caliente common segment 1, the targeted water zone in each case was initially identified as a possibly water-bearing fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Figures 3-75, 3-76, and 3-77). The proposed well locations (PanV14/PanV16, DLV2, DLV3, DLV4, DLV6, PahV1, PahV2, PahV5, and PahV8) could be installed in hydrographic areas 203, 181 and 208, either within or outside the typical maximum 300-meter (1,000 foot)-wide construction right-of-way of common segment 1 (Figures 3-75, 3-76, and 3-77). There are no known existing wells or springs within approximately 10 kilometers (6 miles) of these proposed well locations that are known to be associated with the same fault or fracture system or potentially related major fault or fracture zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

Table 4-62. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – common segment 1.

Well number	Distance to nearest well or nearest spring (kilometers)[a]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[b] per minute pumping rate (kilometers)
PanV7/8	1.00 (well)	0.32	0.49
PanV9/10/11/12	0.55 (well)	0.37	0.48
PanV13/15	1.11 (spring)	0.35	0.63
DLV3	3.66 (spring)	0.50	0.78
DLV4	1.48 (spring)	0.67	1.20
PahV1/2/3	2.06 (spring)	0.60	0.94
PahV7/8/9	1.17 (proposed well)[c]	0.60[d]	NA[e]

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. The nearest well location assumed for PahV7/8/9 is a hypothetical well location (proposed well application location).
d. This result is based on a calculated minimum transmissivity value required for the aquifer in order to yield the specified pumping rate. The published transmissivity value for this aquifer is significantly higher, which would reduce the calculated radius of influence value accordingly.
e. No sensitivity analysis case required because base-case pumping rate assumed is slightly higher than 852 liters per minute.

As described in Section 3.2.6.2, applications have been filed for a proposed irrigation well that would be within approximately 1.7 kilometers (1.1 miles) of proposed well location DLV3 in Dry Lake Valley, for a proposed municipal well that would be within approximately 1.7 kilometers of proposed well location PahV9 in Pahroc Valley, and for proposed municipal wells that would be approximately 1.5 kilometers (0.9 miles) northeast of the proposed PahV7 well location, and approximately 1 kilometer (0.6 mile) northeast of the proposed PahV8 well location, also in Pahroc Valley. Potential impacts resulting from these proposed new applications are evaluated in Section 5.2.2.6.

4.2.6.2.2.3 Garden Valley Alternative Segments. Figures 3-77 and 3-78 show the approximate locations of new wells DOE could install to meet construction-water demands and locations of existing wells and springs in the vicinity of Garden Valley alternative segments. There are seven existing USGS NWIS wells within 1.6 kilometers (1 mile) of Garden Valley alternative segments 1, 2, 3, and 8. These wells are either dry or have been used as testing or monitoring wells. Other than their possible future use as monitoring wells, these wells have no associated productive (beneficial) use.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (see Table 4-63) indicate that existing wells and springs near the Garden Valley alternative segments would be outside the radius of influence of the proposed new water wells.

As described in Section 3.2.6.3.3, an application has been filed for a proposed municipal well that would be approximately 1.2 kilometers (0.8 mile) southwest of proposed new application is evaluated in Section 5.2.2.6.

Table 4-63. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Garden Valley alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
GV2	>1.60 (well)	0.27	0.53
GV10	1.23 (well)[d]	0.18	0.45

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. The well location assumed for GV10 is a hypothetical well location (proposed well application location).

4.2.6.2.2.4 Caliente Common Segment 2 (Quinn Canyon Range Area). Figures 3-78 and 3-79 show the approximate locations of existing wells and proposed new wells within the rail line construction right-of-way to meet water demands along common segment 2. Documented pending annual duties for hydrographic area total approximately 3.95 million cubic meters (3,200 acre-feet).

DOE could install up to two new water wells at proposed alternative well location PeV1 in Penoyer Valley (see Figure 3-78), which would be adjacent to a USGS NWIS well south of common segment 2. This well has no beneficial use and is designed to serve as a groundwater monitoring well only. DOE could install up to three additional new water wells at proposed well pair location PeV2/PeV3 in Penoyer Valley (see Section 3.2.6.3.4 and Figure 3-78) to provide water for construction. There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of this proposed alternative well location.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells and springs near common segment 2 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.5 South Reveille Alternative Segments. The hydrographic area (173A) these alternative segments would cross is not a designated groundwater basin; however, committed groundwater resources exceed the estimated perennial yield. Figure 3-79 shows the approximate location of new water wells DOE would install to meet construction demands for water along these alternative segments. There is one existing NDWR well with a water right approximately 1.77 kilometers (1.1 miles) north northeast of the northern end of South Reveille alternative segment 2 near where it would merge with Caliente common segment 3 (see Figure 3-79). This well provides water for livestock watering.

Assuming proposed base-case average groundwater withdrawal rates at each new well location, analysis results (see Table 4-64) indicate that existing wells and springs near these alternative segments would be outside the radius of influence of proposed new wells. Results of evaluations (Table 4-63) to evaluate the potential for impacts to occur from increasing the groundwater withdrawal rate at any new supply well to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells and springs near South Reveille alternative segments from groundwater withdrawals at these higher potential withdrawal rates.

Table 4-64. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – South Reveille alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
RrV6/11	>1.60 (well)	0.19	0.50
RrV8	0.83 (well)	0.13	Not applicable[d]

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. No calculation was completed for reasons stated in text.

4.2.6.2.2.6 Caliente Common Segment 3 (Stone Cabin Valley Area). Figures 3-79 and 3-80 show the approximate locations of the proposed new water wells in hydrographic areas 141, 149, 156, and 173A needed to support construction. Documented pending annual duties for hydrographic areas 141, 149, 156, and 173A total approximately 4.74 million cubic meters (3,840 acre-feet), all of which are assigned to area 149.

Assuming that the total combined, proposed, base-case average groundwater withdrawal rate of 620 liters (165 gallons) per minute might be applied at either HC5 or HC7 new well location, analysis results (see Table 4-65) indicate that, with the exception of Black Spring, existing wells and springs near Caliente common segment 3 would be outside the radius of influence of the new water wells. If it is conservatively assumed that Black Spring and the host aquifer at proposed new well locations HC5 and HC7 are hydraulically interconnected and groundwater underlying HC5 and HC7 is assumed to be under confined conditions, hydrogeologic impact analysis results indicate that if all of the water required for construction was obtained from the HC5, this might impact flow rates to Black Spring. However, analysis indicates that if the groundwater withdrawal rate at HC5 did not exceed 490 liters (129 gallons) per minute, discharge rates at Black Spring would probably not be affected by the groundwater production. The remaining required withdrawal rate of approximately 140 liters (36 gallons per minute) should be assigned to the wells at HC7. There are no known existing wells or springs within the radius of influence of HC7 (see Figure 3-79), if DOE used wells at that location to meet water needs up to the average required production rate of 620 liters (165 gallons) per minute.

Results of sensitivity analyses (see Table 4-65) to evaluate impacts from increasing the groundwater withdrawal rate at proposed well location HC7 to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells or springs near Caliente common segment 3, including Black Spring, from this rate of groundwater withdrawal. Alternatively, as for the case just described involving proposed base-case average withdrawal rates, a maximum pumping rate of 490 liters (129 gallons) per minute could be imposed at HC5.

Table 4-65. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – common segment 3.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
HC4	1.11 (well)	0.53	0.88
HC5/7	0.73 (spring)	0.49	0.58
SCV3	>1.60 (well)	0.21	0.57

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.

Caliente common segment 3 would cross an underground pipe conveying water from Black Spring to stock-watering ponds east of the proposed rail line (DIRS 173845-Resource Concepts 2005, Figure 5.31a.1).

4.2.6.2.2.7 Goldfield Alternative Segments. Figure 3-80 shows the approximate location of proposed new wells along Goldfield alternative segments. Groundwater withdrawals within hydrographic areas 145 for Goldfield alternative segments 1 and 3, and within hydrographic area 144 for a Goldfield alternative segment 4, Caliente common segment 4, and Bonnie Claire alternative segment 2 combination of alternatives, would exceed the estimated annual perennial yields for those hydrographic areas. However, approximately 93 to 95 percent of the proposed withdrawals would be to support rail roadbed construction and would be temporary (DIRS 176189-Converse Consultants 2006, Section 2.1 and Table 2-2). DOE could install up to seven new water wells at proposed alternative well locations AsV1/2/3/4/5/8/9 in the Alkali Spring Valley hydrographic area (area 142) approximately 3.5 kilometers (2.2 miles) west of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

DOE could install up to seven new water wells at proposed alternative well locations StF1/2/3/4/5/8/9 in the Stonewall Flat hydrographic area (area 145) approximately 1.9 to 2.3 kilometers (1.2 to 1.4 miles) east of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

DOE could install up to eight new water wells at proposed alternative well locations LV1/2/3/4/9/10/11/12 in the Lida Valley hydrographic area (area 144) approximately 4.7 to 5 kilometers (2.9 to 3.1 miles) west of the centerline of Goldfield alternative segment 3 (see Section 3.2.6.3.7 and Figure 3-80). There are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

Assuming proposed base-case average groundwater production rates at each new well, analysis results (see Table 4-66) indicate that existing wells and springs near Goldfield alternative segments would be outside the radius of influence of these proposed new water wells. Similarly, results of sensitivity analyses (see Table 4-66) to evaluate the potential impacts of increasing the groundwater withdrawal rate at any new water well to a maximum value of 852 liters (225 gallons) per minute indicate that there would be no impacts to existing wells or springs near Goldfield alternative segments from groundwater withdrawals at these higher potential production rates.

For three proposed new well locations associated with the Goldfield alternative segments, the targeted water zone is a possibly water-bearing fractured ***volcanic rock*** system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Figure 3-79).

Table 4-66. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Goldfield alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a]	Radius of influence at base-case pumping rate (kilometers)[a]	Radius of influence at 852 liters[b] per minute pumping rate (kilometers)[a]
AsV6	1.04 (spring)	0.18	Not applicable[c]

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. No calculation was completed for reasons stated in text.

The proposed well locations (well locations StF10, LV5/LV13, and LV8/LV19) could be installed in hydrographic areas 144 and 145, within the

300-meter (1,000-foot)-wide construction right-of-way of Goldfield alternative segments 1 and 3 and common segment 4 (Figure 3-80). There are no known existing wells or springs within approximately 10 kilometers (6 miles) of any of these proposed well locations that are known to be associated with the same fault or fracture system as the proposed well locations or potentially related major fault or fracture zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

4.2.6.2.2.8 Caliente Common Segment 4 (Stonewall Flat Area). Figures 3-80 and 3-81 show the approximate locations of proposed new water wells along Caliente common segment 4.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells and springs near common segment 4 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.9 Bonnie Claire Alternative Segments. Figure 3-81 shows the approximate locations of proposed new water wells DOE could use to support construction of these alternative segments. Evaluation of proposed new wells and information regarding existing groundwater wells and springs in the area where Bonnie Claire alternative segments would cross indicate, for cases where groundwater pumping is assumed at the projected base-case average required withdrawal rates and where the hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute is assumed at each location, that known existing wells and springs along Bonnie Claire alternative segments 2 and 3 would be outside the radius of influence of proposed water wells along this portion of the Caliente rail alignment. There are no existing water wells or springs within 1.6 kilometers (1 mile) of Bonnie Claire alternative segments 2 or 3 (see Figure 3-81). For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Figures 3-81 and 3-82 show the approximate locations of proposed new wells that DOE could use to support construction of common segment 5.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (Table 4-67) indicate that existing wells and springs near common segment 5 would be outside the radius of influence of the proposed new water wells. Where the closest existing well or spring to a proposed new well was found to be located more than 2.4 kilometers (1.5 miles) away from that proposed new well location, no quantitative impacts analysis calculations were completed.

4.2.6.2.2.11 Oasis Valley Alternative Segments. A potential concern in this area is that shallow groundwater, if used for meeting ***potable water*** needs at a rail siding, construction camp, or quarry, could have elevated fluoride levels. However, deeper groundwater northeast of Beatty could be of higher quality.

Table 4-67. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – common segment 5.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
SaF4	>1.60 (well)	0.48	0.81
SaF5/9	>1.60 (well)	0.39	0.68
SaF7/11	1.21 (well)	0.36	0.63
OV24/25/26	>1.60 (well)	0.31	0.38

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.

Figure 3-82 shows the approximate locations of proposed new water wells within the Oasis Valley alternative segments 1 and 3 construction rights-of-way. Specific siting and use considerations for new wells that would be installed along this portion of the rail alignment are summarized below. Impacts to existing springs in this area (Section 3.2.6.3.11) would be eliminated by the following strategies.

For Oasis Valley alternative segment 1, up to three proposed new wells at locations OV3 and OV4, and up to two new wells at location OV5, sited within valley-fill alluvial materials, could be used to obtain water needed to support rail line construction. Alternatively, or in combination with these wells, a series of alternate wells approximately 7.2 kilometers (4.5 miles) northwest of proposed well location OV4 (at locations OV24, OV25, and OV26 on Figure 3-82), would also be used to supply water, for the same purpose, to a rail alignment water-demand location in the vicinity of proposed well locations OV3, OV4, and OV5. Locations OV24 through OV26 would be within the proposed rail alignment construction right-of-way, and in valley-fill alluvium. A series of springs on the Upper Oasis Valley Ranch (DIRS 169384-Reiner et al. 2002, Figure 7) are within approximately 1 kilometer (0.6 mile) of proposed well locations OV3, OV4, and OV5. Section 3.2.5, Surface-Water Resources, discusses other springs in this area. Wells at locations OV3, OV4, and OV5 would be between approximately 15 and 30 meters (50 and 100 feet) deep, while wells at locations OV24, OV25, and OV26 would be between approximately 30 and 46 meters (100 and 150 feet) deep (DIRS 176189-Converse Consultants 2006, Appendix B). For a 4-year construction schedule, the total combined withdrawal rate for wells at locations OV3 and OV4, taken together with that for alternative wells at locations OV24 and OV25, would be approximately 410 liters (approximately 110 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). For the same schedule, the total combined withdrawal rate for wells at locations OV5, together with that for alternative wells at location OV26, would be approximately 150 liters (approximately 40 gallons) per minute. The total required water production would be divided between these well locations (Figure 3-82).

For Oasis Valley alternative segment 3, up to two proposed new wells at locations OV13, sited at the same location as OV5 under Oasis Valley alternative segment 1, could be used to obtain water needed to support railroad construction. Alternatively, or in combination with these wells, up to two alternate wells at location OV24, sited at the same location as OV24 under Oasis Valley alternative segment 1 (Figure 3-82), would also be used to supply water to a rail alignment water-demand location in the vicinity of proposed well location OV13. Wells at these locations would have the same depth as the corresponding wells at these locations under Oasis Valley alternative segment 1. For a 4-year construction schedule, the total combined withdrawal rate for wells at location OV13, taken together with that for alternative wells at location OV24, would be approximately 340 liters (approximately 89 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). The total required water production would be divided between these well locations (Figure 3-82).

Analysis results (see Table 4-68) indicate that pumping groundwater from wells at locations OV3, OV4, and OV5, under the Oasis Valley alternative segment 1, and pumping from wells at location OV13, under Oasis Valley alternative segment 3, would need to be limited to a total withdrawal rate of approximately 76 liters (approximately 20 gallons) per minute or less at each location, under each alternative segment, to preclude possible reductions in discharge rates and water quality at the Upper Oasis Valley Ranch springs. The remaining water needed to support construction activities in this portion of the rail alignment would be obtained from proposed alternate well locations OV24, OV25, and/or OV26. For Oasis Valley alternative segment 1, the total combined net production that would be met through the use of wells at alternate well locations would be approximately 340 liters (89 [109 + 40 – 20 – 20 – 20] gallons) per minute. For Oasis Valley alternative segment 3, the total combined net production from wells at location OV24 would be approximately 260 liters (69 [89 – 20] gallons) per minute.

Table 4-68. Summary of calculated radii of influence for proposed new wells for the Caliente rail alignment – Oasis Valley alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[b] per minute pumping rate (kilometers)
OV3/4/5	0.64 (spring)	0.28	Not applicable[c]
OV9	1.5 (spring)	0.18	0.64
OV12/18/19/20/21	0.96 (spring)	0.56	0.61
OV6/8/14/16	1.32 (spring)	0.49	0.64

a. To convert kilometers to miles, multiply by 0.62137.
b. Base-case pumping rate was limited to 76 liters per minute.
c. No calculation was completed for reasons stated in text.

Evaluation of the effects of proposed groundwater withdrawals from proposed wells at locations OV12, OV17, OV18, OV19, and OV20 for Oasis Valley alternative segment 3 indicate that there would be no expected impact to known existing springs or wells in the Oasis Valley area.

Existing UGSG NWIS wells (OVU-Dune Well, OVU-Middle ET Well, OVU-Lower ET Well, and Well ER-OV2) within approximately 0.32 to 0.48 kilometer (0.2 to 0.3 mile) of the proposed new wells at locations OV3, OV4, and OV5 on Oasis Valley alternative segment 1 (see Section 3.2.6.3.11) are shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. All of these wells have no current or projected beneficial use and are used solely for monitoring purposes. An existing well cluster of UGSGS NWIS wells (ER-OV-01, ER-OV-06a, and ER-OV-6a2) is approximately 1.9 kilometers (1.2 miles) northeast of the proposed new wells at location OV20/OV21 on Oasis Valley alternative segment 3. These are also shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. These wells have no current or projected beneficial use and are used solely for monitoring purposes.

Alternatively, for Oasis Valley alternative segment 1, up to four proposed new wells could be installed at proposed alternative well locations OV6 and OV8 west of the Amargosa River in the Oasis Valley area (see Section 3.2.6.3.11 and Figure 3-82). Under Oasis Valley alternative segment 3, these alternate well locations are designated OV14 and OV16, but the wells would have the same characteristics and same required withdrawal rates. These alternate wells would support earthwork construction and would be between 30 and 46 meters (100 and 150 feet) deep. The total combined required withdrawal rate for this set of wells would be approximately 510 liters (136 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). Analysis results (see Table 4-68) indicate that pumping groundwater from these wells at the full required base-case withdrawal rates would not be expected to impact discharge rates and/or water quality at a group of springs (identified in records as Ute Springs and Manley Springs) approximately 0.64 kilometer (0.4 mile) to 0.97 kilometer (0.6 mile) east of the OV14 and OV16 locations.

For two proposed new well locations associated with the Oasis Valley alternatives portion of the alignment, the targeted water zone is a possibly water-bearing detachment fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Maps 14a and 14b). A proposed well location (OV7 or OV15, depending on alternative segment) could be installed in the southern portion of hydrographic area 228, within the typical maximum 300-meter (1,000 foot)-wide construction right-of-way of common segment 6 (Figure 3-82). A new well (see Section 3.2.6.3.11 and Figure 3-82) might be installed in the southern part of the Oasis Valley hydrographic area near the area boundary, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing detachment fault system (DIRS 176189-Converse Consultants 2006, Appendix B). There are no known existing wells or springs within approximately 10 kilometers (6 miles) of either of these proposed well locations that are known to be associated with the same fault system as either of these proposed well locations or potentially related major fault zones, should these wells be used for obtaining water required at corresponding water-demand stations along the rail alignment.

4.2.6.2.2.12 Common Segment 6 (Yucca Mountain Approach). Figure 3-82 shows the approximate locations of proposed new wells along common segment 6. There are approximately 1.4 million cubic meters (1,147 acre-feet) and approximately 72,000 cubic meters (58 acre-feet) of annual committed groundwater resources in hydrographic areas 229 and 227A, respectively. There are approximately 101,000 cubic meters (82 acre-feet) of documented pending annual duties for area 229 and approximately 6,170 cubic meters (5 acre-feet) of pending annual duties for area 227A. Tables 3-35 and 4-60 indicate that water withdrawal required within hydrographic area 229 for construction of common segment 6 would exceed the estimated annual perennial yield for that hydrographic area. However, except for smaller-magnitude water requirements (on the order of 3.8 liters [1 gallon] per minute) associated with a proposed rail siding (DIRS 176189-Converse Consultants 2006, Table 2-1) and a proposed construction camp (approximately 76 liters [20 gallons] per minute), water requirements for common segment 6 would be required for only 9 months (DIRS 176189-Converse Consultants 2006, Appendix A).

There are 14 existing USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs within approximately 1.6 kilometers (1 mile) of common segment 6. DOE proposed up to two new water wells at location CF4. These wells would furnish water for earthwork compaction and would be between approximately 370 and 460 meters (1,200 and 1,500 feet) deep. Although there is one USGS NWIS well approximately 1.4 kilometers (0.9 mile) northeast of this location, that well is a groundwater test/monitoring well (NC-EWDP-18P) installed to test subsurface characteristics and monitor groundwater conditions downgradient of the Yucca Mountain repository site. This well has no current or projected beneficial use, and is only for monitoring purposes (DIRS 176600-Converse Consultants 2005, Plate 4-2 and Appendix A; and DIRS 176808-Nye County Nuclear Waste Repository Project Office 2002, all).

As shown in Table 3-35, the perennial yield for the western two-thirds of hydrographic area 227A is approximately 7210,000 cubic meters (580 acre-feet) and committed groundwater resources are very low.

Appropriations for new wells could be pursued in this area to meet construction-water demand for the proposed operations support facilities inside the Yucca Mountain Site boundary.

Water required for railroad construction and operations through area 227A would be acquired as part of the water inventory of approximately 530,000 cubic meters (430 acre-feet) per year proposed for appropriation in area 227A to support construction and operation of a repository at Yucca Mountain. The total estimated water demand for construction of the portion of common segment 6 within area 227A is approximately 710,000 cubic meters (572 acre-feet). Water requirements associated with the construction and operation of proposed rail facilities in area 227A are described in Section 4.2.6.2.1. If the amount of water required to support rail construction and operations exceeds the current amount proposed for appropriation, the schedule for railroad construction or for water acquisition could be modified to reduce peak water demands, or an additional temporary water appropriation for rail construction could be sought (DIRS 176189-Converse Consultants 2006, p. 15).

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells and springs near common segment 6 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Caliente rail alignment.

4.2.6.3 Operations Impacts

Overall, potential impacts to groundwater resources from operating the rail line from Caliente to Yucca Mountain under the Proposed Action would be small.

Rail line operations facilities would need water for daily operation. However, other than relatively limited water quantities required for maintaining fire protection water-tank reserves at rail sidings and meeting relatively low water needs for operations personnel at selected facility locations along the rail line, there would be no continued need for any large-scale production wells once construction of the railroad is completed. Possible changes to recharge characteristics, if any, in the areas of railroad operations and support facilities would be the same as those at the completion of construction of the rail line.

There would be no impacts to groundwater resources from disposal of wastewater (see Section 4.2.11, Utilities, Energy, and Materials).

4.2.6.4 Impacts under the Shared-Use Option

Impacts to groundwater under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Under the Shared-Use Option, additional commercial rail sidings would be constructed as a third track alongside passing sidings (Figure 2-55). The total length of commercial rail sidings would be relatively small compared to the total length of the rail line. Therefore, under the Shared-Use Option, water needs for construction of the rail line would increase only by approximately 150,000 cubic meters (119 acre-feet).

The commercial sidings would likely be in the Caliente, Panaca/Bennett Pass, Warm Springs Summit, Tonopah, Goldfield, and Beatty/Oasis Valley areas. For purposes of analysis, DOE assumed that the commercial sidings would be in the same hydrographic areas as analyzed for the Proposed Action without shared use. Impacts would be similar to those described for the Proposed Action without shared use; additional impacts to groundwater resources in these areas would be small.

The commercial-only facilities that would be constructed under the Shared-Use Option would likely be close to DOE-owned and -operated rail facilities and would likely overlie the same hydrographic areas identified for the Proposed Action without shared use. Overall, the impacts would be similar to those described for the Proposed Action without shared use and would be small.

Impacts to groundwater under Shared-Use Option operations would be similar to those identified for operations under the Proposed Action without shared use (Section 4.2.6.2). Use of the completed rail line from Caliente to Yucca Mountain, including any additional sidings, would have a small impact on groundwater resources. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

The commercial-only facilities would require water for daily operation. Water demand to operate these facilities has not been determined, but DOE assumes this demand would be small. Therefore, the additional impacts to groundwater resources would likely be small and overall would be similar to those described for the Proposed Action without shared use.

4.2.6.5 Summary

This section summarizes and characterizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment. The potential for impacts to groundwater resources resulting from physical disturbance of the ground surface during the construction phase would be small. Proposed groundwater withdrawals would locally affect groundwater flow patterns and groundwater availability. Impacts on downgradient groundwater basins (hydrographic areas) due to the proposed groundwater withdrawals would be very small. Impacts on groundwater resources due to groundwater withdrawals at proposed quarry locations and rail facility locations would also be very small. DOE would implement best management practices as part of the Proposed Action to avoid, minimize, or otherwise reduce impacts to groundwater resources. Chapter 7 identifies best management practices and potential mitigation measures.

For the case of groundwater withdrawals from proposed wells to support a 4-year rail construction schedule, analysis results (see Tables 4-61 through 4-68) indicate that, based on anticipated hydrogeologic conditions, existing known productive wells or springs are not expected to fall within the radius of influence of the proposed new wells. The proposed groundwater withdrawal at each new withdrawal well would create a drawdown feature in the portion of the ***saturated zone*** immediately surrounding that well, locally affecting groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding the well. The effects in each case where projected average withdrawal rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 kilometers (approximately 0.5 mile) or less in a few instances and generally a much smaller distance. Sensitivity analysis results indicate that the effects in each case where it is assumed that a hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute might be imposed at each proposed well location would be limited in extent to a maximum horizontal distance of approximately 1.2 kilometers (approximately 0.75 mile) or less.

Analysis results (see Tables 4-61 through 4-68) indicate that certain restrictions or use prohibitions would need to be factored into the final siting and use of some specific proposed new groundwater well locations in some cases (mostly with respect to potential higher well-withdrawal scenarios). Specific locations falling into this category are selected proposed well locations in the Oasis Valley hydrographic area (OV3, OV4, and OV5/OV13), Meadow Valley Wash/Panaca Valley hydrographic area (proposed well locations PanV3/6, PanV5, Pan V7/PanV8, PanV26, and possibly location PanV4), and Hot Creek Valley hydrographic area (proposed well location HC5) in order to preclude potential impacts on existing groundwater resources. The resources that have potential to be affected if such restrictions or use prohibitions were not followed include springs (locations OV3, OV4, OV5/13, and HC5) or existing wells (all other locations).

Wells having the largest withdrawal rates would be expected to be those that are designed for use as supply wells for earthwork compaction; groundwater withdrawals from these wells would occur over a period of less than 1 year (typically over a 9-month pumping period). For a longer rail construction schedule (up to 10 years), groundwater withdrawal rates from new wells would be the same or less than those estimated in this section. For this longer schedule, the magnitude of potential impacts to existing groundwater users from groundwater withdrawals would be equal to or less than that determined for the 4-year railroad construction schedule.

Analysis results indicate that the effects of groundwater withdrawals from the proposed wells at the range of withdrawal rates that could be required for the project would be localized in nature and extent. The impacts caused by the majority of water withdrawals and the wells having the highest production rates (those associated with construction of the rail roadbed) would be short term in duration. Additionally, for those areas where proposed new water wells would be near a boundary between adjacent hydrographic areas, downgradient hydrographic areas would not be likely to be affected by the proposed groundwater withdrawals because (1) there are no identified existing groundwater users associated with the downgradient groundwater basins within 1.6 kilometers (1 mile) of any of these proposed well-water withdrawal locations, and (2) available hydrogeologic information indicates that significant inter-basin groundwater (under)flow is not occurring in the areas downgradient of the proposed well locations.

DOE compared hydrogeologic conditions and required groundwater withdrawal durations and proposed groundwater withdrawal rates for new wells required for the Proposed Action to hydrogeologic conditions and groundwater withdrawal rates and pumping durations that have occurred at certain locations in the western United States where ground subsidence has been observed as a result of prolonged, large-scale groundwater withdrawals. Comparison results indicate that the potential for ground subsidence to occur as a result of proposed groundwater withdrawals in the hydrographic areas the Caliente rail alignment would cross would be small, both during the construction phase and the operations phase.

Section 5.2.1.3.2 provides information about pending applications for proposed large groundwater development projects in the Caliente rail alignment cumulative impacts region of influence.

Table 4-69 summarizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Caliente rail alignment.

Table 4-69. Summary of potential impacts to groundwater resources - Caliente rail alignment.

Resource	Proposed Action or Shared-Use Option
Groundwater availability and uses	*Construction* - Analysis results indicate that proposed groundwater withdrawals would locally affect groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding each new withdrawal well. The effects in each case where projected average withdrawal rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 kilometer (approximately 0.5 mile) or less in a few instances and generally a much smaller distance. Sensitivity analysis results indicate that the effects in each case, where it is assumed that a hypothetical withdrawal rate of 852 liters (225 gallons) per minute might be imposed at each proposed well location, would be limited in extent to a maximum horizontal distance of approximately 1.2 kilometers (approximately 0.75 mile) or less. Proposed groundwater withdrawals at selected proposed well locations in the Panaca Valley (PanV5, PanV26, PanV3/6, PanV7/8, and possibly PanV4), and Oasis Valley hydrographic areas (OV3, OV4, and OV5/13), could, if unmitigated, impact existing groundwater users or existing groundwater resources during the construction phase, if base-case average pumping rates (locations PanV26, OV3, OV4, and OV5/13) or average pumping rates of approximately 852 liters (225 gallons) per minute (all of the listed locations) were assumed to be applied at the new well locations. Hydrogeologic effects resulting from use of the proposed new wells for supporting rail roadbed construction would be temporary in nature. *Construction and Operations* - Physical impacts to existing groundwater resource features such as existing wells or springs resulting from railroad construction and operation would be small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, potential impacts to groundwater resources from operating the railroad from Caliente to Yucca Mountain would be small.
Ground subsidence	*Construction* - The temporary duration of the vast majority (approximately 90 percent) of the total groundwater withdrawals required for railroad construction indicate that the potential for the proposed groundwater withdrawals to cause subsidence of the ground surface is small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, the potential for the groundwater withdrawals needed to support railroad operations to cause subsidence of the ground surface is small.
Groundwater quality	*Construction and Operations* - The impact to groundwater resources of contaminants that might be released by construction equipment during railroad construction or operation would be small because of generally deep groundwater depths beneath most of the alignment. *Construction and Operations* - The impact of proposed groundwater withdrawals on groundwater quality would be small. The proposed withdrawals would not conflict with water quality standards protecting groundwater resources.

4.2.7 BIOLOGICAL RESOURCES

This section describes potential impacts to biological resources (vegetation, wildlife, special-status species, State of Nevada game species, and wild horses and burros) from constructing and operating the proposed railroad along the Caliente rail alignment. Potential impacts are reported and described as either direct or indirect, and either long-term or short-term.

There could be short-term impacts to biological resources in the rail line construction right-of-way during the construction phase. These impacts would be short term because DOE would restore disturbed lands not required for railroad operations with appropriate vegetation immediately after construction was complete.

There would be long-term impacts to biological resources in areas where there would be unavoidable impacts that would result in a change in the natural setting that could last beyond the 50-year operations phase. These areas would include the rail roadbed, along access roads, and in facility and quarry footprints. For biological resources, such impacts are identified for areas of the maximum edge of cut and toe of slope for fill (see Section 2.2.2.5).

Section 4.2.7.1 describes the methods DOE used to assess potential impacts to biological resources; Section 4.2.7.2 describes impacts under the Proposed Action; Section 4.2.7.3 describes impacts under the Shared-Use Option; and Section 4.2.7.4 summarizes impacts. Section 6.2.7 summarizes laws and regulations governing the protection of biological resources. Appendix H provides more detail on the methods DOE used to assess potential impacts to biological resources.

4.2.7.1 Impact Assessment Methodology

For this analysis, DOE calculated potential direct long-term impacts to biological resources based on the footprint of the rail roadbed. The footprint would be within the nominal width of the construction right-of-way, and is the area that would involve clearing of vegetation, excavation, and filling to support the rail line. The width of the footprint would fluctuate along the alignment due to topography, cut and fill requirements, land use, and to avoid or minimize impacts to other resources (such as water and structures). This area would experience direct, long-term impacts.

DOE coordinated with personnel from pertinent federal, state, and local agencies to identify potential impacts to biological resources. Where possible, the Department has quantified potential impacts (such as habitat loss due to construction and operations activities).

Although the Department would minimize the use of the area between the edge of the construction footprint and the outside edge of the construction right-of-way, DOE took a conservative approach and analyzed the short-term impacts to biological resources within this area. This approach overstates impacts as DOE would likely not disturb a large portion of this area.

For facilities that would be outside the nominal width of the construction right-of-way (such as quarries and railroad operations support facilities), the area DOE assessed for potential impacts was the maximum construction footprint of each facility. In order to assess potential impacts, the Department performed a spatial Geographical Information System analysis to compare the footprints of these facilities with biological resources information.

Where possible, this section reports potential impacts to biological resources quantitatively. Potential species-specific impacts are reported qualitatively as either small, moderate, or large, as defined in Section 4.1. DOE estimated impacts based on the amount of change to or loss of the resource from the baseline conditions described in Section 3.2.7, and considered the following criteria for determining the level of change in conditions:

- Direct effects would be-
  - Long-term loss of vegetation (land-cover types)
  - Short-term disturbance to habitat and vegetation
  - Long-term and short-term species displacement or alteration of access to important year-round or seasonal habitat during the construction and operations phases (including watering areas and other key areas)
  - Long-term loss of potential habitat (species-specific land-cover types)
  - Short-term disturbance to habitat and vegetation
  - The risk of trains colliding with wildlife
- Indirect effects would be-
  - Changes in land use that could effect movement patterns and migratory patterns
  - Displacement of species after construction that could add additional stress to other areas and habitat

The assessment of impacts to biological resources considers the potential for continued engineering and site evaluation and planning efforts (see Chapter 2), compliance with applicable requirements (see Chapter 6), and implementation of best management practices (see Chapter 7) to minimize or avoid impacts. This section reports potential direct impacts for the entire rail alignment and specific rail line segments.

DOE expects that there would be small indirect impacts, if any, to biological resources from changes in land use and post-construction displacement, because of the large expanses of land in the area and the types of current uses that tend to be less intrusive than normal development and rural or urban expansion.

DOE concluded from the groundwater impact analysis that project-related groundwater withdrawals would not result in changes to water levels at springs; therefore, there would be no impacts to vegetation, wildlife, special status species, state of Nevada game species, wild horses or burros associated with those springs (see Section 4.2.5, Surface-Water Resources).

4.2.7.1.1 Vegetation

DOE began the assessment of impacts to vegetation resources quantitatively and qualitatively by reviewing available resource data and field surveys. The Department considered the potential direct impacts to land-cover types from railroad construction and operations activities. To assess potential direct impacts from the loss or disturbance of most land-cover types, DOE compared the area of a land-cover type that could be disturbed during the construction and operations phase to the land-cover types present within the affected mapping zones. For ecologically important and relatively uncommon land-cover types within the entire mapping zone, such as ***riparian*** and marsh habitats, DOE compared the area of a land-cover type that would be disturbed (within the construction right-of-way and facilities footprints) to the land-cover type present within the study area, as defined in Section 3.2.7.1.2. The Department used this information to quantitatively estimate the potential loss of habitat and to determine qualitatively whether the loss of habitat would result in a small, moderate, or large impact.

DOE also evaluated potential impacts from noxious or invasive plant species based on the potential for railroad construction or operations activities to introduce or spread noxious or invasive species.

4.2.7.1.2 Wildlife

DOE assessed potential impacts to wildlife communities qualitatively by reviewing the land-cover types that could be affected during railroad construction and operations and identifying the wildlife species likely to be present within those areas. Habitat loss with these communities would be the primary driver of impacts to wildlife and is the focus of this analysis. The Department also evaluated potential impacts from railroad operations on wildlife.

4.2.7.1.3 Special Status Species

DOE assessed potential impacts to special status species (threatened and ***endangered species***; ***BLM-designated sensitive species***; and State of Nevada-designated sensitive and protected species) qualitatively by reviewing the potential for a species to occur within the study area and the region of influence; species habitat that would be affected; and the potential mechanisms for impact. The primary impact would be from the loss of habitat, which is the focus of this analysis. DOE also evaluated impacts from railroad operations on special status species.

4.2.7.1.4 State of Nevada Game Species

DOE assessed potential impacts to State of Nevada Game Species, as defined in Section 3.2.7.2.4, based on the potential for loss of important foraging habitat, the potential for loss of important water sources, the potential displacement of game, and the potential disruption of movement patterns.

4.2.7.1.5 Wild Horses and Burros

DOE assessed potential adverse impacts to wild horses and burros based on the potential for loss of important foraging habitat, the potential for loss of important watering areas, and the potential for impacts to individual ***herd management areas***.

4.2.7.2 Environmental Impacts

This section describes potential impacts to biological resources from construction and operation of a railroad along the Caliente rail alignment. To minimize redundancy and provide clear and concise reporting of potential impacts, Section 4.2.7.2.1 describes impacts common to all rail line segments and construction and operations support facilities and how each biological resource could be affected. Section 4.2.7.2.2 describes rail line segment- and facility-specific impacts, and does not repeat impacts common to the entire alignment. Tables list the amount of departure from baseline conditions (see Section 3.2.7) based on the indicators described above.

4.2.7.2.1 Environmental Impacts Common to the Entire Caliente Rail Alignment

This section describes potential short-term and long-term impacts to each biological resource that could result from rail line construction along the Caliente rail alignment.

4.2.7.2.1.1 Vegetation. Construction of the rail line and facilities along the Caliente rail alignment would directly impact a diverse mix of vegetation communities and land-cover types. Tables 4-70, 4-71, 4-72, and 4-73 list the land-cover types associated with the Caliente rail alignment common segments, alternative segments, quarries, and operations support facilities that would be affected during the construction phase. The primary construction-related impacts to vegetation communities during the construction phase would be the physical short-term or long-term removal of vegetation and compaction of the soil.

Table 4-70. Short-term and long-term impacts to land-cover types[a] by common segment.

Land-cover type[e]	Area that would be impacted by common segment (square kilometers)[b,c]											
	CS1[d]		CS2		CS3		CS4		CS5		CS6	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-specific	0	0	<0.01	<0.01	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	<0.01	0	0.01	<0.01	0	0	0	0	0.01	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	4.04	0.54	0.08	<0.01	0.22	0.02	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	14.3	1.55	2.82	0.25	6.05	0.59	0.02	<0.01	<0.01	<0.01	0	0
Inter-Mountain Basins Greasewood Flat	0.05	0.01	0.01	<0.01	0.14	0.01	0.01	<0.01	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	10.5	1.07	10.7	0.85	21.5	1.68	3.09	0.25	0	0	0	0
Inter-Mountain Basins Playa	0.09	<0.01	0	0	0.09	<0.01	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0.08	<0.01	0.01	<0.01	0.47	0.03	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	1.27	0.22	0.16	0.01	1.50	0.14	0.12	<0.01	0.85	0.04	1.78	0.24
Invasive Annual and Biennial Forbland	0	0	0	0	<0.01	<0.01	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0.64	0.11	0	0	0	0	0	0	1.39	0.09	3.18	0.38
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0	0	0	0	0	0	0	0.05	<0.01
North American Warm Desert Playa	0	0	0	0	0	0	0	0	<0.01	0	0.02	<0.01
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	<0.01	<0.01	0	0	0	0	0	0	2.92	0.23	8.13	1.0
Sonora-Mojave Mixed Salt Desert Scrub	<0.01	0	0	0	0	0	0	0	5.93	0.44	0.08	<0.01
Totals[f]	31	3.5	13.8	1.12	30	2.5	3.24	0.26	11.1	0.82	13.2	1.63

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.10.
c. < = less than.
d. CS = common segment.
e. The land-cover types listed are only those that occur within the construction right-of-way.
f. Totals may differ from the sum of values due to rounding.

Table 4-71. Short-term and long-term impacts to land-cover types[a] by alternative segment (page 1 of 2).

	Area impacted by alternative segment (square kilometers)[b,c,d]															
	Interface with Union Pacific Mainline alternative segments				Garden Valley								South Reveille			
	Caliente		Eccles		GV1		GV2		GV3		GV8		SR2		SR3	
Land-cover type[e]	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Agriculture	<0.01	0.02	0.02	0.03	0	0	0	0	0	0	0	0	0	0	0	0
Barren Lands, Non-specific	0	0	0.01	<0.01	0	0	0	0	0	0	0	0	0	0	0	0
Developed, Open Space - Low Intensity	<0.01	<0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.05	0.02	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0.15	0.05	0.04	0.01	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0.18	0.03	1.39	0.16	<0.01	0	<0.01	<0.01	<0.01	0	0.03	<0.01	0.16	<0.01	0.07	<0.01
Inter-Mountain Basins Big Sagebrush Shrubland	0.24	0.05	1.36	0.21	2.76	0.41	1.81	0.39	6.29	0.59	1.65	0.39	0.93	0.13	0.97	0.13
Inter-Mountain Basins Cliff and Canyon	0	0	0	0	<0.01	0	<0.01	0	<0.01	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	0.08	0.05	0.23	0.04	<0.01	0	<0.01	0	<0.01	0	<0.01	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	0.04	0.03	0.75	0.13	6.84	0.70	7.68	1.12	4.27	0.50	7.44	1.17	3.55	0.40	4.07	0.41
Inter-Mountain Basins Montane Sagebrush Steppe	<0.10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	<0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	<0.01	<0.01	0.02	<0.01	0.02	0	0	0	0.01	<0.01	0.01	0	0.46	0.10	0.52	0.10
Inter-Mountain Basins Wash	0.03	<0.01	<0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
North American Arid West Emergent Marsh	0.05	0.09	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals[f]	0.91	0.35	3.85	0.58	9.50	1.11	9.50	1.51	10.58	1.09	9.15	1.57	5.73	0.64	5.63	0.65

Table 4-71. Short-term and long-term impacts to land-cover types[a] by alternative segment (page 2 of 2).

	Area impacted by alternative segment (square kilometers)[b,c,d]													
	Goldfield						Bonnie Claire				Oasis Valley			
	GF1		GF3		GF4		BC2		BC3		OV1		OV3	
Land-cover type[e]	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-specific	0	0	0	0	<0.01	<0.01	0	0	0	0	0	0	0	0
Developed, Medium – Large Intensity	0	0	0	0	0.01	<0.01	0	0	0	0	0	0	0	0
Developed, Open Space - Low Intensity	0	0	0	0	0.03	<0.01	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0.14	<0.01	0.91	0.09	0.21	0.01	<0.01	0	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	1.30	0.18	2.11	0.34	1.34	0.21	0.29	0.02	0.05	<0.01	0	0	0	0
Inter-Mountain Basins Greasewood Flat	0.19	0..03	0.19	0.03	0.19	0.02	0	0	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	10.39	1.71	9.46	1.64	12.24	1.59	1.87	0.20	1.70	0.14	0	0	0	0
Inter-Mountain Basins Playa	0	0	0	0	0	0	0	0	<0.01	<0.01	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0.41	0.04	1.0	0.09	0.27	0.03	0.60	0.06	0.94	0.07	0.12	0.02	0.11	0.02
Invasive Annual Grassland	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	<0.01	<0.01	0	0	0	0	1.79	0.15	1.30	0.13	0.09	0.01	0.02	<0.01
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0
North American Warm Desert Playa	0	0	0	0	0	0	0	0	0	0	0.14	0.02	0.04	<0.01
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0.80	0.05	1.51	0.13	2.05	0.22	2.87	0.31
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0.30	0.02	0.10	<0.01	0.22	0.03	0.89	0.09
Totals[f]	12.46	1.96	13.68	2.19	14.29	1.86	5.65	0.51	5.59	0.49	2.62	0.31	3.95	0.43

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.10.
c. < = less than.
d. BC = Bonnie Claire; GV = Garden Valley; GF = Goldfield; OV = Oasis Valley; SR = South Reveille.
e. The land-cover types listed are only those that occur within the construction right-of-way.
f. Totals might differ from sum of values due to rounding.

Table 4-72. Short-term and long-term impacts to land-cover types[a] by facility (page 1 of 2).

Land-cover type	Area impacted by facility (square kilometers[b])															
	Interchange Yard				Staging Yard						Maintenance-of-Way Trackside Facility		Maintenance-of-Way Headquarters		Rail Equipment Maintenance Yard	
	Caliente		Eccles		Caliente Upland		Caliente Indian Cove		Eccles North							
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Developed, Open Space - Low Intensity	0	<0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0	<0.01	<0.01	0.01	0	0	0.08	0.02	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0	<0.01	<0.01	0.03	<0.01	0	<0.01	0.02	0.01	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	0.01	<0.01	0.08	<0.01	<0.10	0.11	0	0.05	<0.01	0	0	<0.01	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	<0.01	0.04	0.21	<0.01	<0.01	0.02	0	0.06	<0.01	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	0	0	0	0	0.24	0.06	0	0	0.24	0.07	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	0	0.01	0.01	0.03	0.02	<0.01	0	0	0.25	0.03	0.84	0.07	0.08	0	0	0
Inter-Mountain Basins Montane Sagebrush Steppe	0	0	<0.01	<0.01	0	0	<0.01	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Playa	0	0	0	0	<0.10	0	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0	0	0	<0.01	0.02	0	0	<0.01	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0	0	0	0	0	0	0.05	<0.01	0	0	0.09	0.04
Inter-Mountain Basins Wash	0	0	0	0	<0.10	<0.10	0.03	0.03	0	0	0	0	0	0	0	0

Table 4-72. Short-term and long-term impacts to land-cover types[a] by facility (page 2 of 2).

	Area impacted by facility (square kilometers[b])															
	Interchange Yard				Staging Yard						Maintenance-of-Way Trackside Facility		Maintenance-of-Way Headquarters		Rail Equipment Maintenance Yard	
Land-cover type	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06	0.01
North American Arid West Emergent Marsh	0	<0.01	<0.10	0	<0.10	<0.10	0.01	0.02	<0.01	0	0	0	0	0	0	0
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.44	0.24
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	0	0	0	0	0	0	0	0	<0.01	0.01
Totals[c]	0	<0.10	<0.10	0.38	0.33	0.13	0.26	0.10	0.62	0.12	0.90	<0.10	<0.10	0	0.61	0.30

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.10.
c. Totals might differ from sum of values due to rounding.

Table 4-73. Short-term and long-term impacts to land-cover types[a] by quarry.

Land-cover type	Area impacted by quarry (square kilometers[b])											
	CA-8B		NN-9A		NN-9B		NS-3A		NS-3B		ES-7	
	Short-term impacts	Long-term impact	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands	<0.01	<0.01	0	0	0	0	0	0	0	0	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	<0.01	0.02	0	0	0	0	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	<0.01	0.02	0	0	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0.22	0.86	0.03	0.13	0.09	0.21	0.19	0.35	0.02	0.02	0.13	0.34
Inter-Mountain Basins Big Sagebrush Shrubland	0.08	0.27	0.21	0.35	0.10	0.07	0.18	0.31	0.14	0.25	0.15	0.54
Inter-Mountain Basins Mixed Salt Desert Scrub	0	<0.01	0.27	0.74	0.31	0.46	0.40	1.36	0.19	0.72	0.04	0.23
Inter-Mountain Basins Montane Sagebrush Steppe	0	<0.01	0	0	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	<0.01	0.03	0.08	0.18	0.01	0.04	0.23	0.74	0.04	0.11	0	0.02
North American Arid West Emergent Marsh	0.02	0.05	0	0	0	0	0	0	0	0	0	0
Totals[c]	0.34	1.23	0.60	1.40	0.51	0.78	1.00	2.76	0.38	1.11	0.32	1.13

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.10.
c. Totals might differ from sum of values due to rounding.

Areas where there could be short-term impacts to vegetation include the area from the outer edge of the construction right-of-way to the outer edge of the construction footprint. Disturbance to vegetation associated with these areas would result in relatively small impacts compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. The impacts would be short-term because DOE would implement best management practices. These practices would minimize disturbance and promote effective restoration efforts, including stockpiling and replacing topsoil, reseeding of native species, monitoring for success, and in most cases the eventual return of a native vegetation community.

Areas where there could be long-term impacts include the rail line construction footprint and the footprints of facilities. The amount of vegetation loss would be relatively small compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. The removal of vegetation for rail line construction would be primarily linear and for part of its length, would be adjacent to an existing state highway and other roadways. Therefore, impacts related to fragmentation of vegetation communities would be relatively small and would not be expected to disrupt seed dispersal.

Clearing vegetation and disturbing soil during construction activities could create habitat suitable for ***noxious weeds*** and invasive plant species. Additionally, linear disturbances such as the rail line and access roads across relatively undisturbed regions have the potential to increase the spread of noxious weeds and invasive plant species. If noxious weeds and invasive species were to become established along the rail alignment, they could spread to adjacent areas and affect intact plant communities beyond the initial area of disturbance.

DOE would implement best management practices during and after construction to prevent the establishment of noxious weeds and invasive species. Such practices would include limiting the grading of surfaces and surface disturbance to the immediate area of construction; planting stockpiles of topsoil retained for more than a year; establishing staging areas in previously disturbed areas where practicable; applying approved herbicides; and revegetating disturbed areas not needed for operation of the rail line (see Chapter 7). As a result, potential impacts from the spread of noxious weeds and invasive species would be minimized or avoided, and would be small.

The watering of land surfaces during construction activities for such purposes as soil stabilization, ballast cleaning, vehicle washing, and dust suppression could encourage the growth of noxious weeds and invasive species. However, watering would primarily occur on road surfaces where weeds would not become established. DOE would implement best management practices to limit the watering of land surfaces to the extent practicable (see Chapter 7). Short-term impacts from the introduction and spread of noxious weeds and invasive species would be very small during the construction phase; long-term impacts would be small over the entire length of the rail alignment.

4.2.7.2.1.2 Wildlife. Potential impacts to wildlife during construction would consist of the loss of suitable habitat (land-cover types), disturbance of habitat, displacement of or limited access to important year-round or seasonal habitat during the construction phase, disruption of movement patterns, and the potential increase in the risk of wildlife collisions with vehicles along access roads. Reduced vegetation could limit forage for wildlife, such as big game or bird species, and could reduce or limit habitat for ground dwelling mammals in the area. These impacts are reported as direct short- or long- term losses of land-cover types or habitat. To reduce redundancy, direct impacts from habitat disturbance and displacement and changes in wildlife movement and potential collisions with trains and automobiles are described in segment- and facility-specific sections. Train collisions with wildlife would be minimal over most of the alignment due to the amount of sight distance, low speeds of trains, and area for escape beside the tracks.

Wildlife species that use underground habitats and are present within the construction right-of-way could be crushed or smothered during rail line construction. However, DOE would implement best management practices (such as conducting clearance surveys for the presence of sensitive species and their habitat) before and during the construction phase to minimize adverse impacts to wildlife. The more mobile wildlife species, such as kit fox, badgers, mountain lions, and rabbits would be less likely to incur mortality, as they would be able to avoid the construction area, resulting in a short-term impact to these species due to displacement or avoidance of the area.

Cuts into steep hillsides, depending on design, could encourage wildlife to congregate in the cut areas, resulting in a potential increase of collision with trains and possible fatalities. Access roads adjacent to the rail line would allow animals to move off the tracks to avoid oncoming trains. Therefore, the potential for mortality of animals congregating in cut areas would be small. Additionally, sight distance and the low speeds of the trains would help minimize potential collisions. Cuts would also have the potential to slightly disrupt movement patterns of some wildlife species. However, this impact would be small because animals would be able to travel around cuts to move up or down the hillsides.

Construction of additional access roads and the improvement of existing access roads could increase traffic during the construction phase and in the short term could increase wildlife fatality from vehicle collisions and potentially disturb wildlife habitat from the increase in off-road vehicle traffic. However, the degree and magnitude of impacts would be species-specific and would depend on the existing habitat range of the species.

The generation of ***solid waste*** at construction camps could increase the occurrence of coyotes and ravens, indirectly increasing the death rate of the prey of these two species. As part of the worker education program, all personnel would be trained on the proper way to dispose of waste. Therefore, this potential indirect impact would be small.

The Migratory Bird Treaty Act (16 U.S.C. 703 through 712) protects migratory birds, their eggs, and occupied nests, but it does not protect their habitat. As such, all activities that would harm nesting birds or result in nest abandonment would be prohibited during construction and operation of the railroad. However, long-term impacts to migratory bird species as a result of the proposed project could result from loss of suitable nesting and foraging habitat where large amounts of vegetation (for example, junipers and pinyon pines) are removed or where rock outcrops or cliffs are disturbed for construction purposes (see Appendix H, Table H-4 for a list of all bird species that could be present in construction right-of-way). Short-term impacts could include birds avoiding the area during construction activities. To avoid or minimize adverse impacts to migratory birds during the construction phase, DOE would implement best management practices, including minimizing groundbreaking activities in nesting habitat during the critical nesting period, which the BLM defines as May 1 through July 15 (see Chapter 7). If groundbreaking or land-clearing activities had to be conducted during the bird nesting season, DOE would conduct surveys to identify nests of migratory birds before beginning those activities.

4.2.7.2.1.3 Special Status Species. A review of the Nevada Natural Heritage Program database (see Section 3.2.7.1.2), documented 60 special status species that have the potential to be present within the study area, however, this chapter discusses only species that could be affected within the construction right-of-way. Potential impacts to special status wildlife species would include loss of and disturbance to potential foraging and nesting habitat, avoidance behavior that could change movement patterns, and noise disturbance. These impacts are described in more detail in the following discussions of impact types by species, and listed in tables in the segment- and facility-specific sections.

Threatened and Endangered Species There is no suitable breeding habitat for the southwestern willow flycatcher, a federally listed endangered species, within the construction right-of-way (DIRS 182308-Rautenstrauch Trip Report Memo, 2006). Only marginally suitable migratory or non-nesting habitat for the southwestern willow flycatcher occurs within the construction right-of-way; no critical habitat occurs within the study area or construction right-of-way for this species. There could be direct impacts in the form of noise disturbances to migratory southwestern willow flycatchers during construction activities if the birds used nearby habitat. However, these impacts would be small given that there are no recorded occurrences and only marginally suitable migratory or non-nesting habitat for the southwestern willow flycatcher within the construction right-of-way for all segments of the Caliente rail alignment.

Habitat for the western yellow-billed cuckoo, a ***candidate species***, is similar to the habitat of the southwestern willow flycatcher. There is no suitable breeding habitat for the western yellow-billed cuckoo within the construction right-of-way (DIRS 182308-Rautenstrauch Trip Report Memo, 2006). There is only marginally suitable migratory habitat nearby, and no critical habitat has been identified in the vicinity for this species. Therefore, there would be no direct impacts to the western yellow-billed cuckoo due to the destruction of habitat. There could be direct impacts in the form of noise disturbances to migratory western yellow-billed cuckoos during construction activities if the birds used nearby habitat. However, these impacts would be small given that there are no recorded occurrences of the western yellow-billed cuckoo in this area and there is only marginally suitable migratory habitat for this species nearby.

There is no suitable nesting or winter roosting habitat for the bald eagle, which was de-listed as a ***threatened species*** in 2007, within the rail line construction right-of-way. This species is still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Any use of the area along the Caliente rail alignment by bald eagles would be transitory. If a migratory eagle flew over or was present in the vicinity of the Caliente rail alignment during construction, construction activities (noise and human presence) would likely deter the bald eagle from using the area or would cause the bald eagle to flush and leave the area of disturbance. This impact is expected to be small and short-term, and would not affect the population of bald eagles in Nevada because this species does not nest or roost in or near the construction right-of-way.

BLM-Designated Sensitive Species There is potential nesting habitat for peregrine falcons on the cliffs along Clover Creek near the City of Caliente, but no species have been observed in this area. This is the only potential nesting habitat within the construction right-of-way for the entire Caliente alignment. Based on the absence of the species and little potential habitat, DOE would not expect impacts to the peregrine falcon anywhere along the Caliente rail alignment. The reduction in vegetation resulting from rail line construction would not be expected to notably impact the availability of prey species for peregrine falcon, given the availability of foraging habitat outside the construction right-of-way, which would not be affected.

Loggerhead shrikes are known to occur along the entire Caliente rail alignment where suitable habitat is present. There could be impacts to this species from increased human activity and noise associated with the construction phase. If shrikes were nesting in the area during construction they would likely be disturbed, which could result in short-term avoidance of the area to abandonment of nesting activities during a given year. The long-term removal of shrubs along the rail alignment would reduce potential nesting habitat for this species. However, loggerhead shrikes occupy a wide range of habitat. Therefore, there would be no long-term impact to the population or viability of this species for any of the rail line segments.

Suitable shrub steppe and desert scrub habitat for the Western burrowing owl occurs within the entire Caliente rail alignment study area and has been documented near common segment 6 in the vicinity of Yucca Mountain. Construction activities have the potential to negatively impact the burrowing owl by covering or collapsing burrows. However, potential impacts to populations of burrowing owls would be small given the expected wide range of this species in the study area and the small amount of suitable nesting habitat in the greater Pioche and Nellis mapping zones that could be lost.

Ferruginous hawks have been reported to occupy and, in some cases, nest in areas adjacent to the proposed Caliente rail alignment (DIRS 174519-Bennett 2005). Construction activities within potential hawk habitat specifically in the Great Basin Pinyon-Juniper Woodland land-cover type, would reduce the amount of potentially suitable nesting habitat for ferruginous hawks. If this species were present in the construction right-of-way during construction activities, noise and the presence of humans could disrupt nesting and foraging activities. This species is a relatively rare breed in the study area and the Great Basin Pinyon-Juniper Woodland land-cover type is relatively abundant within the mapping zone but rare within the construction right-of-way. Therefore, there would be no impacts to ferruginous hawks or their habitat.

It is possible that some individual cacti and yucca plants would be removed during the construction phase, resulting in a small impact to individual plants. However, construction activities would not threaten cacti or yucca populations.

Potential impacts to bat species along the Caliente rail alignment include the disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill operations, Potential impacts to bat habitats from construction activities would be small.

Both the dark kangaroo mouse and the pale kangaroo mouse distribution ranges are from Dry Lake Valley to Goldfield (DIRS 174519-Bennett 2005, all). Potential impacts would result from burrows being covered over or collapsing during rail line construction. However, there are no known occurrences of these species within the construction right-or-way. Any potential impact would be small (DIRS 182061-Hopkins 2006, all).

4.2.7.2.1.4 State of Nevada Game Species. The rail line would cross areas recognized by the BLM and the Nevada Department of Wildlife as habitat for game species (see Figures 3-101 through 3-104). Direct impacts to game species during rail line construction would include loss of foraging habitat, disturbance from noise, potential fatality or injury from collisions with trains and construction vehicles, and a short-term avoidance of year-round or seasonal habitat, migratory corridors and water sources during construction activities. However, because of the relatively low density of game animals in the study area, their mobility, and the existing presence of humans and machines, such impacts would be small. Potential impacts to game species would be greatest in the areas under active construction. After sections of the rail line were completed, it is possible that trains moving along the completed portion of track could collide with and injure or kill individual game animals. However, the likelihood of such collisions would be low, because most game animals would likely avoid oncoming trains whenever possible.

During rail line construction there would be a potential for short-term impacts from the temporary disruption of movement patterns of game species within an area or along migratory corridors. This could disturb individuals or groups of animals and cause animals to avoid the construction areas. Game species are large, mobile animals and would be able to avoid contact with humans at construction sites and would likely move temporarily to other areas during construction activities. These changes in movement or habitat-use patterns would affect relatively low numbers of individuals at any one time; therefore, changes in utilization of the water or forage resources in the region would be small.

There could be direct impacts to game populations if animals avoid water sources close to construction activities. Water sources are found only along certain portions of the Caliente rail alignment and there could be a small short-term impact to individuals if they are unable to reach those water sources. However, there would be no impact on the overall populations of State of Nevada game species.

Other potential impacts to State of Nevada game species would be similar to those described for wildlife, and would be small.

Construction and operation of the proposed railroad would result in the long-term loss of vegetation, and could result in reduced forage for game species. However, the rail line would pass through various land-cover types with varying forage values and the amount of vegetation removed from these differing land-cover types would have a small impact on the availability of forage for game species.

4.2.7.2.1.5 Wild Horses and Burros. This section identifies the magnitude of potential adverse impacts to wild horses and burros based on the potential for wild horses and burros to be displaced and have their habitat degraded or whether wild horse and burro movement patterns would be substantially interrupted.

Construction activities within herd management areas would result in a long-term loss of forage, mortality of individual animals from collisions with trains, the short-term loss of year-round or seasonal habitat, and the potential to disrupt wild horse and burro movement patterns. Appendix H describes specific herd management areas that could be affected during the construction phase.

The removal of vegetation during the construction phase would result in a long-term loss of potential forage for wild horses and burros. However, the amount of vegetation removed would be relatively small compared to the available forage within the affected herd management areas, and would result in an overall small impact to the associated herd management area. Tables in segment- and facility-specific sections list the potential loss of forage due to construction of the proposed railroad.

Generally, wild horses and burros avoid contact with humans and therefore would likely move to other areas during construction activities. These potential changes in movement or habitat-use patterns would affect relatively low numbers of individuals due to the localized nature of construction; therefore, changes in utilization of the water or forage resources in the region would be small. DOE would minimize impacts to herd management areas by fencing off temporary ponds or reservoirs that are used during construction activities to prevent herds from utilizing those water sources, which could otherwise change herd movement patterns. The loss of potential forage and habitat and the temporary short-term loss of access would be the same for each herd management area.

4.2.7.2.2 Segment-Specific Impacts

Sections 4.2.7.2.2.1 through 4.2.7.2.2.18 describe potential short- and long-term direct impacts to biological resources from the construction of specific alternative segments and common segments, quarries, and facilities along the Caliente rail alignment. The discussion in Section 4.2.7.2.1 for the impacts to biological resources common to all segments is not repeated. Rather, tables provide the information necessary to report direct impacts to the specific biological resources associated with each alternative segment, common segment, quarry, and facility. Unless otherwise noted, these sections only identify biological resources for which an impact has been identified.

4.2.7.2.2.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline. As presented in Table 4-70, construction of the Caliente and Eccles alternative segments would result in long- and short-term impacts to several land cover types, as described in the following paragraphs.

Vegetation Both the Caliente and Eccles alternative segments would impact the Great Basin Juniper Woodland land-cover type, which is relatively common on the lower mountain slopes in the area and likely provides roosting and nesting habitat for some raptors. Either alternative segment would also pass through several land-cover types that include sagebrush communities, including Inter-Mountain Basins Big Sagebrush Shrubland, Great Basin Xeric Mixed Sagebrush Shrubland, and the Inter-Mountain Basins

Montane Sagebrush Steppe. These vegetation communities are relatively common in the area and provide habitat for various species that depend on sagebrush communities, such as the sage thrasher and Brewer's sparrow.

Construction of the Caliente or the Eccles alternative segment would result in some unavoidable impacts to wetland and riparian habitats. Short-term impacts would include removal of plant material. Long-term adverse impacts would include the removal of plant materials or alteration of the largely organic growing medium through the deposition of fill material for construction. Following construction, DOE would revegetate disturbed areas outside the operations right-of-way. Additionally, potential adverse impacts within wetlands would be reduced or minimized through mitigation actions such as increasing the slope of the rail roadbed to reduce the area of disturbance along the Caliente alternative segment to approximately 20 meters (70 feet) wide or by constructing bridges through wetlands (see Chapter 7).

The Caliente alternative segment would be constructed within areas classified as wetlands within the Meadow Valley Wash, including the Indian Cove area and along Clover Creek. Impacts within these areas would be limited to the loss of 0.11 square kilometer (27 acres) of habitat and 0.09 square kilometer (22 acres) disturbance to habitat; however, impacts in both areas would be limited. DOE would minimize the amount of wetland and riparian habitat affected within Meadow Valley Wash by constructing the rail line on an existing historic railroad bed. Within Clover Creek, impacts to riparian and wetland habitat within Clover Creek would be small because construction would only involve constructing a bridge. Construction of the Eccles alternative segment would require constructing a bridge across Meadow Valley Wash approximately 1.6 kilometers (1.0 mile) south of Caliente Common Segment 1. Construction of the bridge would cause potential impacts to Meadow Valley speckled dace and Meadow Valley Wash desert sucker habitat, but would not result in any long-term impacts.

The Eccles alternative segment would begin about 8 kilometers (5 miles) east of the City of Caliente and generally run north through Meadow Valley. Construction would result in small impacts to riparian habitat within Clover Creek as a result of activities associated with construction of a 300-meter (1,000-foot) bridge. Short-term impacts such as sedimentation and erosion within wetlands and riparian habitat would be minimized and managed by implementing best management practices during construction.

Special Status Species

Threatened and Endangered Species: Table 4-74 lists impacts to threatened and endangered species. Ute ladies'-tresses, a federally listed threatened species, is currently known to occur near Panaca Spring, approximately 8 kilometers (5 miles) north of the Caliente and Eccles alternative segments. There is a small potential for this species to be present in the moist habitats in Meadow Valley Wash between Panaca and Caliente along the Caliente alternative segment.

The known population of Ute ladies'-tresses near Panaca Spring is relatively undisturbed by livestock grazing, compared with the area of the construction right-of-way in Meadow Valley Wash that has been actively grazed by livestock. The known existing population of Ute ladies'-tresses near Panaca Spring would not be affected by construction of either alternative segment, because that population would be outside the construction right-of-way. DOE does not consider potential impacts to this species because of its restricted distribution and because it would be unlikely to occur within the construction right-of-way. The impacts to Ute ladies'-tresses would be the same for all common segments and alternative segments, and no loss of species would be expected.

Table 4-74. Summary of the magnitude of potential impacts to biological resources from rail line construction along the Caliente or Eccles alternative segment.

Resource/impact type	Extent of impact, Caliente alternative segment	Extent of impact, Eccles alternative segment
Wildlife		
Loss of vegetation or land-cover type (long-term)	0.35 square kilometer[a]	0.58 square kilometer
Construction-related disturbance vegetation or land-cover type (short-term)	0.91 square kilometer	3.85 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0.11 square kilometer	0.10 square kilometer
Construction-related disturbance to riparian habitats (short-term)[b]	0.09 square kilometer	0.10 square kilometer
Wildlife water sources	No impact to water access	No impact to water access
Special status species		
Threatened and endangered species		
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Small loss of marginal non-nesting habitat; no impact	Small loss of marginal non-nesting habitat; no impact
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Small loss of marginally suitable habitat; no impact	Small loss of marginally suitable habitat; no impact
BLM- and State of Nevada-designated sensitive/protected species		
Ute ladies'-tresses (*Spiranthes divuvialis*)	Small loss of potential habitat/small impact	Marginal habitat outside the construction right-of-way; no impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to suitable habitat	Small impact to suitable habitat
Western burrowing owl (*Athenes pallidus*)	Small impact to suitable habitat	Small impact to suitable habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to marginal habitat	Small impact to marginal habitat
Needle Mountains milkvetch (*Astragalus eurylobus*)	No loss of species; small impact to suitable habitat	No loss of species; small impact to suitable habitat
White River catseye (*Cryptantha welshii*)	Potential loss of species; small impact to suitable habitat	No loss of species or suitable habitat; no impact
Pioche blazingstar (*Mentzelia argillicola*)	No loss of suitable habitat; no impact	No loss of species; no loss of suitable habitat; no impact
Meadow Valley speckled dace (*Rhinichthys osculus* ssp. 11)	Small loss of habitat; small impact	Small loss of habitat; small impact
Meadow Valley Wash desert sucker (*Catostomus clarki* ssp., unnamed subspecies)	Small loss of habitat; no loss of species; small impact	Small loss of habitat; no loss of species small impact
Southwestern toad (*Bufo microscaphus*)	Small loss of habitat; small impact	Small loss of habitat; small impact
Bat species (see Table 3-51)	Small construction-related impacts to species through disturbance	Small construction-related impacts to species through disturbance
State of Nevada game species		
Mule deer	Small impact loss of potential habitat and displacement	Small impact loss of potential habitat and displacement
Wild horses and burros	Small impact loss of foraging habitat and displacement	Small impact loss of foraging habitat and displacement

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

BLM- and State of Nevada-Designated Sensitive/Protected Species: The Meadow Valley speckled dace and the Meadow Valley Wash desert sucker are known to occur in Meadow Valley Wash and Clover Creek. Construction of the Caliente alternative segment would require widening the existing abandoned rail roadbed and constructing several bridges which could result in a short-term increase in sediment load within the Meadow Valley Wash. This could increase stress levels of breeding adults or result in individuals unable to reproduce or escape predators. Heightened levels of turbidity and potential filling of adjacent wetlands could result in a short-term increase in fish mortality levels. However, adverse impacts would be minimized by shifting the alignment to minimize filling of wetlands, and engineering all crossings so that there would be no long-term impacts to stream flow or velocity.

DOE would implement best management practices to minimize and manage adverse impacts within Meadow Valley Wash.

The southwestern toad occurs within Meadow Valley Wash and has been observed as far north as the confluence of Meadow Valley Wash and Clover Creek near the southern terminus of the Caliente alternative segment(DIRS 174048-Bennett and Thebeau 2005). Suitable habitat for this species consists of cottonwood-willow associations, creeks, pools, irrigation ditches, flooded fields, and reservoirs. However, this habitat is not found within the construction right-of-way of the Caliente alternative segment, but does occur within the greater study area. Impact to habitat for this species would be small due to possible filling of a small area of wetlands along the Caliente alternative segment. However, DOE would mitigate any potential adverse impact to toad habitat by reducing the area of disturbance (to a minimum of 15 meters [50 feet]) in wetland areas. There is potential suitable habitat within the construction right-of-way where the Eccles alternative segment would cross Meadow Valley Wash. There would be no long-term impacts to toad habitat, but there would be small short-term impacts, such as disturbance to vegetation and soils or increased sedimentation, during bridge construction and where there is habitat at specific sites.

There could be impacts to several bat species, listed in Table 3-53, during the construction phase if water sources were disturbed. These impacts would be short-term and small because bats generally return to a water source once the disturbance has ceased, or would find and utilize a different water source nearby. Potential long-term impacts to bat habitat along the Caliente or Eccles alternative segment include rock slopes with cracks, crevices, and cliff faces that would be altered during cut and fill activities. These impacts would be small.

The Needle Mountains milkvetch (a U.S. Fish and Wildlife Service-designated species of concern) has been documented within the vicinity of Meadow Valley Wash. The closest recorded occurrence is 687 meters (2,253 feet) from the Eccles alternative segment, northeast of the proposed Interchange Yard. There are additional occurrences of this species within the study area farther north. However, there would be no impact because they would be outside the construction right-of-way. Suitable habitat for this species could be affected as a result of direct removal of vegetation (habitat); this would result in a small impact.

White River catseye (a U.S. Fish and Wildlife Service-designated species of concern) has been documented in the vicinity of Meadow Valley Wash. The closest recorded occurrence is 80 meters (264 feet) from the Caliente alternative segment. Potential impacts to this species could include loss of suitable habitat which could result from damage or removal of the upper soil crust within the range of this species. However, construction of the Caliente alternative segment would not likely have an adverse impact on the overall population because riparian and wetland communities are not considered preferred habitat for this species.

The closest documented occurrence of the Pioche blazingstar to the Caliente and Eccles alternative segments is approximately 1.6 kilometers (1 mile) east of Panaca. Potential habitat for this species might be present; however, this species appears to be restricted to barren clay knolls and slopes between Panaca and the Patterson Wash. There could be impacts to potential suitable habitat for this species as a result of the direct removal of vegetation during construction. If individuals of this species were present in the construction right-of-way, they could be trampled, crushed, dug up, or covered during construction activities. There would be limited impacts because there are no known occurrences of and very little suitable habitat for the Pioche blazingstar within the construction right-of-way.

State of Nevada Game Species There are mule deer and its designated habitat within the study area of the Caliente and Eccles alternative alignments. Construction of either alternative segment would result in a small loss of habitat.

Wild Horses and Burros There would be potential small seasonal impacts in the Little Mountain Herd Management Area, which would affect approximately 35 horses during the winter when horses move into the area from the Miller Flat Herd Management Area. Horses and burros in the Clover Creek Herd Management Area would lose localized areas for watering, but the availability of water sources nearby would provide for the displaced animals, resulting in small short-term impacts.

4.2.7.2.2.2 Facilities Construction at the Interface with the Union Pacific Railroad Mainline. As presented in Table 4-71, construction of the interface with the Union Pacific Railroad Mainline would result in long- and short-term impacts to several land cover types. These impacts are discussed in Section 4.2.7.2.2.2.

Vegetation The proposed Interchange Yard along the Caliente alternative segment would be within the City of Caliente, entirely within the Union Pacific Railroad right-of-way, which consists of previously and currently disturbed land and contains no native vegetation. Therefore, there would be no adverse impact to any vegetative land-cover types from construction of the Interchange Yard.

The proposed Interchange Yard along the Eccles alternative segment would be constructed within the Clover Creek floodplain adjacent to the Union Pacific mainline. Portions of this area have been disturbed by recent flooding and Union Pacific Railroad activities. Construction of the Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. It is possible that fill would be required along the entire length of the Interchange Yard, which would be approximately 1,500 meters (5,000 feet) long. Construction of the Interchange Yard would have a long-term impact on 0.01 square kilometer (3.14 acres) and temporarily impact less than 0.01 square kilometer (about 2.64 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland, and a negligible amount (0.15 square meter [1.61 square feet]) of North American Arid West Emergent Marsh (see Table 4-72) within the construction right-of-way. The direct loss of local wetland and riparian vegetation would be small, with some alteration in stream flow and potential increase in erosion. To reduce any further adverse impacts within the Clover Creek drainage, DOE would implement appropriate erosion control mechanisms to stabilize and protect riparian habitat.

The Caliente-Indian Cove option for the Staging Yard would be located within an area including wetland and riparian habitat. The area includes emergent wetlands and pasturelands that appear to be frequently inundated (refer to Section 4.2.5.2.3.2 for more details). As summarized in Table 4-72, construction of the Staging Yard at Indian Cove would have a long-term impact on 0.02 square kilometer (5.4 acres) of North American Arid West Emergent Marsh and 0.02 square kilometer of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland; and a short-term impact on 0.01 square kilometer (3.5 acres) of North American Arid West Emergent Marsh and 0.08 square kilometer (18.6 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland. DOE would implement best management practices to reduce erosion and sedimentation within the wetlands during construction activities to reduce adverse impacts.

The Caliente-Upland option of the Staging Yard would be located in an area that includes a small area of wetlands and riparian habitat along Meadow Valley Wash. Construction of the Staging Yard at this location would have a long-term impact on less than 0.01 square kilometer (about 0.79 acre) and short-term impact on 0.02 square kilometer (5.4 acres) of North American Arid West Emergent Marsh.

The proposed Eccles-North option of the Staging Yard including a small portion of wetland and riparian habitat. Construction of the Staging Yard at this location would temporarily impact less than 0.01 square kilometer (about 0.35 acre) of North American Arid West Emergent Marsh. There would be no long-term impacts to riparian/wetland vegetation.

Wildlife There would be potential direct impacts to various wildlife populations because of changes in access to sources of water including springs and streams and migratory routes. These impacts would be small and short term, because there are many places along Clover Creek and the Meadow Valley Wash for wildlife to access water sources.

Special Status Species

Threatened and Endangered Species: There is no potential habitat for the yellow-billed cuckoo or southwestern willow flycatcher at any of the facility locations associated with the Union Pacific interchange.

BLM- and State of Nevada-Designated Sensitive/Protected Species: The loss of Great Basin Pinyon-Juniper Woodland land-cover as a result of constructing the Staging Yard at Indian Cove would result in the loss of potential habitat for the ferruginous hawk. This impact would be small given the amount of this land-cover type within the Pioche mapping zone. If DOE selected the Eccles alternative segment, construction of the Interchange Yard would also result in the loss of potential habitat for the ferruginous hawk.

There is potential suitable habitat for the southwestern toad within the Indian Cove area. Construction of the Staging Yard at Indian Cove would likely require the wetland meadow area to be drained and filled above the level of the floodplain. As a result, there would be a small long-term impact from direct loss of suitable habitat for the southwestern toad.

State of Nevada Game Species There is designated mule deer and elk habitat at the proposed locations of the Interchange Yard and Staging Yard. Potential impacts would be small, but long term, due to loss of habitat.

Wild Horses and Burros Construction of the Staging Yard at Indian Cove would result in a small direct loss of forage area as a result of surface disturbance and a small indirect impact if wild horses and burros avoided the area during construction activities.

Table 4-75 summarizes the potential impacts on wildlife, special status species, game species, and wild horse and burro populations that have the potential to occur at the proposed facilities associated with the Caliente and Eccles alternative segments.

4.2.7.2.2.3 Quarry CA-8B Construction and Operation. Table 4-76 summarizes potential direct impacts to biological resources from construction of potential quarry CA-8B.

DOE assessed impacts to land-cover types in this potential quarry area utilizing the footprint of the quarry, which includes the quarry site and all access roads and conveyer belts.

Table 4-75. Summary of the magnitude of potential impacts to biological resources from construction of the facilities associated with the Caliente and Eccles alternative segments.

Resource/impact type	Extent of Impacts/ Interchange Yard-Caliente	Extent of Impacts/ Interchange Yard-Eccles	Extent of Impacts/ Staging Yard-Indian Cove	Extent of Impacts/ Staging Yard-Upland	Extent of Impacts/ Staging Yard-Eccles
Wildlife					
Loss of vegetation or land-cover type (long-term)	0.04 square kilometer[a]	0.4 square kilometer	0.1 square kilometer	0.13 square kilometer	0.12 square kilometer
Construction-related disturbance to habitat (short-term)	0	0.07 square kilometer	0.26 square kilometer	0.33 square kilometer	0.62 square kilometer
Loss of riparian and water-related habitats (long-term)[b]	0.005 square kilometer	0.01 square kilometer	0.04 square kilometer	0.003 square kilometer	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0.01 square kilometer	0.09 square kilometer	0.01 square kilometer	0.001 square kilometer
Wildlife water resources	No impact	Small impact due to avoidance	Small impact due to avoidance	Small impact due to avoidance	Small impact due to avoidance
Special Status species					
Threatened and endangered species	No impact	No impact	No impact	No impact	No impact
BLM- and State of Nevada-designated sensitive/protected species					
Ferruginous hawk (*Buteo regalis*)	No impact to habitat or species	No impact to habitat or species	Small impact on potential habitat	No impact to habitat or species	No impact to habitat or species
Southwestern toad (*Bufo microscaphus*)	No impact to habitat or species	No impact to habitat or species	Small impact on habitat	No impact to habitat or species	No impact to habitat or species
State of Nevada game species					
Mule deer	No impact	Small impact to habitat and avoidance	Small impact to habitat and avoidance	Small impact to habitat and avoidance	Small impact to habitat and avoidance
Elk	No impact	Small impact to habitat and avoidance	Small impact to habitat and avoidance	Small impact to habitat and avoidance	Small impact to habitat and avoidance
Wild horses and burros	No impact	No impact	Small impact to forage and avoidance	No impact	No impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation As discussed in Section 3.2.7, there are several land-cover types that provide habitat for unique or obligate wildlife species that would be impacted by construction of proposed quarry CA-8B along the Caliente alternative segment. The quarry footprint would occupy approximately 1.6 square kilometers (400 acres) (see Section 2.2.2.3.2). Section 4.2.7.2.1.1 discusses the impacts to these land-cover types. Table 4-73 lists the amount each land-cover type that would be impacted by construction. The affected vegetation communities are relatively common in the area; therefore, there would be a small impact from the loss of a small portion of these land-cover types.

Table 4-76. Summary of potential impacts to biological resources from construction and operation of potential quarry CA-8B.

Resource/impact type	Extent of impact, Caliente quarry CA-8B
Wildlife	
Loss of vegetation or land-cover type (long-term)	1.23 square kilometers[a]
Construction-related disturbance to habitat (short-term)	0.34 square kilometer
Loss of riparian and water-related habitats (long-term)[b]	0.07 square kilometer
Construction-related disturbance to riparian habitats (short-term)[b]	0.03 square kilometer
Wildlife water resources	Small impacts
Special status species	
Threatened and endangered species	
Southwestern willow flycatcher (*Empidonax traillii extimus*)	No impact to habitat or species
Western yellow-billed cuckoo (*Coccyzus americanus*)	No impact to habitat or species
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Ferruginous hawk (*Buteo regalis*)	No impact to habitat or species
Meadow Valley speckled dace (*Rhinichthys osculus* ssp. 11)	Small short-term impact to species and habitat
Meadow Valley Wash desert sucker (*Catostomus clarki* ssp., unnamed subspecies)	Small short-term impact to habitat and species
Southwestern toad (*Bufo microscaphus*)	Small impact to habitat
Bat species (see Table 3-51)	Small impact to habitat and species
State of Nevada game species	
Mule deer	Small impact to habitat
Wild horses and burros	Small short-term impact from loss of habitat and displacement

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

There are two types of riparian and wetland habitat types that would be affected by activities associated with the operation of the quarry CA-8B. Construction of the railroad siding associated with this quarry would have a long-term impact on 0.05 square kilometer (13.3 acres) of North American Arid West Emergent Marsh and 0.02 kilometer (about 5 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland, and a short-term impact of 0.02 kilometer (about 6 acres) of North American Arid West Emergent Marsh and less than 0.01 square kilometer (about 2.5 acres) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland. Impacts from construction and operation of the siding would be small from the long-term loss of riparian and wetland vegetation.

Wildlife Potential impacts to wildlife species associated with potential quarry CA-8B would be similar to those described in Section 4.2.7.2.1.2, except for the loss of water resources from construction and operation of the quarry.

Special Status Species Table 4-76 summarizes potential impacts to special status species that have the potential to occur within or near (approximately 1 kilometer [0.62 mile]) potential quarry CA-8B.

State of Nevada Game Species Table 4-76 lists potential impacts to State of Nevada game species.

Wild Horses and Burros The location of the quarry site between the Highland Peak Herd Management Area and the Little Mountain Herd Management Area would result in the potential for small adverse localized impacts similar to those described under section 4.2.7.2.1.6. There would be a small, short-term loss of forage during the construction phase.

4.2.7.2.2.4 Caliente Common Segment 1 (Dry Lake Valley Area), Rail Line Construction. Table 4-77 summarizes potential impacts to biological resources from construction of Caliente common segment 1.

Vegetation Caliente common segment 1 would pass through several land-cover types that provide habitat for unique or obligate wildlife species. Table 4-70 lists the amount of each land cover type that would be impacted by construction. Section 4.2.7.2.1.1 discusses the impact to these land cover types.

Construction of Caliente common segment 1 would not disturb any wetland or riparian communities.

Wildlife Impacts to wildlife species from construction of Caliente common segment 1 would be similar to those described in Section 4.2.7.2.1.2. Table 4-77 summarizes the potential impacts on wildlife species that have the potential to occur within or near Caliente common segment 1 alignment.

Special Status Species

Threatened and Endangered Species: There would be no impacts to any threatened, endangered, or candidate species from construction of Caliente common segment 1.

BLM- and State of Nevada-Designated Sensitive/Protected Species: There is potential habitat for the sage thrasher, Brewer's sparrow, and the greater sage-grouse along Caliente common segment 1. One sage thrasher was sighted during the 2005 field surveys. No sage-grouse or sage-grouse leks were observed during the 2005 fieldwork; however, a portion of common segment 1 would pass through potential nesting habitat and potential winter habitat of the sage-grouse (see Figure 3-100). Construction along common segment 1 would result in the long-term loss of 0.21 square kilometer (51.9 acres) of Great Basin Xeric Mixed Sagebrush Shrubland and 0.29 square kilometer (71.7 acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-70), which is considered suitable sage-grouse, Brewer's sparrow, and sage thrasher habitat. However, the impact would be small because within the affected mapping zones there are 7,600 square kilometers (1.8 million acres) of Great Basin Xeric Mixed Sagebrush Shrubland and 8,000 square kilometers (1.9 million acres) of Inter-Mountain Basins Big Sagebrush Shrubland (Table 3-46).

Table 4-77. Summary of potential impacts to biological resources from constructing a rail line along Caliente common segment 1.

Resource/impact type	Extent of impact, common segment 1
Wildlife	
Loss of vegetation or land-cover type (long-term)	3.51 square kilometers[a]
Construction-related disturbance to habitat (short-term)	31.1 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species	No impacts/no species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrikes (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularis*)	Small impact to habitat
Ferruginous hawk (*Butea regalis*)	No impacts
Brewer's sparrows (*Spizella breweri*)	Small impact from loss of habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact from loss of habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact from loss of habitat
Needle Mountains milkvetch (*Astragalus eurylobus*)	No impact to individuals or habitat
Long-calyx eggvetch (*Astragalus oophorus*)	No impact to individuals or habitat
White River catseye (*Cryptantha welshii*)	No impact to individuals or habitat
Schlesser pincushion (*Sclerocactus schlesseri*)	Small impact to habitat
Tiehm blazingstar (*Mentzelia tiehmii*)	Small impact to suitable habitat
Pygmy rabbit (*Brachylagus idahoensis*)	Small impact to habitat
Bat species (see Table 3-51)	Small impact to habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impacts to habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impacts to habitat
State of Nevada game species	
Desert bighorn sheep (*Ovis Canadensis*)	Small impacts to foraging habitat
Mule deer	Small impacts to foraging habitat
Elk	Small impacts to foraging habitat
Pronghorn antelope	Small impacts to foraging habitat
Wild horses and burros	Small impacts to species and foraging habitat

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Construction along Caliente common segment 1 east of Dry Lake Valley could result in the loss of local habitat for the Schlesser pincushion. This potential impact would be small because there is ample potential habitat for this species in the area.

Tiehm blazingstar has been documented in the White River Valley west of the White River near Caliente common segment 1. The closest recorded occurrence of this species is 1.1 kilometers (0.7 mile) away from common segment 1. Field surveys conducted in May 2005 did not detect the presence of this species at the location described in the Nevada Natural Heritage Program (DIRS 182061-Hopkins 2006, all). Construction along common segment 1 could result in the loss of suitable habitat for the Tiehm blazingstar. Implementation of best management practices during the construction phase and restoration of disturbed areas following construction would minimize adverse impacts to Tiehm blazingstar habitat.

The pygmy rabbit is known to occur in the vicinity of Caliente common segment 1 north of where the segment would cross the White River. With the exception of an isolated population west of Beatty, this is the most southerly extent of pygmy rabbit range (DIRS 174519-Bennett 2005, all). No pygmy rabbits have been documented within the construction right-of-way; however, they are believed to be more widespread throughout the area than the reported data suggests. Potential impacts would be small and long-term due to loss of habitat and possible avoidance of the area.

State of Nevada Game Species As described in Section 3.2.7.3.5, there is habitat for Bighorn sheep, elk, antelope, and mule deer along common segment 1. Potential impacts from loss of foraging habitat would be small.

Wild Horses and Burros Caliente common segment 1 would pass through the Dry Lake, Highland Peak, and Seaman Herd Management Areas. There is a potential for an indirect loss of watering locations that would result in impacts to wild horses in the Highland Peak Herd Management Area at Bennett Springs and in the Dry Lake Herd Management Area along the North Pahroc Range. The number of individuals potentially affected at Bennett Pass could range from 35 to 80 animals. The greatest potential for adverse impacts along Bennett Pass would be during the spring. Because the westernmost proposed construction camp along this segment would be within the Seaman Herd Management Area, there would adverse impacts from loss of forage, but these impacts would be small, localized, and short-term.

4.2.7.2.2.5 Garden Valley Alternative Segments, Rail Line Construction. Table 4-78 summarizes the potential direct impacts to biological resources from rail line construction along the Garden Valley alternative segments.

Vegetation The Garden Valley alternative segments would pass through several land-cover types that represent sagebrush vegetation communities including Inter-Mountain Basins Big Sagebrush Shrubland and the Great Basin Xeric Mixed Sagebrush Shrubland. These vegetation communities are relatively common in the area and provide habitat for various unique and sagebrush community-obligate species. None of the proposed Garden Valley alternative segments would pass through wetland or riparian land-cover types.

Wildlife There are three ***wildlife guzzlers*** within the study area: Scofield #3 and two guzzlers, both named Garden Valley (see Figure 3-95). Scofield #3 guzzler is 7.6 kilometers (4.7 miles) north of Garden Valley alternative segment 3. The first Garden Valley guzzler is 1.8 kilometers (1.1 miles) south of Garden Valley alternative segment 8. The second is approximately 2 kilometers (1.2 miles) south of Garden Valley alternative segment 8. Because of the distances between the guzzlers and the rail alignment, DOE would expect no impacts to these wildlife guzzlers from construction of the rail line.

Table 4-78. Summary of potential impacts from construction of a rail line along the Garden Valley alternative segments.

Resource/impact type	Extent of impact, Garden Valley 1	Extent of impact, Garden Valley 2	Extent of impact, Garden Valley 3	Extent of impact, Garden Valley 8
Wildlife				
Loss of vegetation or land-cover type (long-term)	1.11 square kilometers[a]	1.51 square kilometers	1.09 square kilometers	1.57 square kilometers
Construction-related disturbance to habitat (short-term)	9.64 square kilometers	9.50 square kilometers	10.58 square kilometers	9.15 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0	0	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0	0	0
Wildlife water resources	No impact	No impact	No impact	No impact
Potential impacts to special status species				
Threatened and endangered species	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species				
White River catseye (*Cryptantha welshii*)	Small impact to habitat	Small impact to habitat	Small impact to habitat	Small impact to habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to nesting habitat	Small impact to nesting habitat	Small impact to nesting habitat	Small impact to nesting habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact	Small impact	Small impact	Small impact
Brewer's sparrow (*Spizella breweri*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact to nesting and winter habitat	Small impact to winter habitat	Small impact to nesting and winter habitat	Small impact to winter habitat
Pygmy rabbit (*Brachylagus idahoensis*)	Small impact to habitat	Small impact to habitat	Small impact to habitat	Small impact to habitat
Bat species (see Table 3-51)	No impact	No impact	No impact	No impact
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small short-term impact to habitat	Small short-term impact to habitat	Small short-term impact to habitat	Small short-term impact to habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	No impact	No impact	No impact	No impact
State of Nevada game species				
Mule deer	Small impact from habitat loss	Small impact from habitat loss	Small impact from habitat loss	Small impact from habitat loss
Elk	Small impact from habitat loss	Small impact from habitat loss	Small impact from habitat loss	Small impact from habitat loss
Pronghorn antelope	Small impact from habitat loss	Small impact from habitat loss	Small impact from habitat loss	Small impact from habitat loss
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage	Small impact from loss of forage	Small impact from loss of forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, proposed, or candidate species within the study area of the Garden Valley alternative segments.

BLM- and State of Nevada-Designated Sensitive/Protected Species: There is potential habitat for the sage thrasher and Brewer's sparrows along the Garden Valley alternative segments. One sage thrasher was sighted during the 2005 field surveys. Construction of any of the Garden Valley alternative segments would result in the loss of Great Basin Xeric Mixed Sagebrush Shrubland and Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-71), which is considered suitable Brewer's sparrow and sage thrasher habitat. Comparatively, the overall impact would be small because within the affected mapping zones there are 7,600 square kilometers (1.8 million acres) of Great Basin Xeric Mixed Sagebrush Shrubland and 8,000 square kilometers (1.9 million acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 3-46).

There would be a small impact to the greater sage-grouse as a result of Garden Valley alternative segments 1 and 3 because Garden Valley alternative segment 3 would pass through nesting habitat and Garden Valley 1 would run adjacent to nesting habitat. All Garden Valley alternative segments would pass through potential winter habitat for the sage-grouse (see Figure 3-100). Construction of any of the Garden Valley alternative segments would result in small a loss of suitable greater sage-grouse habitat.

DOE surveyed the area on May 13, 2005, for signs of recent use or individual birds, but there was no evidence that sage grouse still occupy the area even though suitable habitat was present at the time. Therefore, there would be no impacts on sage-grouse breeding and nesting areas during the operations phase in the Garden Valley area, unless sage grouse were to occupy this area in the future.

The pygmy rabbit is known to occur in the vicinity of the Garden Valley alternative segments 1, 2, 3 and 8. Potential impacts would be small and long-term due to loss of habitat and possible avoidance of the area.

State of Nevada Game Species There is designated mule deer, elk, and antelope habitat along the Garden Valley alternative segments (see Section 3.2.7.3.5). The potential loss of habitat would result in a small impact.

Wild Horses and Burros The Garden Valley alternative segments would cross a small portion of the Seaman Herd Management Area. The potential loss of forage from construction of any one of the four Garden Valley alternative segments would result in a small impact.

4.2.7.2.2.6 Caliente Common Segment 2 (Quinn Canyon Range Area), Rail Line Construction. Table 4-79 summarizes the potential direct impacts to biological resources from construction of a rail line along Caliente common segment 2.

Vegetation Caliente common segment 2 would pass through Great Basin Juniper Woodland which is relatively common on the lower mountain slopes in the area, and likely provides roosting and nesting habitat for some raptors such as the ferruginous hawk. Common segment 2 would have a long-term impact on 0.25 square kilometer (62 acres) of Inter-Mountain Basins Big Sagebrush Shrubland and on less than 0.01 square kilometer (about 0.33 acres) of Great Basin Xeric Mixed Sagebrush Shrubland. These land-cover types are relatively common in the area and provide habitat for various unique and sagebrush community-obligate species. In addition, common segment 2 would create a long-term impact on 0.85 square kilometer (210 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. Caliente common segment 2 would not pass through any wetland or riparian land-cover types.

Table 4-79. Summary of potential impacts on biological resources from construction of a rail line along Caliente common segment 2.

Resource/impact type	Extent of impact, Caliente common segment 2
Wildlife	
Loss of vegetation or land-cover type (long-term)	1.12 square kilometers[a]
Construction-related disturbance to habitat (short-term)	13.8 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to potential habitat
Brewer's sparrow (*Spizella breweri*)	Small impact to habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact to habitat
Pygmy rabbit (*Brachylagus idahoensis*)	Small impact to habitat
Bat species (see Table 3-51)	Small impact to habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to habitat
Pale kangaroo mouse (*Microdipodops pallidu*s)	Small impact to habitat
State of Nevada game species impacts	
Mule deer, pronghorn antelope, and elk	Small impact from loss of forage
Wild horses and burros	Small impact to winter and summer foraging

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species

Threatened and Endangered Species There are no threatened, endangered, proposed, or candidate terrestrial or aquatic species within the study area of the Caliente common segment 2.

BLM- and State of Nevada-Designated Sensitive/Protected Species: Table 4-79 lists potential direct impacts to designated sensitive and protected species.

State of Nevada Game Species There is designated mule deer, pronghorn antelope, and elk habitat along common segment 2 (see Section 3.2.7.3.5). The potential loss of forage would result in a small impact.

Wild Horses and Burros Seasonal wild-horse movements in the area suggest that construction of the easternmost portion of Caliente common segment 2 would result in a small loss of spring and summer forage and construction of the western portions of the common segment would result in a small loss of winter forage. Construction activities along this segment could result in a small short-term impact to seasonal wild-horse movement as it is likely that some horses would move from the Quinn Canyon Range (summer) to lower elevations near the proposed rail line in winter.

4.2.7.2.2.7 South Reveille Alternative Segments, Rail Line Construction. Table 4-80 summarizes potential impacts to biological resources from construction of a rail line along the South Reveille alternative segments.

Vegetation The South Reveille alternative segments would pass through several land-cover types that represent sagebrush vegetation communities, including Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland. These land-cover types are relatively common in the area and may provide habitat for various unique and sagebrush community-obligate species.

The South Reveille alternative segments would not impact any wetland or riparian land-cover types.

Special Status Species There are no threatened, endangered, proposed, or candidate species or habitat for such species along the South Reveille alternative segments. Table 4-80 lists potential impacts to other special status species.

State of Nevada Game Species There is designated pronghorn antelope habitat along the South Reveille alternative segments (see Section 3.2.7.3.5). There would be small long-term impacts due to loss of potential forage and possible antelope avoidance of the area during construction activities.

Wild Horses and Burros South Reveille alternative segments 1 and 2 would skirt a northeastern corner of the Nellis Herd Management Area. There would be short-term impacts from the loss of forage at the southern end of the Reveille Valley. Impacts to wild horses and burros would be similar for each alternative segment.

4.2.7.2.2.8 South Reveille Alternative Segments, Quarry Construction. DOE has identified two potential quarry sites, NN-9A and NN-9B along the south Reveille alternative segments.

Table 4-81 summarizes potential impacts to biological resources from construction of the South Reveille quarry sites.

Table 4-80. Summary of potential impacts on biological resources from constructing a rail line along the South Reveille alternative segments.

Resource/impact type	Extent of impacts, South Reveille 2	Extent of impacts, South Reveille 3
Wildlife[a]		
Loss of vegetation or land-cover type (long-term)	0.64 square kilometers[a]	0.65 square kilometers
Construction-related disturbance to habitat (short-term)	5.73 square kilometers	5.63 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species	No species or habitat occurrence	
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact	Small impact
Western burrowing owl (*Athenes cunicularia*)	Small impact	Small impact
Brewer's sparrow (*Spizella breweri*)	No impact	No impact
Sage thrasher (*Oreoscoptes montanus*)	No impact	No impact
Bashful beardtongue (*Penstemon pudicus*)	No impact	No impact
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact	Small impact
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact	Small impact
Bat species (see Table 3-51)	No Impact	No impact
State of Nevada game species		
Pronghorn Antelope	Small impact	Small impact
Wild horses and burros	Small impact to winter and summer foraging	Small impact to winter and summer foraging

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation There are several land-cover types that provide habitat for unique or obligate wildlife species within the potential South Reveille quarry sites. Potential quarry site NN-9B would create a long-term impact to 0.07 square kilometer (16 acres) of Inter-Mountain Basins Big Sagebrush Shrubland and 0.21 square kilometer (51 acres) of Great Basin Xeric Mixed Sagebrush Shrubland, which are relatively common in the area and provide habitat for various sagebrush community-obligate species. In addition, 0.46 square kilometer (114 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, which provides habitat for various wildlife species, would be affected long term. Construction of potential quarry NN-9A would cause a long-term impact to 0.13 square kilometer (31 acres) of Great Basin Xeric Mixed Sagebrush Shrubland, 0.35 square kilometer (86 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, 0.74 square kilometer (183 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, and a small percentage of other land-cover types.

There are no wetland or riparian land-cover types in the study area for potential quarry sites NN-9A and NN-9B.

Table 4-81. Summary of potential impacts on biological resources from construction of the potential South Reveille quarries.

Resource/impact type	Extent of impacts, quarry NN-9A	Extent of impacts, quarry NN-9B
Wildlife		
Loss of vegetation or land-cover type (long-term)	1.40 square kilometers[a]	0.78 square kilometer
Construction-related disturbance to habitat (short-term).	0.60 square kilometers	0.51 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0
Wildlife water resources	No impact	No impact
Raptor nesting site	Small to moderate impact	Small impact
Special status species		
Threatened and endangered species and habit	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat	Small impact to habitat
Brewer's sparrow (*Spizella breweri*)	Small impact to habitat	Small impact to habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to habitat	Small impact to habitat
Bashful beardtongue (*Penstemon pudicus*)	No impact	No impact
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to habitat	Small impact to habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact to habitat	Small impact to habitat
Bat species (see Table 3-51)	No impact	No impact
State of Nevada Game Species		
Pronghorn Antelope	Small impact to habitat	Small impact to habitat
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Wildlife Rock outcrops and talus slopes within the footprints of the potential South Reveille quarry sites provide perching and nest sites for raptors and reptiles. During the January 2006 field visit, the biologist observed an unoccupied raptor nest site on a ridge within the quarry NN-9A footprint. The biologist observed signs of raptors on the vertical rock face and collections of small mammal remains (bones) on the ridge. DOE would avoid construction activity during the nesting season to minimize the impact to raptors utilizing this nest site.

Special Status Species There are no threatened, endangered, proposed, or candidate species or habitat for such species in the study area for the potential quarries in Reveille Valley. Table 4-81 lists potential impacts to BLM- and State of Nevada-designated sensitive/protected species.

State of Nevada Game Species There is designated pronghorn antelope habitat within the footprints of both potential South Reveille quarries. A potential small impact would result from the construction of either quarry due to a small loss of habitat and possible displacement.

Wild Horses and Burros There would be a potential small adverse impact to wild horses and burros in the Nellis Herd Management Area from construction of either quarry due to a small loss of forage.

4.2.7.2.2.9 Caliente Common Segment 3 (Stone Cabin Valley Area), Rail Line Construction. Table 4-82 summarizes potential direct impacts to biological resources (threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from rail line construction along the Caliente common segment 3.

Vegetation Caliente common segment 3 would pass through several land-cover types that provide habitat for unique or obligate wildlife communities. Some of these land-cover types include sagebrush vegetation communities, such as Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland, which are relatively common in the area and provide habitat for various sagebrush community-obligate species. However, common segment 3 would primarily impact Inter-Mountain Basins Mixed Salt Desert Scrub, which provides habitat for other wildlife species.

Special Status Species

Threatened and Endangered Species: The Railroad Valley springfish was previously introduced into Warm Springs near Warm Springs Summit. Surveys in 1994 indicate this species no longer occurs in this area. Therefore, there would be no impact to the Railroad Valley springfish from rail line construction along Caliente common segment 3.

BLM- and State of Nevada-Designated Sensitive/Protected Species: The Tonopah fishhook cactus has been documented along Caliente common segment 3, but no individuals were observed during field surveys in May 2005. Rail line construction along common segment 3 would result in a small impact to suitable fishhook cactus habitat.

Eastwood milkweed is known to occur near Caliente common segment 3. The closest known occurrence of this species is 8.4 kilometers (5.2 miles) from common segment 3. Rail line construction along common segment 3 could result in a loss of suitable habitat for this species. However, this would result in a small impact to the Eastwood milkweed population because of the small amount of potential habitat that would be disturbed.

Williams combleaf is known to occur 10 kilometers (6 miles) south of common segment 3, but it is highly unlikely that rail line construction would have an impact on this species. The Nevada dune beardtongue has been identified near common segment 3. The closest known occurrence of this species is 1.1 kilometers (0.7 mile) from common segment 3. Rail line construction could result in loss of habitat and of individual plants. However, this would result in a small impact to Nevada dune beardtongue because of the small amount of potential habitat that would be disturbed.

Bashful beardtongue has been documented near Caliente common segment 3. The closest known occurrence of this species is 8.6 kilometers (5.34 miles) from common segment 3. This species has a narrow distribution and is known from only five sites within the Kawich Range. Because of its limited distribution and range there would be no impact to this species from rail line construction along common segment 3.

State of Nevada Game Species There is designated mule deer and pronghorn antelope habitat along common segment 3. Potential impacts from loss of vegetation for forage and habitat needs would be small.

Table 4-82. Summary of potential impacts to biological resources from rail line construction along Caliente common segment 3.

Resource/impact type	Extent of impacts, common segment 3
Wildlife	
Loss of vegetation or land-cover type (long-term).	2.49 square kilometers[a]
Construction-related disturbance to habitat (short-term)	30 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Potential impacts to special status species	
Threatened and endangered species and habitat	
Railroad Valley springfish (*Crenichthys nevadae*)	No impact
BLM- and State of Nevada-designated sensitive/protected species	
Tonopah fishhook cactus (*Sclerocactus nyensis*)	Small impact to habitat
Eastwood milkweed (*Asclepias eastwoodiana*)	Small impact to habitat
Williams combleaf (*Ployctenium williamsidae*)	No impact
Nevada dune beardtongue (*Penstemon arenarius*)	Small impact to habitat
Bashful beardtongue (*Penstemon pudicus*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Brewer's sparrow (*Spizella breweri*)	Small impact to habitat
Sage thrasher (*Oreoscoptes montanus*)	Small impact to habitat
Greater sage-grouse (*Centrocercus urophasianus*)	Small impact to habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	No impact
Pale kangaroo mouse (*Microdipodops pallidus*)	No impact
State of Nevada game species	
Mule deer	Small impact to habitat
Pronghorn antelope	Small impact to habitat
Wild horses and burros	Small impact to foraging habitat and water access

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian combined.

Wild Horses and Burros Caliente common segment 3 would pass through the Reveille, Stone Canyon, and Saulsbury Herd Management Areas (see Section 3.2.7.3.6). The segment would pass through an area of winter range for wild horses and could result in small adverse impacts to seasonal wild-horse migrations as animals move from the Kawich Range in the summer to the Reveille Valley in the winter. A proposed construction camp in this area could result in a small adverse impact on water availability because there is a major source of water at the Reveille Mill (more than 6.4 kilometers [4 miles] away) and wild horses would potentially exhibit avoidance behavior if workers visit this area.

Potential short-term small impacts in the Reveille Herd Management Area could affect up to 129 wild horses.

4.2.7.2.2.10 Common Segment 3 (Stone Cabin Valley Area), Facilities Construction. DOE would construct the Maintenance-of-Way Trackside Facility along Caliente common segment 3. Potential direct impacts to biological resources would be similar to the impacts described in Section 4.2.7.2.2.9 and would be small, if any. Table 4-73 lists potential impacts to land-cover types from construction of these facilities along Caliente common segment 3.

Horse populations in this area have recognized unique genetic characteristics. In addition, the Stone Cabin Herd Management Area is of particular historic significance (see Appendix H). Construction of the Maintenance-of-Way Trackside Facility would likely result in a small impact to foraging and herd distribution in the northern portion of Stone Cabin Valley.

4.2.7.2.2.11 Goldfield Alternative Segments, Rail Line Construction. Table 4-83 summarizes potential impacts to biological resources from construction of a rail line along the Goldfield alternative segments.

Vegetation The Goldfield alternative segments would pass through several land-cover types that provide habitat for unique or obligate wildlife species. Some of these land-cover types include sagebrush vegetation communities, including Inter-Mountain Basins Big Sagebrush Shrubland, Great Basin Xeric Mixed Sagebrush Shrubland, and Inter-Mountain Basins Montane Sagebrush Steppe, which are relatively common in the area and could provide habitat for various sagebrush community-obligate species. Rail line construction along any of the Goldfield alternative segments would not impact riparian or wetland vegetation.

Willow and Cole Springs are close to (less than 1 kilometer to 3 kilometers [less than 1 mile to 1.8 miles] west) of Goldfield alternative segment 3. There could be impacts to wildlife species active only during the day because they would likely avoid water sources close to construction activities. Wildlife species active at night when there were no construction activities would likely not avoid the water sources. During the summer, when large animals need daily access to water, inability to access those resources during rail line construction activities could result in small adverse impacts.

There would be no impacts to riparian or wetland habitat from the rail line construction along the Goldfield alternative segments.

Special Status Species Eastwood milkweed is known to occur near the Goldfield alternative segments south of where they would join common segment 3. The closest known occurrence of this species is 140 meters (460 feet) west of Goldfield alternative segment 3, near Mud Lake. Construction of any of the Goldfield alternative segments could lead to habitat loss and the loss of individual plants. These impacts would be small.

State of Nevada Game Species There is designated mule deer and pronghorn antelope habitat along the Goldfield alternative segments (see Section 3.2.7.3.5). Potential impacts would be the same as those described in Section 4.2.7.2.1.5.

Wild Horses and Burros The Goldfield alternative segments would pass through the Goldfield Herd Management Area. Small potential adverse impacts to burros would include loss of foraging vegetation and some disruption from construction-related activities. However, because of extensive mining in the area, burros in the Goldfield Herd Management Area are very familiar with human activities.

Table 4-83. Summary of potential impacts to biological resources from rail line construction along the Goldfield alternative segments.

Resource/impact type	Extent of impacts, Goldfield 1	Extent of impacts, Goldfield 3	Extent of impacts, Goldfield 4
Wildlife			
Loss of vegetation or land-cover type (long-term)	1.96 square kilometers[a]	2.19 square kilometers	1.86 square kilometers
Construction-related disturbance to habitat (short-term)	12.46 square kilometers	13.68 square kilometers	14.29 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0	0
Wildlife water resources	Small impact (avoidance)	Small impact (avoidance)	Small impact (avoidance)
Potential impacts to special status species			
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/ protected species			
Eastwood milkweed (*Asclepias eastwoodiana*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to habitat and species
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-51)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species			
Mule deer	Small impact to habitat	Small impact to habitat	Small impact to habitat
Pronghorn antelope	Small impact to habitat	Small impact to habitat	Small impact to habitat
Wild horses and burros	Small impact to habitat	Small impact to habitat	Small impact to habitat

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Rail line construction along the Goldfield alternative segments could affect up to six horses and 20 burros, likely in the area around the beginning of the segments at the end of Caliente common segment 4.

Goldfield alternative segment 4 would also pass through the Montezuma Peak Herd Management Area, which would result in a small loss of forage vegetation. Goldfield alternative segment 4 could impact up to 18 horses and 20 burros.

4.2.7.2.2.12 Goldfield Alternative Segments, Quarry Construction. DOE has identified three potential quarry sites in the Goldfield area, NS-3A, NS-3B, and ES-7. Quarries NS-3A and NS-3B would be along Goldfield alternative segment 3. Quarry ES-7 would be along Goldfield alternative segment 4.

Table 4-84 summarizes potential direct impacts to biological resources (threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from construction of the potential quarries near Goldfield.

Vegetation Several land-cover types that provide habitat for unique or obligate wildlife species are present within potential quarry sites NS-3A, NS-3B, and ES-7. All three quarry footprints contain land-cover types that include sagebrush vegetation communities, including Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland, which are relatively common in the area and could provide habitat for various sagebrush community-obligate species. Potential quarry ES-7 would impact a more sagebrush community than NS-3A or NS-3B.

Construction of the potential Goldfield quarries would not impact any riparian or wetland vegetation.

Special Status Species There could be impacts to bat species from constructing the proposed Goldfield quarries, which would include the disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill or quarry operations. Potential impacts to bat habitats from construction activities would be small.

State of Nevada Game Species There is designated mule deer and pronghorn antelope habitat within the study area of the potential Goldfield quarry sites. Impacts would be the small and due to a loss of forage and habitat.

Wild Horses and Burros Potential quarries NS-3A and NS-3B would be within the Goldfield Herd Management Area. Quarry ES-7 would be within the Montezuma Peak Herd Management Area. Potential impacts to burros from quarries NS-3A and NS-3B would be a small, short-term, loss of vegetation for forage and some minor disturbance from construction activities. There would be no impact to wild horses from quarries NS-3A and NS-3B because the Goldfield Herd Management Area does not support wild horses. Potential impacts to wild horses and burros from construction activities at quarry ES-7 would be a small, short-term, loss of vegetation for forage and some minor disturbance from construction activities. Construction of potential quarry ES-7 could affect 18 horses and 20 burros.

State of Nevada Game Species There is designated mule deer and pronghorn antelope habitat within the study area of the potential Goldfield quarry sites. Impacts would be the small and due to a loss of forage and habitat.

Wild Horses and Burros Potential quarries NS-3A and NS-3B would be within the Goldfield Herd Management Area. Quarry ES-7 would be within the Montezuma Peak Herd Management Area. Potential impacts to burros from quarries NS-3A and NS-3B would be a small, short-term, loss of vegetation for forage and some minor disturbance from construction activities. There would no impact to wild horses from quarries NS-3A and NS-3B because the Goldfield Herd Management Area does not support wild horses. Potential impacts to wild horses and burros from construction activities at quarry ES-7 would be a small, short-term, loss of vegetation for forage and some minor disturbance from construction activities. Construction of potential quarry ES-7 could affect 18 horses and 20 burros.

4.2.7.2.2.13 Common Segment 4 (Stonewall Flat Area), Rail Line Construction. Table 4-85 summarizes potential direct impacts to biological resources from rail line construction along common segment 4.

Table 4-84. Summary of potential impacts to biological resources from construction of the Goldfield quarry sites.

Resource/impact type	Extent of impact, quarry NS-3A	Extent of impact, quarry NS-3B	Extent of impact, quarry ES-7
Wildlife[a]			
Loss of vegetation or land-cover type (long-term)	2.76 square kilometers[a]	1.11 square kilometers	1.13 square kilometers
Construction-related disturbance to habitat (short-term)	1 square kilometer	0.38 square kilometer	0.32 square kilometer
Loss of riparian and water-related habitats (long-term)[b]	0	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0	0
Wildlife water resources	No impact	No impact	No impact
Special status species			
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species			
Eastwood milkweed (*Asclepias eastwoodiana*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Special status species (continued)			
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-51)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Dark kangaroo mouse (*Microdipodops megacephalus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Pale kangaroo mouse (*Microdipodops pallidus*)	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species			
Mule deer	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Pronghorn antelope	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage	Small impact from loss of forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Vegetation Caliente common segment 4 would pass through a land-cover type that provides habitat for unique or obligate wildlife species. It would pass primarily through Inter-Mountain Basins Mixed Salt Desert Scrub, creating a long-term impact to 0.25 square kilometer (62 acres) of this land-cover type. It would pass through a small portion of Inter-Mountain Basins Big Sagebrush Shrubland, which is relatively common in the area and could provide habitat for various sagebrush community-obligate species.

Table 4-85. Summary of potential impacts on biological resources from rail line construction along Caliente common segment.

Resource/impact type	Extent of impacts, common segment 4
Wildlife	
Loss of vegetation or land-cover type (long-term)	0.26 square kilometer[a]
Construction-related disturbance to habitat (short-term)	3.24 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Bat species (see Table 3-51)	Small impact to potential habitat
Nevada Game Species	
Mule deer	Small impact
Pronghorn antelope	Small impact
Bighorn sheep	Small impact
Wild horses and burros	Small impact from loss of forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Rail line construction along Caliente common segment 4 would not impact any riparian or wetland vegetation.

Special Status Species There are no threatened, endangered, proposed, or candidate species or habitat for such species along Caliente common segment 4. Table 4-84 lists potential direct impacts to BLM- and State of Nevada-designated sensitive and protected species.

State of Nevada Game Species Common segment 4 would pass near designated desert bighorn sheep, mule deer, and antelope yearlong habitat. It is possible that these game species would pass through the area of the rail line, which along common segment 4 would be adjacent to an existing transportation corridor (U.S. Highway 95). Although it is likely that game species use this area during migration, there are no designated game ***movement corridors*** along or near common segment 4. Thus, impacts to game species would be small and short-term, primarily from avoidance of the area during construction activities.

Wild Horses and Burros Caliente common segment 4 would pass through the Stonewall Herd Management Area. The potential impact to burros is a small loss of vegetation for foraging. Burro population estimates indicate that as many as 34 resident burros could be affected.

4.2.7.2.2.14 Bonnie Claire Alternative Segments, Rail Line Construction. Table 4-86 summarizes potential direct impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Vegetation The area of the Bonnie Claire alternative segments represents a transition in vegetative communities. Sagebrush communities occur less frequently as the rail alignment progresses south to southeast into the Mojave mapping zone. The Bonnie Claire alternative segments would pass through only a small portion of Inter-Mountain Basins Big Sagebrush Shrubland and would pass through primarily Inter-Mountain Basins Mixed Salt Desert Scrub, Mojave Mid-Elevation Mixed Desert Scrub, and Sonora-Mojave Creosotebush-White Bursage Desert Scrub (see Section 3.2.7 and Table 4-71).

Riparian/Wetland Habitat Rail line construction along the Bonnie Claire alternative segments would not impact any riparian or wetland vegetation.

Special Status Species As summarized in Table 4-86, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along the Bonnie Claire alternative segments.

State of Nevada Game Species As summarized in Table 4-86, there would be small potential impacts to game species along the Bonnie Claire alternative segments.

Wild Horses and Burros The Bonnie Claire alternative segments would pass through the Stonewall Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be a small loss of vegetation for foraging.

4.2.7.2.2.15 Common Segment 5 (Sarcobatus Flat Area), Rail Line Construction. Table 4-87 summarizes potential direct impacts to biological resources from rail line construction along common segment 5.

Vegetation As discussed in Section 3.2.7 and shown in Table 4-70, common segment 5 would pass through a small area of Great Basin Juniper Woodland, which would be temporarily affected during rail line construction activities. This land-cover type is relatively common on the lower mountain slopes in the area and likely provides roosting and nesting habitat for some raptors.

Construction of common segment 5 would primarily affect Sonora-Mojave Mixed Salt Desert Scrub and Sonora-Mojave Creosotebush-White Bursage Desert Scrub. The potential impacts on these land-cover types would be small because the amount of vegetation loss associated with rail line construction along common segment 5 would be small in relation to the amount of these land-cover types within the mapping zone. Common segment 5 would affect a small portion of Inter-Mountain Basins Big Sagebrush Shrubland, which provides habitat for various sagebrush community-obligate species.

Rail line construction along common segment 5 would not impact any riparian or wetland vegetation.

Special Status Species As summarized in Table 4-87, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along common segment 5. Habitat for the burrowing owl and loggerhead shrike are present along common segment 5 and are discussed in section 4.3.7.2.1, Environmental Impacts Common to the Entire Mina Rail Alignment. Some isolated sand dunes provide habitat for the Nevada dune beardtongue (*Penstemon arenarius*). Rail line construction would create a small impact to the habitat. Occasional stands of pinion juniper provide habitat for the ferruginous hawk (*Buteo regalis*). Impacts to this species would be small and short-term.

Table 4-86. Summary of potential impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Resource/impact type	Extent of impact, Bonnie Claire 2	Extent of impact, Bonnie Claire 3
Wildlife		
Loss of vegetation or land-cover type (long-term)	0.51 square kilometers[a]	0.49 square kilometers
Construction-related disturbance to habitat (short-term)	5.65 square kilometers	5.59 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-51)	Small impact to potential habitat	Small impact to potential habitat
Nevada Game Species		
Mule deer	Small impact	Small impact
Pronghorn antelope	Small impact	Small impact
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Habitat for the Oasis Valley speckled dace is confined to streams in southern Nye County. Impacts to potential habitat for this species would be small and short-term due to the proposed construction of a bridge across Oasis Valley that would temporarily increase turbidity in the stream. After construction, the impact would be minimal.

State of Nevada Game Species There is designated pronghorn antelope yearlong habitat to the north of the rail alignment in the Gold Flat area (see Figure 3-103). Potential impacts, if any, to antelope as a result of rail line construction along common segment 5 would be small. Common segment 5 would pass near desert bighorn sheep and mule deer yearlong habitat. It is possible that desert bighorn sheep and mule deer would pass through the area of the rail line, which along common segment 5 would be adjacent to an existing transportation corridor (U.S. Highway 95). Although it is likely that desert bighorn sheep and mule deer use this area during migration, there are no designated game movement corridors along or near common segment 5. Thus, impacts to these species would be small and short-term, primarily from avoidance of the area during construction activities.

Wild Horses and Burros Common segment 5 would not pass through any wild horse and burro herd management areas. However, burro activity in the region is likely based on local utilization patterns. Potential impacts to wild horses and burros would be limited to the areas through which the segment passes.

Table 4-87. Summary of potential impacts to biological resources from rail line construction along common segment 5.

Resource/impact type	Extent of impact, common segment 5
Wildlife	
Loss of vegetation or land-cover type (long-term)	0.81 square kilometer[a]
Construction-related disturbance to habitat (short-term)	11.12 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to potential habitat
Bat species (see Table 3-51)	Small impact to potential habitat
Nevada dune beardtongue (*Penstemon arenarius*)	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6)	Small impact to potential habitat
State of Nevada game species	
Pronghorn antelope	Small, short-term impact from avoidance during construction activities
Bighorn sheep	Small, short-term impact from avoidance during construction activities
Mule deer	Small, short-term impact from avoidance during construction activities
Wild horses and burros	Small impact to potential habitat

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

4.2.7.2.2.16 Oasis Valley Alternative Segments, Rail Line Construction. Table 4-88 summarizes potential direct impacts to biological resources from rail line construction along the Oasis Valley alternative segments.

Vegetation There is wetland and riparian habitat present within the study area of the Oasis Valley alternative segments. Oasis Valley alternative segments 1 and 3 would cross the Thirsty Canyon/Oasis Valley Wash area. Oasis Valley alternative segment 3 would run within 0.7 kilometer (0.4 mile) of Colson Pond and across the Amargosa River drainage (see Section 3.2.5.3.11).

The Amargosa River receives ephemeral flows during high precipitation events; it does not carry water most of the year. There would be no impacts to Colson Pond and engineering design would include appropriate structures (a culvert and bridge) to reduce impacts to the Amargosa River drainage. Within the Oasis Valley alternative segment 3 construction right-of-way, construction activities would temporarily impact 0.02 square kilometer (4.67 acres) of the North American Warm Desert Lower Montane Riparian Woodland and Shrubland land-cover type.

Table 4-88. Summary of potential impacts on biological resources from rail line construction along the Oasis Valley alternative segments.

Resource/impact type	Extent of impacts, Oasis Valley 1	Extent of impacts, Oasis Valley 3
Wildlife		
Loss of vegetation or land-cover type (long-term)	0.31 square kilometer[a]	0.43 square kilometer
Construction-related disturbance to habitat (short-term)	2.62 square kilometer	3.95 square kilometer
Loss of riparian and water-related habitats (long-term)[b]	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0.02
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat	Small impact to species and potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact	No impact
Amargosa toad (*Bufo nelsoni*)	No Impact	No impact
Bat species (see Table 3-51)	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species		
Mule deer	Small impact	Small impact
Desert bighorn sheep	Small impact	Small impact
Wild horses and burros	Small impact from loss of forage	Small impact from loss of forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Potential impacts would be short-term from rail line construction along this Oasis Valley alternative segment 3, which would only cross this land-cover type. Given the small amount of this land-cover type within the mapping zone and its high value for wildlife, the impacts on riparian and wetland vegetation would be moderate, but short-term. However, DOE would use drainage structures and best management practices to minimize erosion, runoff, and the subsequent impacts to riparian vegetation along the Oasis Valley alternative segments.

Special Status Species The black woollypod, a BLM-designated sensitive plant species, is known to occur along the Beatty Wash section of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Construction of the Oasis Valley alternative segments could result in small impacts due to loss of suitable habitat and possible individuals present during construction. However, black woollypod appears to adapt well to disturbed areas, thus, anticipated impacts to this species habitat and population would be small from rail line construction along the Oasis Valley alternative segments.

The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near the towns of Springdale and Beatty, less than 1.6 kilometers (1 mile) southwest from Oasis Valley alternative segment 1. This subspecies has a very limited range and is only known from this watershed in Oasis Valley. Specific distribution of this fish varies with available water. Because of the distance of this habitat from construction activities, there would be no impacts to the Oasis Valley speckled dace during rail line construction.

The Oasis Valley pyrg is an ***endemic*** snail of the springs found in Oasis Valley. This species has not been documented closer than 4 kilometers (2.5 miles) from the rail alignment and suitable habitat for this species would not occur within the construction right-of-way. Therefore, rail line construction would not impact this species.

The Amargosa toad occurs along the Amargosa River drainage and has been recorded in Oasis Valley, 1.4 kilometers (0.84 mile) from Oasis Valley alternative segment 1 and 1.9 kilometers (1.2 miles) from Oasis Valley alternative segment 3. Typical habitat for this species is near open water, such as springs, seeps and ponds, and the riparian vegetation generally associated with wet areas. In these instances, the presence of moist soil might be sufficient for suitable habitat. There are no open waters that would be within the construction right-of-way, and all seeps and springs within Oasis Valley and Thirsty Canyon would be outside and down gradient of the construction right-of-way. Therefore, it is unlikely that the Amargosa toad would occur within the construction right-of-way, resulting in no impacts to the Amargosa toad.

State of Nevada Game Species The Oasis Valley alternative segments would pass within mule deer limited range (see Figure 3-102) and would be near designated desert bighorn sheep yearlong habitat (see Figure 3-101). Oasis Valley supports riparian vegetation and ephemeral flows that are highly valuable as a potential water source and for forage. Colson Pond, which also provides a potential water source for these species, is 0.7 kilometer (0.4 mile) from Oasis Valley alternative segment 3. However, impacts from rail line construction along the Oasis Valley alternative segments would be small and short-term.

Wild Horses and Burros The Oasis Valley alternative segments would pass through northern portions of the Bullfrog Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be small losses of vegetation for foraging and grazing.

4.2.7.2.2.17 Common Segment 6 (Yucca Mountain Approach), Rail Line Construction. Table 4-89 summarizes potential direct impacts to biological resources (vegetation, threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from rail line construction along common segment 6.

Vegetation As discussed in Section 3.2.7 and shown in Table 4-70, common segment 6 would pass through mostly Sonora-Mojave Creosotebush-White Bursage Desert Scrub and Mojave Mid-Elevation Mixed Desert Scrub.

Rail line construction along common segment 6 would not impact wetland vegetation.

Special Status Species

Threatened and Endangered Species: The Mojave desert tortoise is a federally listed threatened species and has low-density habitat (the northern-most extent of its range) in the area crossed by common segment 6. Construction of the proposed rail line, well sites, and construction camps along common segment 6 would result in the potential for species fragmentation, potential species loss, and disturbance of desert tortoise habitat along the southwestern section of common segment 6 from Beatty south to Yucca Mountain (see Figure 3-99). The rail line would not cross any areas of U.S. Fish and Wildlife Service-designated critical habitat. Potential direct impacts to desert tortoises during construction activities could include tortoise injury or mortality from being buried in their burrows or being crushed by construction equipment or other vehicles on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of the rail line, there would be no long-term impacts to the survival of this species. Indirect impacts would result from the fragmentation of habitat. A total of 5.61 square kilometers (1,387 acres) of desert tortoise habitat would be disturbed by rail line and facilities construction along common segment 6 (see Table 4-90).

BLM- and State of Nevada-designated Sensitive/Protection Species: The black woollypod, a BLM-designated sensitive plant species, is known to occur along the Beatty Wash portion of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Rail line construction along common segment 6 could result in small impacts from the loss of suitable habitat and individual plants. However, black woollypod appears to adapt well to disturbed areas; thus, anticipated impacts to this species habitat and population would be small. In addition, DOE would implement best management practices (see Chapter 7) to avoid or minimize plant mortality.

Rock purpusia has been documented approximately 13 kilometers (8 miles) from common segment 6. The loss of a small percentage (less than 0.01 square kilometer [about 1 acre]) of the North American Warm Desert Bedrock Cliff and Outcrop land-cover type would be a long-term impact as a result of rail line construction along common segment 6. There would be possible loss of suitable habitat (rock crevices and cliffs); however, there would be no impact on this species.

There is suitable habitat for the Amargosa toad in Oasis Valley west of common segment 6. This common segment would not cross any suitable habitat; thus, impacts to this species would be highly unlikely. However, any potential impact to this species would be limited to the northern portion of common segment 6 where it would connect to the Oasis Valley alternative segments (see Section 4.2.7.2.2.16).

Habitat for the Oasis Valley speckled dace is found in the neighboring Oasis Valley. It is unlikely that speckled dace exist in the area that would be crossed by common segment 6 due to lack of persistent streams or ponds.

Therefore, no impacts to speckled dace would occur. The Oasis Valley pyrg requires habitat similar to the speckled dace and no impact is expected for this segment.

Chuckwalla have been documented in the southeastern foothills of Yucca Mountain adjacent to common segment 6. This area represents the chuckwalla's northern-most range in southern Nevada. Construction activities in this area could result in the loss of habitat for this species and possible loss of individuals. This would be a small overall impact to this species.

State of Nevada Game Species Common segment 6 would intersect a designated desert bighorn sheep migratory corridor near Beatty Wash (see Figure 3-101). There is also yearlong desert bighorn sheep habitat southwest of common segment 6. Impacts would be moderate, but mostly short-term, due to possible displacement from the designated migratory corridor during construction activities. There is also mule deer habitat along common segment 6 (see Figure 3-102). Impacts to mule deer habitat would be small.

Table 4-89. Summary of potential impacts on biological resources from rail line construction along common segment 6.

Resource/impact type	Extent of impacts, common segment 6
Wildlife	
Loss of vegetation or land-cover type (long-term)	1.63 square kilometers[a]
Construction-related disturbance to habitat (short-term).	13.24 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-51)	Small impact to habitat
Impacts to State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Moderate, short-term impact to migration corridor
Mule deer	Small impact to habitat
Wild horses and burros	Small impact to forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Wild Horses and Burros Common segment 6 would pass through central portions of the Bullfrog Herd Management Area. Impacts to the herd management area and any wild horses and burros in the area would be similar – a small loss of vegetation for grazing. Burro activity south of Beatty Wash and in the Crater Flat area would likely shift temporarily to other locations farther away from the disturbance of human activity. Burro population estimates for this area suggest that 34 burros could be affected. There are no known populations of wild horses along common segment 6

4.2.7.2.2.18 Common Segment 6 (Yucca Mountain Approach), Facilities Construction.

Table 4-91 summarizes potential direct impacts to biological resources (vegetation, threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from construction of facilities along common segment 6.

Table 4-90. Amount of desert tortoise habitat that would be disturbed during construction of the rail line and facilities along common segment 6.

Source of disturbance	Amount of habitat disturbed (square kilometers)[a,b]
Rail roadbed and adjacent access roads	4.45
Access road to Beatty Wash bridge and well site 14	0.04
Access road to well site 15	<0.01
Construction camp 12	0.10
Access road to construction camp 12	0.20
Rail Equipment Maintenance Yard	0.81
Total	5.61

a. To convert square kilometers to acres, multiply by 247.10.
b. < = less than.

Vegetation

The Rail Equipment Maintenance Yard would occupy an area of 0.41 square kilometer (100 acres). There are several different land-cover types in the area, but most of the land cover is Sonora-Mojave Creosotebush-White Bursage Desert Scrub. Construction of the Rail Equipment Maintenance Yard would impact 0.24 square kilometer (60 acres) in the long term and 0.44 square kilometer (108 acres) in the short term.

Special Status Species

Threatened and Endangered Species: Potential impacts to the desert tortoise would be similar to those described in Section 4.2.7.2.2.17. Construction of the Rail Equipment Maintenance Yard would result in a loss of tortoise habitat (see Table 4-90); however, areas of critical habitat would not be affected. The increase in human activity in the area would increase the risk of vehicle collisions with tortoises on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of this facility, there would be no impacts to the long-term survival of this species. Therefore, potential impacts to the desert tortoise as a result of the facility would be small.

Potential impacts to special status species would be similar to the impacts described in Section 4.2.7.2.2.17.

State of Nevada Game Species The Rail Equipment Maintenance Yard would be within mule deer limited range (see Figure 3-102). Potential impacts would be similar as those described in Section 4.2.7.2.1.5. Potential impacts would be small due to the infrequent occurrence of mule deer in the area. However, any existing mule deer would likely avoid the area due to increased human activity and noise.

Wild Horses and Burros Potential impacts to wild horses and burros would be similar to the impacts described in Section 4.2.7.2.2.17.

4.2.7.2.3 Operations Impacts Common to the Entire Caliente Rail Alignment

4.2.7.2.3.1 Vegetation Activities during the operations phase would remain within the operations right-of-way or areas disturbed during the construction phase. Therefore, there would be no additional impacts to land-cover types.

Table 4-91. Summary of potential impacts on biological resources from constructing facilities along common segment 6.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long-term)	0.30 square kilometer[a]
Construction-related disturbance to habitat (short-term)	0.61 square kilometer
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-51)	Small impact to habitat
State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Moderate impact to habitat
Mule deer	Small impact to habitat
Wild horses and burros	Small impact from loss of forage

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Wetland/Riparian Habitat Operations activities would not result in continuing land-disturbing activities outside areas disturbed during the construction phase. Therefore, there would be no additional direct loss of wetland or riparian habitat during the operations phase.

Noxious Weeds and Invasive Species There would be no additional direct habitat disturbances during the operations phase. However, use of the rail line, facilities, and associated access roads would continue to provide a mechanism for dispersal of seeds and rootable fragments of noxious weeds or invasive plant species.

During the operations phase, DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species.

4.2.7.2.3.2 Wildlife. During the operations phase, there would be potential direct impacts to wildlife in the form of wildlife collisions with trains. DOE estimates that approximately 17 one-way trains per week would utilize the track during the operations phase. While some individual animals could be lost from collisions with trains, the impact on wildlife communities would be small based on the speed of the trains (25 to 50 miles [40 to 80 kilometers] per hour), extremely good line of sight, and open space along the rail line. Areas with large cuts and fill could trap animals, but there would be very few such areas along the alignment. Because some wildlife species in the area are often more active at night, nighttime collisions with trains would be possible. DOE would expect small impacts to the nocturnal wildlife communities.

Construction of communication towers, bridges, or any other structures that would provide raptors, crows (*Corvus brachyrhynchos*), and ravens (*Corvus corax*) with additional perches would increase predation pressure on local populations of small animals such as reptiles, rodents, and small birds. This could result in a potential negative indirect impact on the small animals, but a positive indirect impact on the predatory species. Some long-term structures, such as bridges, if designed to include bat roosting and hibernation sites, could provide additional habitat and result in positive indirect impacts to bat species.

Throughout the operations phase, noise from trains would disturb wildlife species close to the rail line. However, this disturbance would diminish with distance from the track and over time because some wildlife species would become acclimated to daily disturbances from passing trains. Noise from the trains and the presence of humans at railroad facilities could cause wildlife species to move away from the tracks during the period of disturbance (short-term avoidance) and possibly cause changes in migratory patterns (long-term displacement).

4.2.7.2.3.3 Special Status Species.

Threatened and Endangered Species General impacts to vegetation and wildlife described in Sections 4.2.7.2.3.1 and 4.2.7.2.3.2 also apply to the threatened and endangered species described below.

Railroad operations would not result in the disturbance or removal of suitable habitat for Ute ladies'-tresses. Therefore, there would be no impacts to this species during the operations phase.

Railroad operations would result in potential short-term impacts to southwestern willow flycatchers and western yellow-billed cuckoos in the form of noise from passing trains and human activities. However, these impacts would be small given that there are no recorded occurrences and only marginal suitable migratory habitat for the flycatcher and cuckoo along the Caliente rail alignment. Furthermore, the area of the marginally suitable habitat is near the existing Union Pacific Railroad rail line and existing roads. Thus, these species would likely already be acclimated to such disturbances.

There would be no impacts to the Railroad Valley springfish during the operations phase because habitat for these species is far from the operations right-of-way and would not be disturbed.

Potential impacts to desert tortoises from habitat fragmentation would be small. Although there is no available documentation of tortoise behavior related to rail lines, it is possible that desert tortoises could use culverts installed within washes under the rail line to cross from one side of the rail line to the other.

Utility lines, buildings, or communication towers installed to support railroad operations might provide additional nesting and perching sites for the common raven, a frequent predator of juvenile tortoises. Therefore, the presence of these structures could increase juvenile tortoise mortality.

BLM- and State of Nevada-Designated Sensitive and Protected Species Potential impacts to vegetation and special status plants associated with railroad operations would be from the possible introduction of invasive plant species by train or maintenance vehicles. Invasive species could take hold in disturbed areas and essentially out-compete native species for resources.

Any active sage-grouse mating and nesting areas close to the Garden Valley alternative segments would be adversely affected by noise and vibration from the daily operations and maintenance activities during the sage-grouse breeding season. This could result in reduced nesting success, especially during the incubation period when birds would be frightened from their nests, exposing the eggs to predation. However, only one historic sage-grouse lek was identified in the construction right-of-way. No active leks were identified. In general, passing trains would initially disturb BLM-special status and state-protected wildlife close to the track. However, this disturbance would diminish with distance from the track and over time as animals became acclimated to daily disturbances. Individual animals could occasionally be killed or injured in collisions with trains. Nevertheless, impacts to animals near the rail line would be small because of the infrequency of trains using the rail line.

Facilities operations would create a potential disturbance to BLM-special status and state-protected wildlife species due to the presence of humans and associated noise. This could result in short-term avoidance of an area or lead to long-term displacement, depending on the degree of disturbance.

Migratory Birds Impacts to migratory bird species from railroad operations would be limited to potential disturbances from passing trains (noise and vibration), facility operations, and maintenance activities. Impacts such as altered behavior and nest abandonment could occur initially. However, noise and vibration disturbances would diminish with distance from the track and over time birds could become acclimated to daily disturbances.

4.2.7.2.3.4 State of Nevada Game Species. Direct impacts to game species from the railroad operations would consist of long-term habitat loss within the footprint of the rail line, access roads, facilities at the interface with the Union Pacific Railroad mainline, the Maintenance-of-Way Headquarters Facility, and the Rail Equipment Maintenance Yard. There would be a long-term impact on game species habitat in areas where DOE would construct the proposed rail line and associated roads and facilities.

Direct impacts to game species in the form of collisions with trains would also occur during the railroad operations when there would be increased traffic on the rail line. Again, mortality rates from collisions would not be expected to increase greatly because game animals are fairly agile and would often be able to move out of the way of oncoming trains. While some individual animals could die from collisions with trains, the impact on game communities would be small.

Noise from trains would disturb game species close to the rail line throughout the operations phase; however, this disturbance would diminish with distance from the track and over time as the game species became acclimated to daily disturbances from passing trains. Noise from the trains could cause game species to move away from the tracks and possibly cause changes in migratory patterns before game species became acclimated to the noise.

The rail roadbed itself would represent an attractive nuisance to antelope, because they prefer a vantage point from which to survey the surrounding areas for predators and would utilize the roadbed for this purpose. As noted above, antelope are agile and would usually be able to avoid oncoming trains.

The finished rail line would bisect game habitat and movement corridors. However, the rail line would not be fenced and once the animals became acclimated to its presence, they would be able to move freely across the rail line. Therefore, impacts to game-species movements would be small.

Operation of support facilities would create a potential disturbance to game species due to the presence of humans and associated noise. This could result in short-term avoidance or long-term displacement of game species from the area.

In the rare event of a possible train derailment resulting in the spill of diesel fuel into surrounding vegetation, foraging habitat and sources of drinking water could become contaminated. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.2.7.2.3.5 Wild Horses and Burros. Direct impacts to wild horses and burros from operation of the rail line along the Caliente rail alignment would consist of long-term habitat loss where the footprints of the rail line and associated maintenance roads would intersect herd management areas.

There would also be potential direct impacts to wild horses and burros in the form of collisions with trains. DOE estimates that approximately 17 one-way trains per week would utilize the track during the operations phase. Again, death rates from collisions would not be expected to be sizeable because wild horses and burros are fairly agile and would usually be able to move out of the way of oncoming trains. While some individual animals could die from collisions with trains, the impact on wild horse and burro communities would be small.

Noise from trains would disturb wild horses and burros close to the rail line throughout the operations phase; however, this disturbance would diminish with distance from the track and over time the wild horses and burros would become acclimated to daily disturbances from passing trains. Noise from the trains could cause wild horses and burros to move away from the tracks and possibly cause changes in migratory patterns.

The rail line would not be fenced and once the horses and burros became acclimated to its presence, they would be able to move freely across the rail line. Therefore, potential impacts to wild horse and burro movements, as discussed in Section 4.2.7.2.1.6, would be small.

4.2.7.3 Impacts under the Shared-Use Option

The Shared-Use Option would require construction of commercial sidings. All such construction would be immediately adjacent to the DOE rail alignment and would have impacts similar to those under the Proposed Action without shared use. The Shared-Use Option would mean an increase in train traffic. Therefore, DOE would expect special status species, State of Nevada game species, and wild horse and burro interactions with train traffic (collisions, change in movement patterns, altered behavior, and nest abandonment) to be slightly higher than those interactions with rail traffic under the Proposed Action without shared use. This slight increase in train traffic would result in small impacts to the wildlife communities.

4.2.7.4 Summary

Table 4-92 summarizes potential impacts to biological resources from constructing and operating the proposed rail line along the Caliente rail alignment.

Impacts to vegetation communities would be small in relation to the abundance of the vegetation communities in the region, with minimal loss of unique or particularly sensitive communities.

There would be impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove or Upland), the Eccles alternative segment, and the Interchange Yard. There could be impacts to wetlands in the vicinity of common segment 1 and Oasis Valley alternative segment 1 from rail line construction. However, during rail line final design, DOE would make slight adjustments to minimize such impacts.

Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species.

Although there could be impacts to wildlife habitats and individual populations as a result of rail line construction, impacts would be small and would not affect the continued existence of any wildlife species.

There would be the potential for impacts to threatened or endangered species during rail line construction. Potential impacts to desert tortoises would be small. There could be localized and minor loss of roosting and foraging habitat for the southwestern willow flycatcher and western yellow-billed cuckoo. However, because these species do not nest along the rail alignment, impacts would be small and limited to transient individuals.

Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed during the construction and operations phase. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act.

Overall, there would be a loss of conifer habitat and individual conifer trees. There would also likely be a net loss of cacti and yucca along the proposed rail line.

Overall, potential impacts to migratory birds would be short-term noise disturbances during the construction phase and long-term habitat loss during the operations phase. These impacts would not have an adverse impact on migratory birds.

Although there would be impacts to game habitats and potential impacts to individuals or populations, impacts would be small and would not significantly affect the continued existence of game species.

Although there would be impacts to herd management areas and potential impacts to individuals or wild horse and burro populations, impacts would be small and would not significantly impact the management strategies utilized within the herd management areas. Direct impacts to wildlife and wild horses and burros during the operations phase would consist of wildlife collisions with trains and short-term disruption of activities (such as foraging, nesting, and resting) due to noise from passing trains and from noise and the presence of humans at railroad facilities. Direct impacts could also include potential contamination of forage, prey species, nesting and spawning habitat, and sources of drinking water in the rare event of train derailment and an associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the presence of communications towers and other structures that would provide new perch habitat for raptors and other predatory birds.

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 1 of 8).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Caliente alternative segment	0.91	0.35	Small	Small	0.09	0.11	Small impact to potential habitat Ute ladies' -tresses	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, ferruginous hawk, southwestern toad, Needle Mountains milkvetch, Meadow Valley speckled dace, Meadow Valley Wash desert sucker, Needle Mountains milkvetch, White River Catseye, and southwestern toad	No to small impact on bats, southwestern willow flycatcher, western yellow-billed cuckoo, peregrine falcon, loggerhead shrike, western burrowing owl, ferruginous hawk, and southwestern toad	Small impact to mule deer, Clover Creek Herd Management Area, and Little Mountain Herd Management Area	Small impact to mule deer, Clover Creek Herd Management Area, and -Little Mountain Herd Management Area
Caliente Interchange Yard	0.00	0.04	No impact	Small	0.00	0.005	No impact	No impact	No impact	No impact	Small	Small
Caliente-Upland Staging Yard	0.33	0.13	No impact	Small	0.01	0.003	No impact	No impact	No impact	No impact	Small	Small
Caliente-Indian Cove Staging Yard	0.26	0.10	No impact	Small	0.09	0.04	No impact	No impact	Small impact on ferruginous hawk and southwestern toad	No impact	Small	Small
Caliente quarry CA-8B	0.34	1.23	No impact	Small	0.03	0.07	No impact	No impact	Small impact on bats, Meadow Valley Wash desert sucker, Meadow Valley speckled dace, loggerhead shrike, western burrowing owl, and southwestern toad	Small impact on bats, Meadow Valley Wash sucker, Meadow Valley speckled dace, and southwestern toad	Small impact on mule deer, Highland Peak Herd Management Area, and Little Mountain Herd Management Area	Small impact on mule deer, Highland Peak Herd Management Area, and -Little Mountain Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 2 of 8).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management area/Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Eccles alternative segment	3.85	0.58	Small	Small	0.10	0.10	No impact	No impact	Small impact on bats, loggerhead shrike, western burrowing owl, ferruginous hawk, Meadow Valley speckled dace, Meadow Valley Wash desert sucker, southwestern toad, White River catseye, and Needle Mountains milkvetch	Small impact on loggerhead shrike. western burrowing owl, Meadow Valley speckled dace, and Meadow Valley Wash desert sucker	Small impact on mule deer, Clover Creek Herd Management Area, and Little Mountain Herd Management Area	Small impact on mule deer, Clover Creek Herd Management Area, and Little Mountain Herd Management Area
Eccles Interchange Yard	0.00	0.4	No impact	Small	0.01	0.01	No impact	No Impact	No impact	No impact	Small	Small
Eccles North Staging Yard	0.62	0.12	No impact	Small	0.01	0.00	No impact	No Impact	No impact	No impact	Small	Small
Common segment 1	31.1	3.51	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, western burrowing owl, Brewer's sparrows, sage thrasher, Schlesser's pincushion, tiehm blazingstar, pygmy rabbit, dark kangaroo mouse, pale kangaroo mouse, and greater sage-grouse	Small impact on bats, loggerhead shrike, western burrowing owl, Brewer's sparrows, sage thrasher, greater sage-grouse, Needle Mountains milkvetch, and Schlesser's pincushion	Small impact on Bighorn sheep, mule deer, elk, pronghorn antelope, Dry Lake Herd Management Area, Highland Peak Herd Management Area, and Seaman Herd Management Area	Small impact on Bighorn sheep, mule deer, elk, pronghorn antelope, Dry Lake Herd Management Area, Highland Peak Herd Management Area, and Seaman Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 3 of 8).

	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/Nevada game species	
Segment/ facility	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Garden Valley 1	9.64	1.11	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn, antelope, and Seaman Herd Management Area
Garden Valley 2	9.50	1.51	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area
Garden Valley 3	10.58	1.09	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on dark kangaroo mouse, loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area
Garden Valley 8	9.15	1.57	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, dark kangaroo mouse, White River catseye, pygmy rabbit, and greater sage-grouse	Small impact on dark kangaroo mouse, loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area	Small impact on mule deer, elk, pronghorn antelope, and Seaman Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 4 of 8).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Common segment 2	13.80	1.12	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, pygmy rabbit, loggerhead shrike, western burrowing owl, ferruginous hawk, dark kangaroo mouse, pale kangaroo mouse, Brewer's sparrows, sage thrasher, and greater sage-grouse	Small impact on bats, pygmy rabbit, loggerhead shrike, western burrowing owl, Brewer's sparrows, sage thrasher, and greater sage-grouse	Small impact on mule deer, elk, and pronghorn antelope	Small impact on mule deer, elk, and pronghorn antelope
South Reveille 2	5.73	0.64	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on pronghorn antelope and Nellis Herd Management Area	Small impact on pronghorn antelope
South Reveille 3	5.63	0.65	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike and western burrowing owl	Small impact on pronghorn antelope and Nellis Herd Management Area	Small impact on pronghorn antelope and Nellis Herd Management Area
South Reveille quarry NN-9A	0.60	1.40	No impact	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, and sage thrasher	Small impact on pronghorn antelope	Small impact on pronghorn antelope
South Reveille quarry NN-9B	0.51	0.78	No impact	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, dark kangaroo mouse, pale kangaroo mouse, and sage thrasher	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, and sage thrasher	Small impact on pronghorn antelope and Nellis Herd Management Area	Small impact on pronghorn antelope and Nellis Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 5 of 8).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Common segment 3	30.00	2.49	Small	Small	0.00	0.00	No impact	No impact	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, greater sage-grouse, Tonopah fishhook cactus, eastern milkweed, and Nevada Dune beardtongue	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area
Maintenance-of-Way Trackside Facility	0.90	0.10	No impact	Small	0.00	0.00	Small	Small	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, greater sage-grouse, Tonopah fishhook cactus, eastern milkweed, and Nevada Dune beardtongue	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area
Maintenance-of-Way Headquarters Facility	0.10	0.00	No impact	Small	0.00	0.00	Small	Small	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on loggerhead shrike, western burrowing owl, Brewer's sparrow, sage thrasher, and greater sage-grouse	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area	Small impact on mule deer, pronghorn antelope, Reveille Herd Management Area, Stone Canyon Herd Management Area, and Saulsbury Herd Management Area
Goldfield 1	12.46	1.96	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, eastwood milkweed, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 6 of 8).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Goldfield 3	13.68	2.19	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area
Goldfield 4	14.29	1.86	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, eastwood milkweed, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area
Goldfield quarry NS-3A	1.00	2.76	No impact	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area
Goldfield quarry NS-3B	0.38	1.11	No impact	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area	Small impact on mule deer, pronghorn antelope, and Goldfield Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 7 of 8).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Goldfield quarry ES-7	0.32	1.13	No impact	Small	0.00	0.00	No impact	No impact	Small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	No to small impact on bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact on mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area
Common segment 4	3.24	0.26	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, Bighorn sheep, Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, Bighorn sheep, Stonewall Herd Management Area
Bonnie Claire 2	5.65	0.51	Small	Small	0.00	0.00	No impact	No impact	No to small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, Bighorn sheep, Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, Bighorn sheep, Stonewall Herd Management Area
Bonnie Claire 3	5.59	0.49	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, pronghorn antelope, Bighorn sheep, Stonewall Herd Management Area	Small impact on mule deer, pronghorn antelope, Bighorn sheep, Stonewall Herd Management Area

Table 4-92. Summary of potential impacts to biological resources from constructing and operating the railroad along the Caliente rail alignment (page 8 of 8).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Common segment 5	11.12	0.82	Small	Small	0.00	0.00	No impact	No impact	Small impact: on bats, loggerhead shrike, western burrowing owl, Oasis Valley speckled dace, ferruginous hawk, and Nevada Dune beardtongue	Small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on pronghorn antelope, Bighorn sheep and mule deer.	No impact
Oasis Valley 1	2.62	0.31	Small	Small	0.00	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, black woollypod, and western burrowing owl	No to small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, desert Bighorn sheep, Bullfrog Herd Management Area	Small impact on Bullfrog Herd Management Area
Oasis Valley 3	3.95	0.43	Small	Small	0.03	0.00	No impact	No impact	Small impact on bats, loggerhead shrike, black woollypod, and western burrowing owl	No to small impact on bats, loggerhead shrike, and western burrowing owl	Small impact on mule deer, desert Bighorn sheep, Bullfrog Herd Management Area	Small impact on Bullfrog Herd Management Area
Common segment 6	13.24	1.63	Small	Small	0.00	0.00	Small impact on desert tortoise	Small impact on desert tortoise	Small impact on bats, loggerhead shrike, western burrowing owl, chuckwalla, black woolypod, and desert tortoise	Moderate impact on desert bighorn sheep. Small impact on mule deer, and bats, loggerhead shrike, western burrowing owl, chuckwalla, and desert tortoise	Moderate impact on desert Bighorn sheep. Small impact on mule deer and Bullfrog Herd Management Area	Small impact on Bullfrog Herd Management Area
Rail Equipment Maintenance Yard	0.61	0.30	No impact	Small	0.00	0.00	Small impact on desert tortoise	Small impact on desert tortoise	Small impact on bats, loggerhead shrike, western burrowing owl, chuckwalla, and black woollypod	Small impact on bats, loggerhead shrike, western burrowing owl, and chuckwalla	Moderate impact on Bighorn sheep, mule deer and Bullfrog Herd Management Area	Moderate impact on Bighorn sheep and Bullfrog Herd Management Area
Totals	220.25	33.35	Small	Small	0.61	0.48	Small	Small	Small	Small	Small	Small

a. To convert square kilometers to acres, multiply by 247.10.

4.2.8 NOISE AND VIBRATION

This section describes potential noise and vibration impacts from constructing and operating a railroad along the Caliente rail alignment. Section 4.2.8.1 describes the methodology DOE used to assess potential impacts; Section 4.2.8.2 describes potential construction impacts; Section 4.2.8.3 describes potential operations impacts; Section 4.2.8.4 describes potential impacts under the Shared-Use Option; Section 4.2.8.5 describes a responsible opposing viewpoint; and Section 4.2.8.6 summarizes potential impacts of constructing and operating a railroad along the Caliente rail alignment.

Section 3.2.8.1 describes the region of influence for the analysis of noise and vibration impacts along the Caliente rail alignment. Appendix I, Noise and Vibration Impact Assessment Methodology, provides more information on the fundamentals of analyzing noise.

4.2.8.1 Impact Assessment Methodology

The approach for analyzing potential noise impacts is based on measurements of current ambient sound levels (see Section 3.2.8.2), noise modeling for future activities (proposed railroad construction and operations), and identification of changes in sound levels that receptors within the region of influence would experience.

To establish a baseline for determining if there would be an increase in noise, DOE measured ***ambient noise*** in the study area at three representative locations along the rail alignment: Caliente, Garden Valley, and Goldfield (see Section 3.2.8.2). DOE chose these locations because they are representative of the few populated areas or Special Recreational Management Areas near the rail alignment. There is already substantial train activity in Caliente; therefore, DOE used a combination of modeling and measurements to determine the difference between existing and potential future (railroad-related) noise levels in that area.

DOE used several criteria to determine the level of potential impacts from noise and vibration along the rail alignment. For noise impacts from construction activities, DOE used U.S. Department of Transportation, Federal Transit Administration, methods (DIRS 177297-Hanson, Towers, and Meister 2006, all), and construction noise guidelines listed in Table 4-93.

Table 4-93. Federal Transit Administration construction noise guidelines.[a,b]

Land use	8-hour L_{eq} (dBA)		30-day average DNL (dBA)
	Day	Night	
Residential	80	70	75[c]
Commercial	85	85	80[d]
Industrial	90	90	85[d]

a. Source: DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-8.
b. dBA = A-weighted decibels; DNL = ***day-night average noise level***; L_{eq} = equivalent sound level.
c. In urban areas with very high ambient noise levels (DNL greater than 65 dBA), DNL from construction projects should not exceed existing ambient +10 dBA.
d. Twenty-four hour L_{eq}, not DNL.

For operation of trains during the construction and operations phases, DOE analyzed noise impacts under established STB criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by DNL of 3 dBA or more
- An increase to a noise level of 65 DNL or greater

Day-night average noise level (DNL): The energy average of A-weighted decibels (dBA) sound level over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the day.

A-weighted decibels (dBA): A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

If the estimated noise-level increase at a location would exceed either criterion, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, or nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, recent noise evaluations indicate that both criteria must be met to cause an adverse noise impact (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more for an adverse noise impact to occur.

The approach for analyzing potential vibration impacts is based on estimates of project-generated vibration and measurements of current ambient vibration conditions (see Section 3.2.8). To evaluate potential vibration impacts from construction and operation activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded 80 VdB (human annoyance criterion for infrequent events) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inches per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be a vibration impact (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

To establish a baseline for determining if there would be an increase in vibration, DOE measured ambient vibration in the study area at three representative locations: Caliente, Garden Valley, and Goldfield (see Section 3.2.8).

4.2.8.2 Construction Impacts

Noise and vibration levels created by construction equipment vary greatly depending on such factors as the type of equipment, the specific model, the operation being performed, and the condition of the equipment. In addition, the proximity of the equipment to noise- and vibration-sensitive locations, duration of the activity, and time of day will influence the effects of construction noise and vibration. The results of this assessment reflect the ***uncertainty*** about the exact details of construction activities that would be required. However, the analysis assumes extreme combinations of equipment and operations known at this time that conservatively estimate upper-bound construction noise and vibration levels.

4.2.8.2.1 Construction Noise

The Federal Transit Administration construction noise analysis method suggests using the two noisiest pieces of equipment to estimate noise levels at sensitive locations (DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-7). For this analysis, DOE used heavy trucks and bulldozers as the two noisiest pieces of equipment, based on the types of construction equipment that would be needed (DIRS 180921-Nevada Rail Partners 2007, Appendix B). DOE estimated the effects of pile driving separately because mobile noise sources, such as trucks, would be likely to cross the entire rail alignment, whereas pile driving would only occur at specific locations such as bridges.

DOE developed 8-hour construction noise-level estimates by assuming that a bulldozer (with a noise emission level of 85 dBA at 15 meters [50 feet]) would be at full operation for 8 hours at a given location along an alternative segment or common segment at the approximate minimum distance to the nearest residential receptor anywhere along the proposed rail alignment. Tables 4-94 and 4-95 list estimated construction noise levels for Caliente, Garden Valley, and Goldfield. In addition, based on the construction schedule, the analysis conservatively assumed that 15 bulldozers would be operating simultaneously in the same general area. DOE also assumed that trucks (with a noise emission level of 88 dBA at 15 meters) would be at full power in the same general area for 8 hours per day. Based on the construction schedule, DOE conservatively assumed that 27 trucks would be operating simultaneously in the same general area. These analyses assume that there would be no construction activities during the night.

Table 4-94. Estimated construction noise levels along the Caliente rail alignment (8-hour L_{eq}).[a]

Alternative segment	Approximate distance to nearest receptor (meters)[b]	8-hour bulldozer L_{eq}	8-hour truck L_{eq}	Total 8-hour L_{eq} (dBA)[a]
Caliente	60	85	90	91
Eccles	120	79	84	85
Garden Valley 1	3,400	50	55	56
Garden Valley 2	1,800	55	61	62
Garden Valley 3	7,100	43	49	50
Garden Valley 8	4,100	48	54	55
Goldfield 1	6,200	44	50	51
Goldfield 3	9,700	41	46	47
Goldfield 4	250	72	78	79

a. dBA = A-weighted decibels; L_{eq} = equivalent sound level.
b. To convert meters to feet, multiply by 3.2808.

Table 4-95. Estimated construction noise levels along the Caliente rail alignment (30-day DNL).[a]

Alternative segment	Approximate distance to nearest receptor (meters)[b]	30-day bulldozer DNL	30-day truck DNL	Total 30-day DNL (dBA)
Caliente	60	70	76	77
Eccles	120	64	69	70
Garden Valley 1	3,400	35	40	42
Garden Valley 2	1,800	40	46	47
Garden Valley 3	7,100	28	34	35
Garden Valley 8	4,100	33	39	40
Goldfield 1	6,200	30	35	36
Goldfield 3	9,700	26	31	32
Goldfield 4	250	58	63	64

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert meters to feet, multiply by 3.2808.

With the exception of the Caliente and Eccles alternative segments, the distances from construction activities to the nearest receptors would be great; therefore, construction noise levels would be below the Federal Transit Administration noise guidelines listed in Table 4-93. However, construction noise levels in the City of Caliente would exceed the Federal Transit Administration daytime residential noise guidelines by 11 dBA; construction noise levels for receptors near the Eccles alternative segment would exceed guidelines by 5 dBA (see Table 4-94).

DOE also evaluated pile-driving noise from construction of bridges that would cross highways, ravines, or bodies of water. For Goldfield alternative segment 4, the closest residential building to pile-driving activity would be approximately 800 meters (2,600 feet). Assuming continuous pile driving for 8 hours per day and continuous use for 30 days (or longer at some locations), the estimated 8-hour equivalent sound level and 30-day DNL would be 67 dBA, which is below the noise guidelines listed in Table 4-93. Along the Caliente alternative segment, the closest residential building to pile-driving activity would be approximately 80 meters (260 feet). Assuming continuous pile driving for 8 hours per day and continuous use for 30 days, the estimated 8-hour equivalent sound level and 30-day DNL would be 87 dBA, which is 12 dBA above the 30-day DNL noise guidelines listed in Table 4-93.

Of the railroad operations support facilities, only the Interchange Yard and the Staging Yard at the Interface with the Union Pacific Railroad Mainline, if it were located in Caliente, would be near receptors. These facilities could be approximately 1,200 meters (3,900 feet) to the north of receptors in Caliente. Equipment similar to that used to construct the rail line would be used to construct these facilities. Because construction activity related to the rail line would be much closer to receptors, that construction noise would dominate over construction noise associated with the Interchange Yard and the Staging Yard; therefore, there would be no adverse noise impacts from construction of associated rail facilities.

4.2.8.2.2 Construction Vibration

DOE based the construction vibration analysis on Federal Transit Administration methods (DIRS 177297-Hanson, Towers, and Meister 2006, all). Construction vibration should be assessed in cases where there is a significant potential for impact from construction activities. Such activities include blasting, pile driving, drilling, or excavation close to ***sensitive structures***.

Based on the proposed construction equipment and Federal Transit Administration vibration data, DOE estimated potential ground-borne vibration levels due to construction activity. Table 4-96 lists estimated vibration levels associated with potential bulldozer activity.

Table 4-96. Estimated construction vibration levels along the Caliente rail alignment.

Alternative segment	Approximate distance to nearest receptor (meters)[a]	Peak particle velocity (inches per second)
Caliente	60	0.0040
Eccles	120	0.0014
Garden Valley 1	3,400	0.000009
Garden Valley 2	1,800	0.000025
Garden Valley 3	7,100	0.000003
Garden Valley 8	4,100	0.000007
Goldfield 1	6,200	0.000004
Goldfield 3	9,700	0.000002
Goldfield 4	250	0.0005

a. To convert meters to feet, multiply by 3.2808.

In addition to mobile vibration sources along the rail alignment, DOE evaluated vibration due to pile driving, which would occur at specific locations such as bridges. For the Caliente alternative segment, the closest residential building to pile-driving activity would be approximately 80 meters (260 feet) away, which would result in a peak particle velocity of approximately 0.045 inch per second. For Goldfield alternative segment 4, the nearest residential building to pile-driving activity would be approximately 800 meters (2,600 feet) away, which would result in a peak particle velocity of approximately 0.0014 inch per second. These vibration levels and the vibration levels listed in Table 4-96, are all below Federal Transit Administration building vibration damage criteria (0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings). Therefore, DOE would expect no damage to buildings due to vibration during construction. In addition, because of relatively low vibration levels and the temporary nature of construction, human annoyance due to construction vibration would be low.

Blasting operations could be required as part of the excavation process to accommodate the rail roadbed in hilly areas. Uncertainty about the need for and the exact locations of blasting operations is typical at this phase of the proposed project. If blasting were needed and would occur near populated areas, DOE would assess potential blasting noise and vibration and take measures to minimize these temporary impacts, if any.

Of the railroad operations support facilities, only the Interchange Yard and the Staging Yard at the Interface with the Union Pacific Railroad Mainline, if it were located in Caliente, would be near receptors. These facilities could be approximately 1,200 meters (3,900 feet) to the north of receptors in Caliente. Equipment similar to that used to construct the rail line would be used to construct these sites. Because construction activity related to the rail line would be much closer to receptors, that construction vibration would dominate over vibration associated with construction of the Interchange Yard and the Staging Yard; therefore, there would be no adverse vibration impacts from construction of these facilities.

4.2.8.2.3 Construction-Train Noise

As the rail roadbed, track, and bridges were completed, construction trains would be employed to move railroad ties, ballast, and other rail line construction equipment to other construction areas. The amount of construction train activity would vary between Caliente, Garden Valley, and Goldfield. Up to 16 one-way trains per day could pass by certain receptor locations, such as those in Caliente, during a 4-year construction period. If the construction period extended up to 10 years, the same total number of construction trains would operate, but at a lower average number of trains per day. This analysis conservatively uses the higher number of 16 trains per day. As with operations trains, locomotive horn sounding at grade crossings would be the dominant noise source.

Using the equations in Appendix I, Section I.2.1, and analytical methods described in that appendix, DOE generated construction-train noise contours for the three representative areas studied: Caliente, Garden Valley, and Goldfield. Figures 4-92 through 4-94 show 65 DNL noise contours for construction-train activity in these three areas.

There would be no receptors within the 65 DNL contour in the areas studied. However, approximately 44 receptors would be included within the 3 dBA increase contour in Caliente and approximately 190 receptors would be included within the 3 dBA increase contour in Goldfield. There would be no receptors within the 3 dBA increase contour in Garden Valley.

There would be no adverse noise impacts associated with these receptors because they would not experience a 3 dBA increase and also be exposed to 65 DNL or greater noise levels. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. However, because transportation noise sources are audible throughout the United States, the audibility of train noise itself does not constitute an adverse noise impact.

4.2.8.2.4 Construction-Train Vibration

Construction trains would travel at lower speeds than operations trains. Because vibration is a function of train speed, construction-train vibration would be lower than operations-train vibration (see Section

4.2.8.3.4). Freight trains operating at 80 kilometers (50 miles) per hour would produce an annoyance-based vibration contour extending approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no buildings within approximately 24 meters of the Caliente rail alignment, so operations trains would produce no adverse vibration impacts; therefore, there would be no adverse vibration impacts from construction trains.

Construction-train cars carrying ballast could weigh more than operations-train cars; therefore, construction-train cars could produce higher levels of vibration. The locomotive itself would be considered representative of heavier cars. However, typically the locomotive produces the highest vibration level during a train passby, which would determine the maximum passby vibration level. Because operations-train and construction-train locomotives would be similar, the higher-speed operations locomotive would generate the highest level of vibration.

4.2.8.2.5 Quarry-Site Noise

Noise sources associated with potential quarry operations during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic.

There are no receptors in the immediate vicinity of potential quarry CA-8B northwest of Caliente, potential quarries NN-9A and NN-9B in South Reveille Valley, or potential quarries NS-3A and NS-3B northeast of Goldfield. Therefore, there would be no noise impacts associated with operation of these quarries during the construction phase.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in west Goldfield. While quarry noise would likely be audible in west Goldfield, this distance and the intervening topography, which would act as a barrier to and would attenuate noise, would make it unlikely there would be adverse noise impacts from this quarry.

4.2.8.2.6 Quarry-Site Vibration

Vibration sources associated with operations at potential quarries during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic. Peak overpressures and ground-borne vibration associated with blasting can be an issue in relation to the structural integrity of buildings close to blasting activities.

There are no receptors in the immediate vicinity of potential quarry CA-8B northwest of Caliente, potential quarries NN-9A and NN-9B in South Reveille Valley, or potential quarries NS-3A and NS-3B northeast of Goldfield. Therefore, there would be no vibration impacts associated with operation of these quarries during the construction phase.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in Goldfield. Because of this large distance between quarry activities and receptors, it is unlikely that ground-borne vibration would be perceptible at receptor locations; therefore, there would be no adverse vibration impacts.

4.2.8.3 Operations Impacts

The primary sources of noise considered in the analysis for railroad operations were wayside train noise and horn noise. Wayside noise refers collectively to all train-related operations noise adjacent to the operations right-of-way, excluding locomotive warning-horn noise. Wayside noise results from steel train wheels contacting steel rails (wheel-rail noise) and from locomotive exhaust and engine noise.

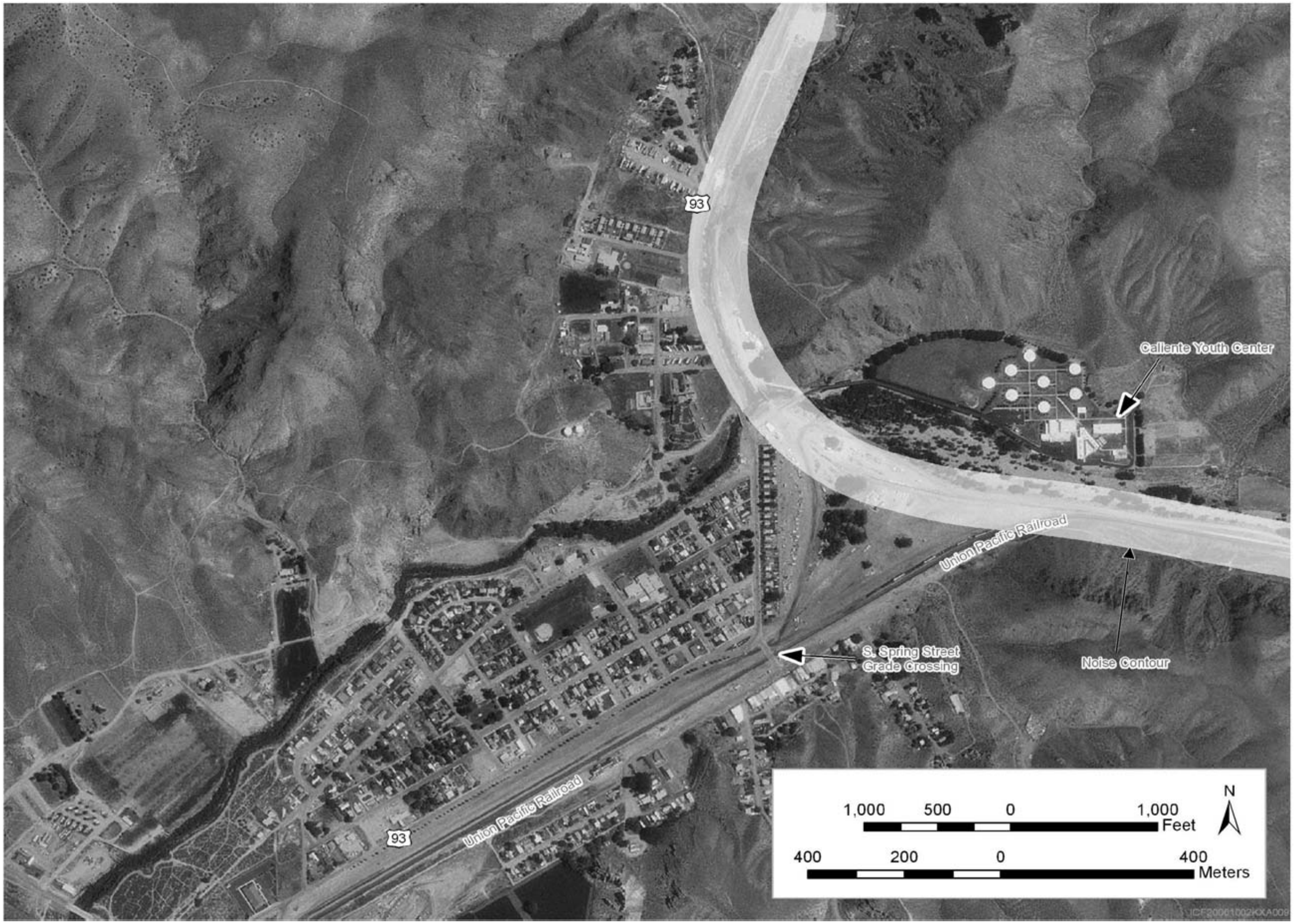


Figure 4-14. Construction-train 65 dBA DNL contour, Caliente, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114E52.sid.)

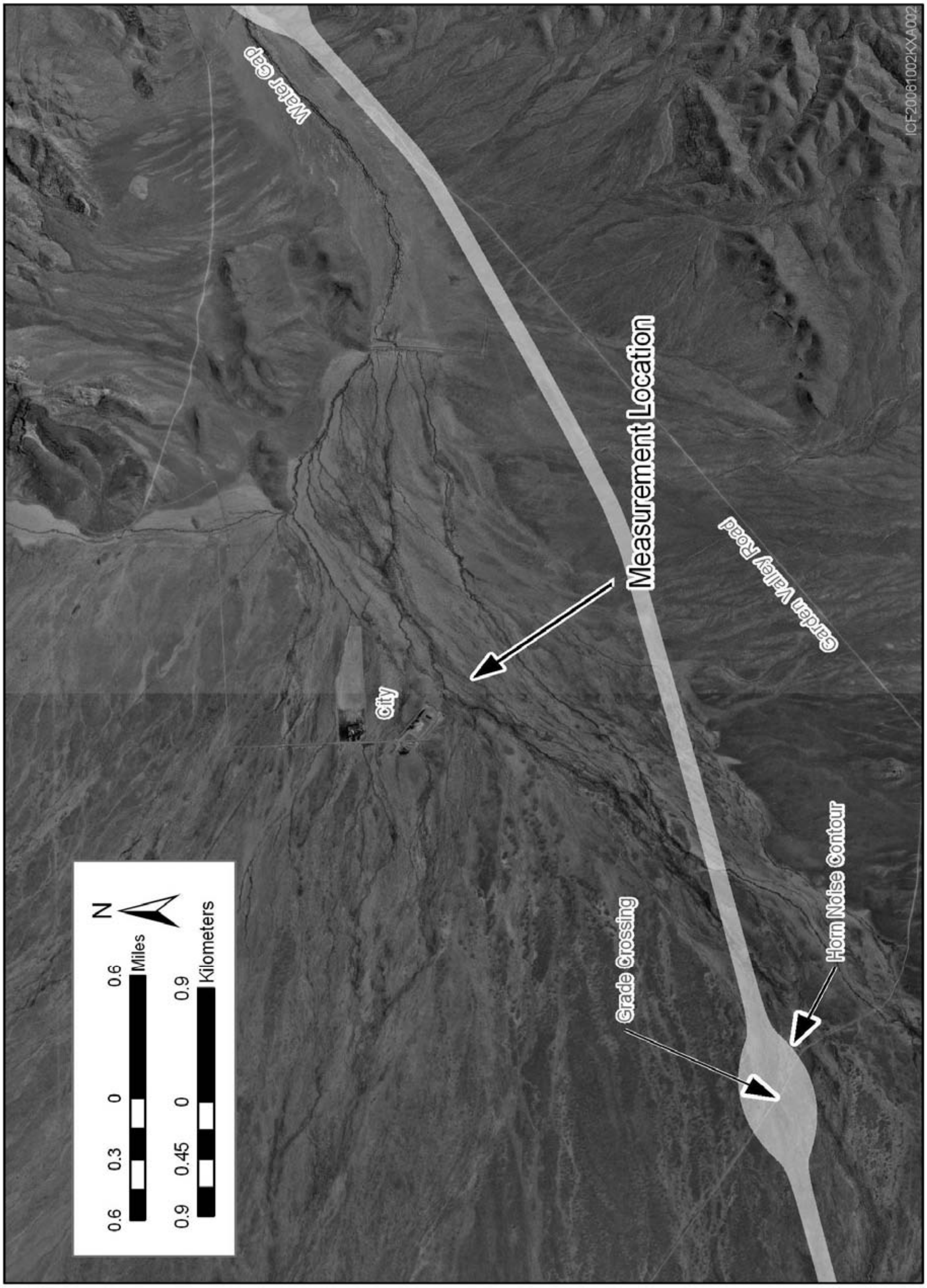


Figure 4-15 Construction-train 65 dBA DNL contour, Garden Valley, Nevada.
(Source: DIRS 174497-Keck Library 2004, filenames 38115A43.sid and 38115A44.sid.)

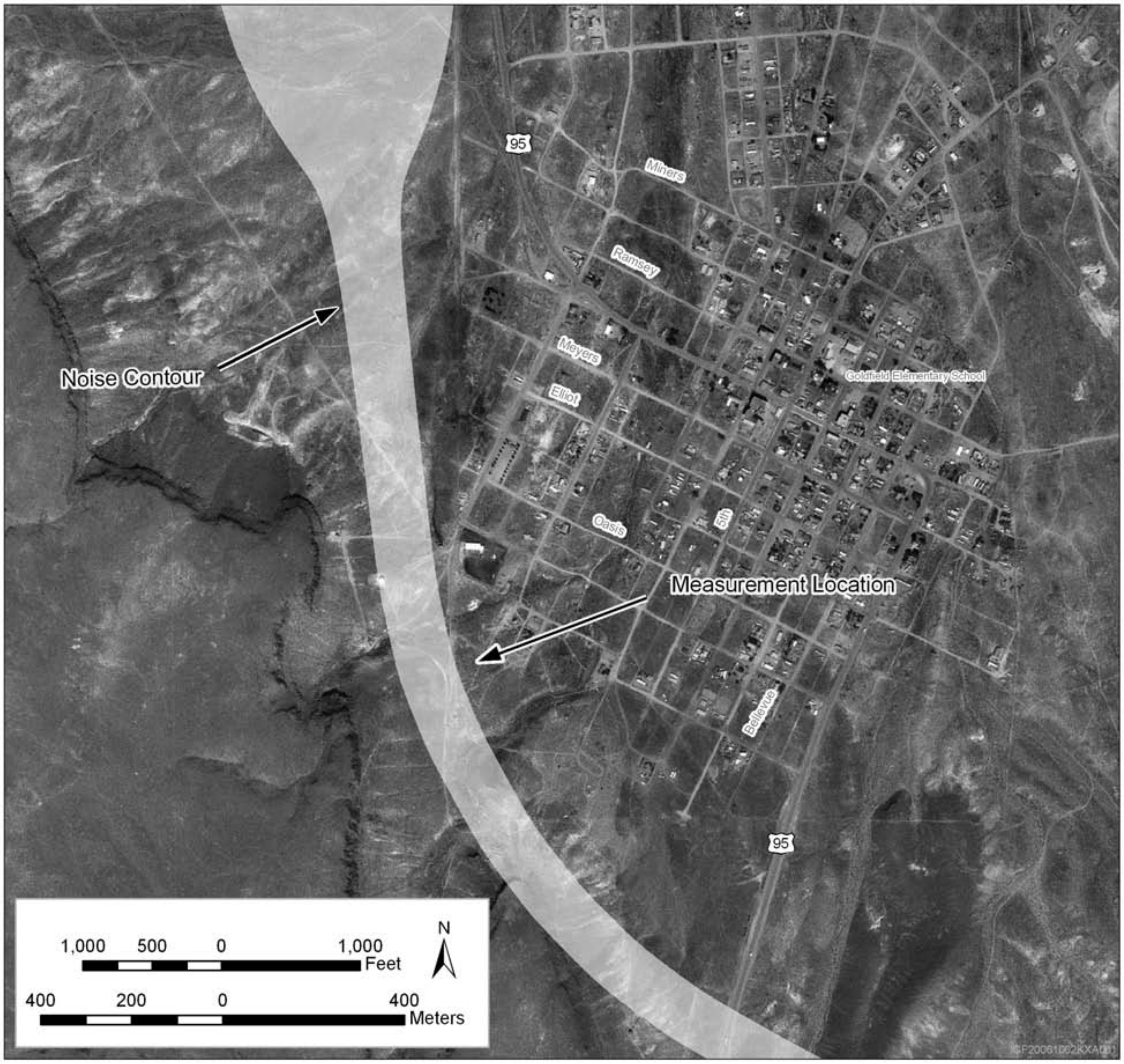


Figure 4-16. Construction-train 65 dBA DNL contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114F21.sid.)

The amount of noise created by the wheels on the rails would depend on train speed; the amount of engine noise created by the locomotive would depend on the throttle setting. Wheel squeal can sometimes occur on curved sections of track where the radius of curvature of the track is small. There would be horn noise in the vicinity of grade crossings to warn motorists and pedestrians of approaching trains; this noise is assessed separately from wayside noise.

4.2.8.3.1 Wayside Noise

Appendix I describes the methodology DOE used to estimate wayside noise during the operations phase. Wheel-rail noise would vary as a function of speed and could increase by as much as 15 dBA if wheels or rails were in poor condition (DIRS 174623-Kaiser 1998, all). One of the most common causes of additional noise from wheels is the formation of flat surfaces on wheels caused by wheels sliding during hard braking.

The main components of locomotive noise are the exhaust of the diesel engines, cooling fans, general engine noise, and the wheel-rail interaction. Noise associated with the engine exhaust and cooling fans usually dominates; this noise would depend on the throttle setting (most locomotives have eight throttle settings), not on locomotive speed. Tests have shown that locomotive noise levels change by about 2 dBA for each step change in throttle setting, meaning that noise levels increase by about 16 dBA as the locomotive throttle is moved from notch one to notch eight (DIRS 174623-Kaiser 1998, all). Because locomotive engineers constantly adjust throttle settings as necessary, only rough estimates of throttle settings are usually available for noise projections. Numerous field measurements of freight train operations indicate that locomotive noise can be projected with reasonable accuracy by assuming a base condition of throttle position six and adjusting noise levels when better information about typical throttle position is known.

Given the maximum train passby noise level of freight cars and a locomotive under a specific set of reference conditions, the noise models allow estimation of the maximum train passby sound level, the sound exposure level, the DNL, and other noise metrics for varying distances from the track, varying train speeds, and varying schedules.

The spent nuclear fuel and high-level radioactive waste train used to model noise impacts for this analysis would consist of two to three locomotives and four to eight railcars (one to five ***cask cars***, ***two buffer*** cars, and one ***escort car***). The average length of the cars would be about 18 to 27 meters (59 to 89 feet), and the length of the locomotives would be 23 meters (75 feet), for a total train length ranging from 118 to 285 meters (390 to 940 feet).

Trains would operate along the rail line at a top speed of 80 kilometers (50 miles) per hour. Because train speed has a direct correlation to noise generated, DOE used the top train speed to conservatively estimate potential noise levels. Table 4-97 lists distances to the wayside 65 DNL noise contour for three locations along the Caliente rail alignment, assuming an average of 2.4 trains per day (based on 17 one-way trips per week). The average of 2.4 trains per day includes ***cask*** trains, maintenance-of-way trains, and repository supply and construction trains.

Table 4-97. Summary of distances to 65 dBA DNL at three locations along the Caliente rail alignment.

Area	Speed in kilometers per hour[a,b]	Distance in meters[c] to 65 dBA DNL contour[d]		Noise level increase (dBA)[d]
		Wayside	Horn	
Caliente	80[d]	17	75	0 to 3
Garden Valley	80	17	75	0
Goldfield	80	17	75	0 to 10

a. To convert kilometers per hour to miles per hour, multiply by 0.62137.
b Actual speeds would be lower.
c. To convert meters to feet, multiply by 3.2808.
d dBA = A-weighted decibels; DNL = day-night average noise level.

4.2.8.3.2 Horn Noise

The key components in projecting noise exposure from horn noise are the horn sound level, the duration of the horn noise, the distance of the receptor from the tracks, and the number of trains running during daytime and nighttime hours.

For safety reasons, the Federal Railroad Administration requires train engineers to sound horns when approaching most grade crossings unless a Quiet Zone has been established. Horn sounding is generally not required at private crossings. Federal Railroad Administration regulations at 49 CFR 229.129 require all lead locomotives to have an audible warning device that produces a minimum sound level of 96 dBA at a distance of 30 meters (100 feet) in front of the locomotive.

Most freight train audible warning devices are air horns. The maximum sound level of the air horns can usually be adjusted to some degree by adjusting the air pressure. Maximum sound levels are typically 105 to 110 dBA at 30 meters (100 feet) in front of the trains, well above the 96 dBA value required by the Federal Railroad Administration. Additional noise sources associated with grade crossings would be the grade crossing bells that would start sounding just before the gates were lowered, and idling road traffic that must wait at the crossing. Because train horns create high noise levels, noise exposure would be dominated by horn noise near any grade crossing where sounding horns is required. The analysis assumes that trains would be equally likely to occur at any hour of the day or night. Table 4-97 does not include adjustments for building or terrain shielding. At distances beyond approximately 30 meters, obstructions such as buildings or terrain could act as a partial acoustic shield, causing a noise reduction of approximately 5 to 10 dBA. As one of the final steps in the noise modeling process, DOE included adjustments for building shielding, based on International Organization for Standardization standard number ISO 9613-2 *Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation* (DIRS 176684-ISO 1996, all).

4.2.8.3.3 Railroad Operations Noise Impacts

Table 4-97 lists approximate distances to the wayside for train noise without horns and horn-noise contours from the centerline of the rail alignment in Caliente, Garden Valley, and Goldfield. These distances do not include the effects of building shielding. However, the building shielding effects were accounted for in the noise contours generated through modeling potential noise impacts. Also shown are potential increases in noise in relation to ambient noise conditions, which would vary between and within the three areas where DOE took ambient noise measurements. Ambient noise refers to existing conditions in the region of influence. At present, there is no train activity in Goldfield or Garden Valley, but there is substantial train activity in Caliente.

Figures 4-15, 4-17, 4-18, and 4-19 show modeled 65 DNL contours in Caliente, Garden Valley, and Goldfield. These figures show that no receptors would be included in the 65 DNL contours in Caliente, Garden Valley, and Goldfield. Figures 4-18 and 4-22 show 3 dBA increase contours for Caliente and Goldfield. The Caliente 3 dBA increase contours are wider to the north because that location (for existing conditions) is quieter than near the grade crossing at South Spring Street where horns are sounded. For Garden Valley, assuming an ambient noise level of 62 DNL, the 3 dBA increase contour is only slightly larger than the 65 DNL contours shown in Figures 4-19 and 4-20. The 3 dBA increase in the wayside noise contour would extend 26 meters (86 feet) from the tracks and the horn noise contour would extend 120 meters (390 feet) from the tracks.

DOE counted receptors that would be included in the 3 dBA increase contours in accordance with STB procedures (DIRS 173225-STB 2003, all). Because of the relatively low ambient sound level in Goldfield (47 DNL), 37 receptors would be within the 3 dBA increase contour. There would be no adverse noise impacts associated with these 37 receptors because they would not experience a 3 dBA increase and also be exposed to 65 DNL or greater. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. The audibility of train noise itself does not constitute an adverse noise impact. Because of the higher existing ambient sound level in Caliente (53 DNL) and Garden Valley (62 DNL), the 3 dBA increase contours are narrow; therefore, there would be no receptors within the 3 dBA increase contours for these locations. Discounting the two sonic booms measured in Garden Valley (see Section 3.2.8) would result in an ambient noise level of 41 DNL. Conservatively assuming that the ambient level is 41 DNL would result in 3 dBA increase contours that also would include no receptors.

DOE identified two receptors within approximately 120 meters (400 feet) of the Eccles alternative segment. These two receptors would not be within the 65 DNL contour. DOE did not measure ambient sound levels at this location, but based on review of aerial photographs, the population density is low; therefore, ambient sound levels would likely be low. Assuming ambient sound levels as low as measured in Goldfield (47 DNL), and estimated wayside train noise level at this location (52 DNL), these two receptors would be included within the 3 dBA increase contours. However, there would be no adverse noise impact associated with railroad operations at this location because these receptors would not experience a 3 dBA increase and also be exposed to 65 DNL or greater.

DOE estimated differences in train noise levels associated with each alternative segment in Garden Valley and Goldfield (see Table 4-98). The analysis accounts for distance attenuation, assumed horn-sounding locations at specific grade crossings, and excess attenuation, and does not include shielding associated with terrain or the effects of ambient noise. DOE calculated the noise levels listed in Table 4-98 at the receptor that would be nearest to each alternative segment.

Goldfield alternative segments 1 and 3 would be much quieter than Goldfield alternative segment 4 because they would be much farther away from receptors than Goldfield 4 (see Table 4-98). In the Garden Valley area, Garden Valley alternative segment 2 would be the noisiest alternative segment, being the closest to receptors. Garden Valley alternative segment 8 would be 6 dBA quieter than Garden Valley 2, and Garden Valley 1 and 3 would produce even less noise because they would be more distant from receptors than the other Garden Valley alternative segments. Garden Valley 3 would be 15 dBA quieter than Garden Valley 2. A 10 dBA reduction is considered a subjective halving of loudness to most people, so Garden Valley 3 would be perceived as less than half as loud as Garden Valley 2.

Table 4-98. Potential railroad operations noise levels for Caliente rail alignment alternative segments in Caliente, Garden Valley, and Goldfield.

Alternative segment	Approximate distance to nearest receptor (meters)[a]	Noise level (DNL, dBA)[b,c]
Caliente	60	57
Eccles	120	52
Garden Valley 1	3,400	30
Garden Valley 2	1,800	37
Garden Valley 3	7,100	22
Garden Valley 8	4,100	31
Goldfield 1	6,200	20
Goldfield 3	9,700	11
Goldfield 4	250	50

a. To convert meters to feet, multiply by 3.2808.
b. dBA = A-weighted decibels; DNL = day-night average noise level.
c. Noise-level differences are based on comparing alternatives with the noisiest alternative segment.

4.2.8.3.4 Railroad Operations Vibration Impacts

At certain times, such as when a locomotive is idling near a residential building, trains can produce low-frequency airborne noise, which in turn can cause structural vibrations. However, trains generally do not produce enough airborne noise or ground-borne vibrational energy to cause building damage.

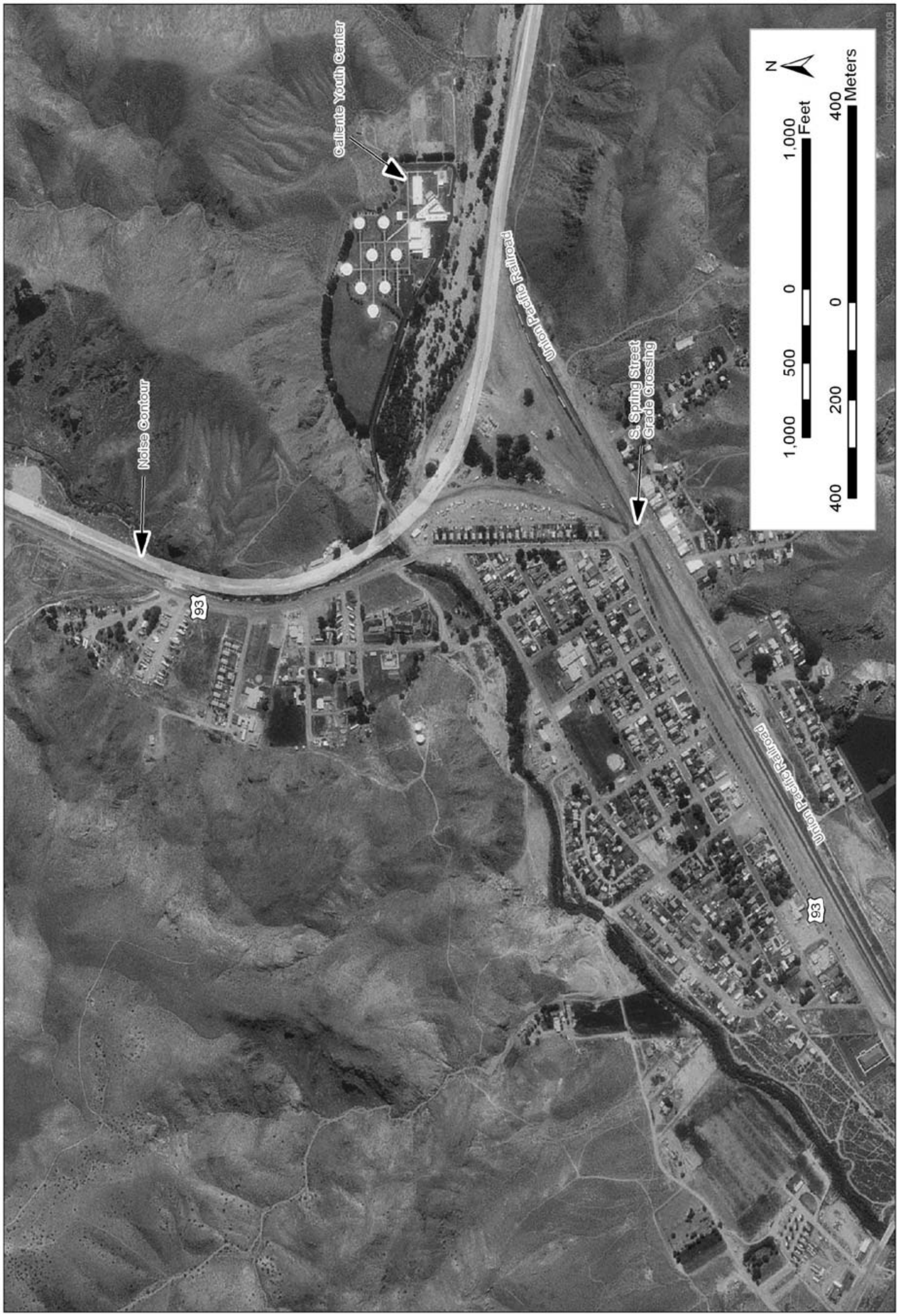


Figure 4-17 65 dBA DNL contour, Caliente, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114E52.sid.)

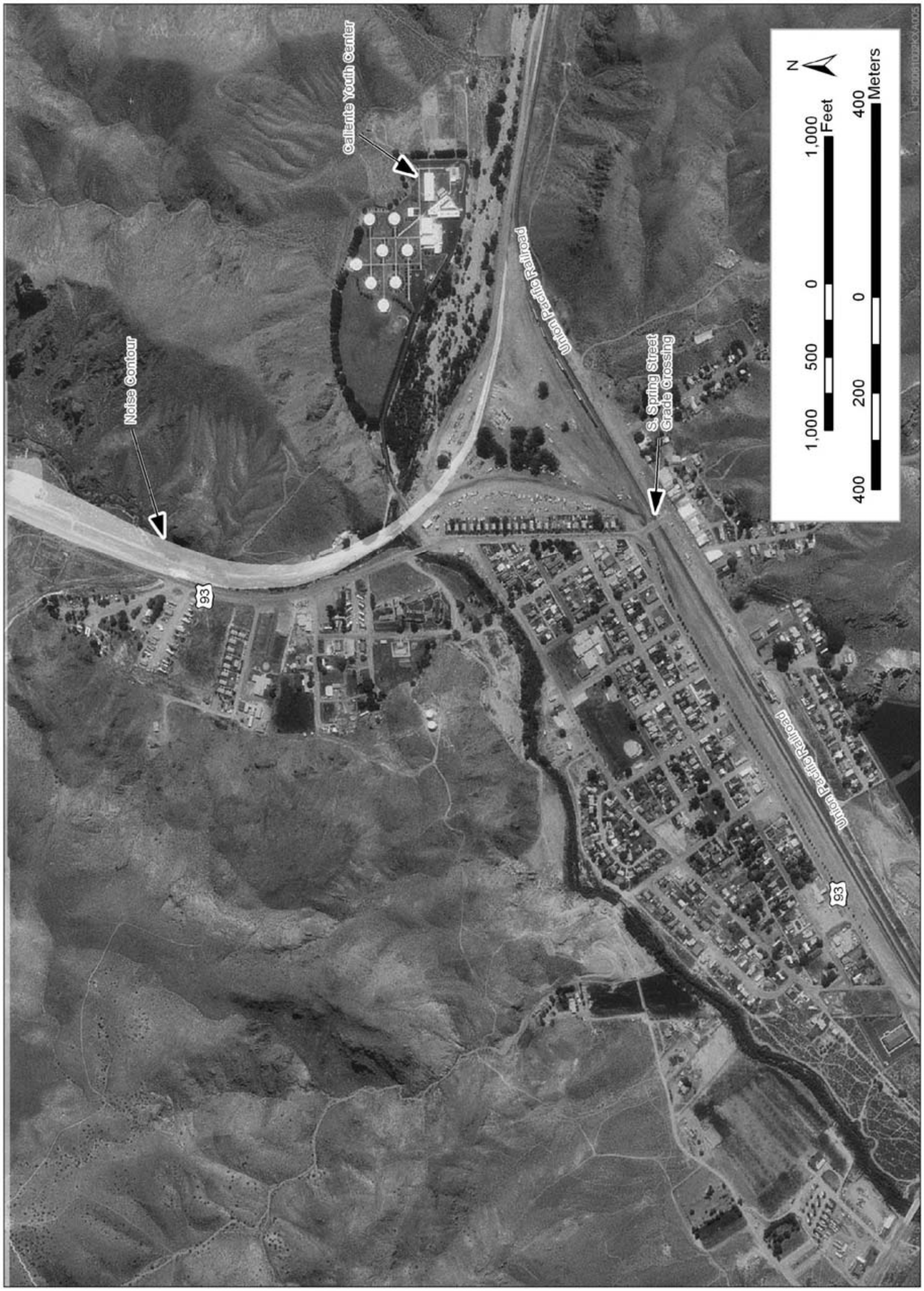


Figure 4-18. 3 dBA increase contour, Caliente, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114E52.sid.)

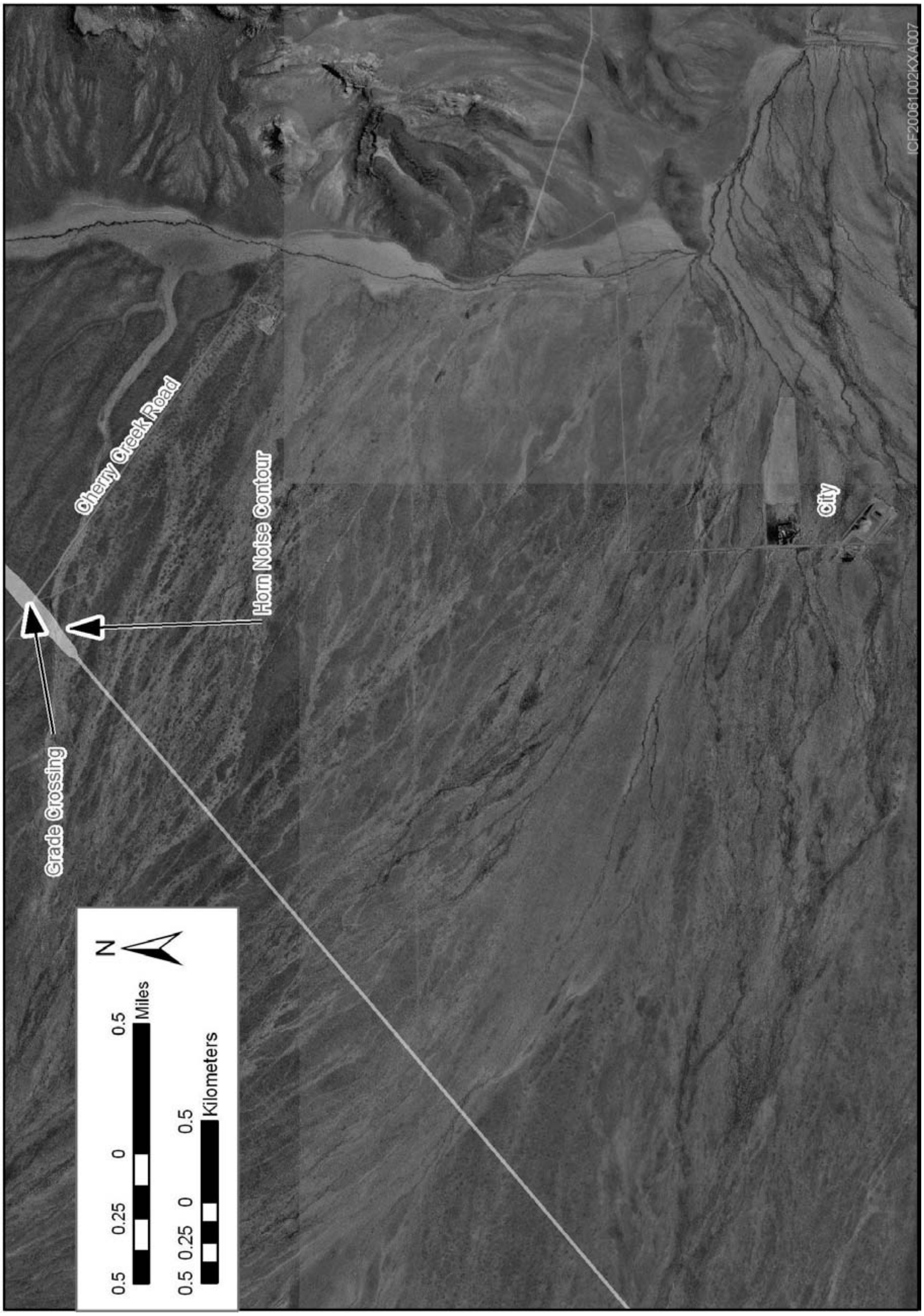


Figure 4-19. 65 dBA DNL noise contour, Garden Valley alternative segment 1.
(Source: DIRS 174497-Keck Library 2004, filenames 38115A43.sid and 38115A44.sid.)

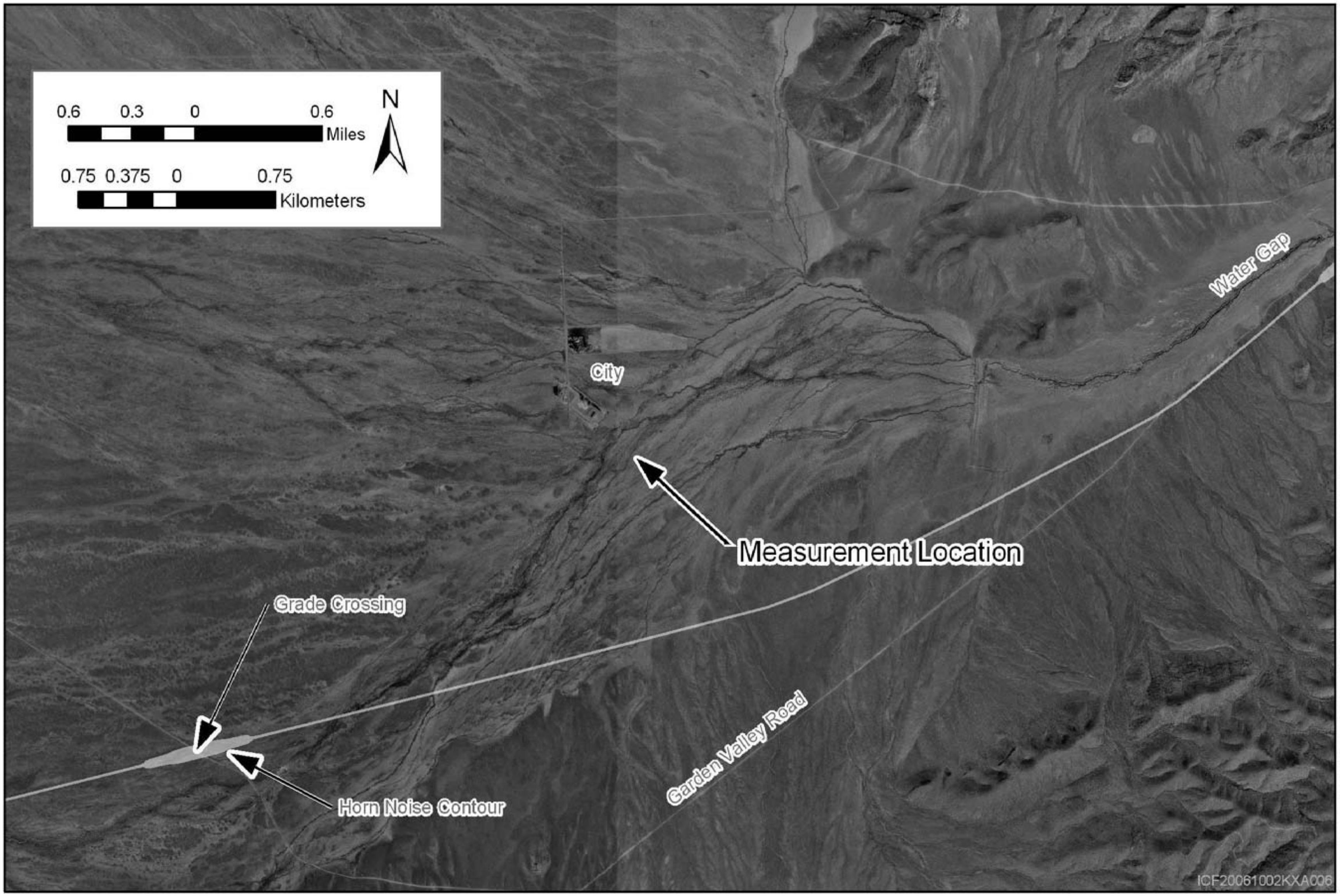


Figure 4-20. 65 dBA DNL contour, Garden Valley alternative segment 2.
(Source: DIRS 174497-Keck Library 2004, filenames 38115A43.sid and 38115A44.sid.)

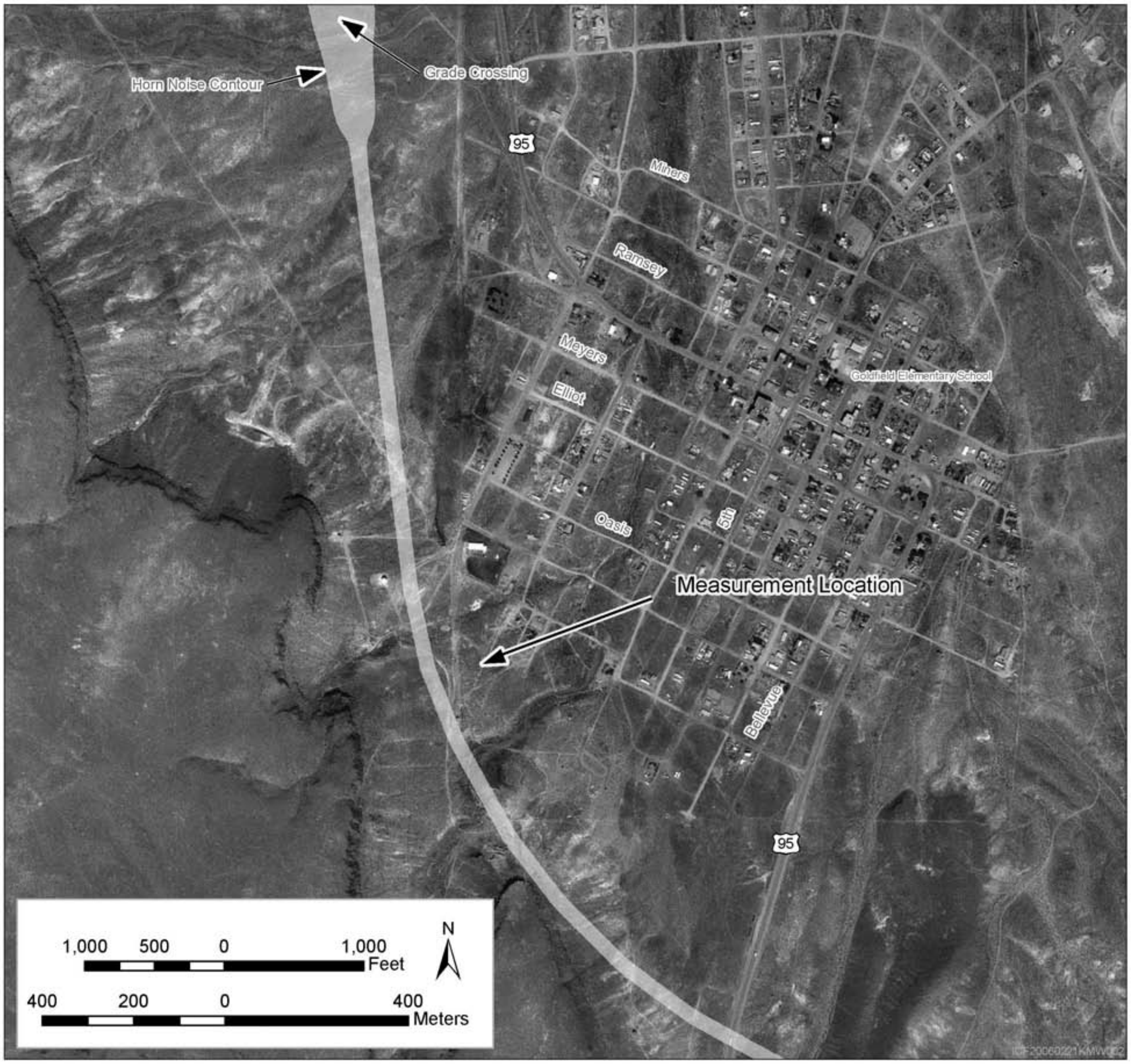


Figure 4-21. 65 dBA DNL contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37117F21.sid.)

DOE evaluated the potential impacts from vibration during railroad operations by using train-induced vibration levels as a function of distance from a rail line, along with vibration levels likely to result in building damage or annoyance, in combination with information on the location of residences or other buildings in relation to the rail line.

Unlike noise, vibration impacts are evaluated on the basis of maximum level. A freight train traveling at 80 kilometers (50 miles) per hour will generate a vibration velocity level of 95 decibels with respect to 1 micro-inch per second (VdB), measured 3 meters (10 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). This level of vibration is substantially lower than levels that can cause cosmetic building damage (0.51 centimeter per second [0.20 inch per second]), nominally a vibration velocity of 106 VdB, or 100 VdB, assuming a crest factor of 2 (DIRS 176857-Martin 1980, all).

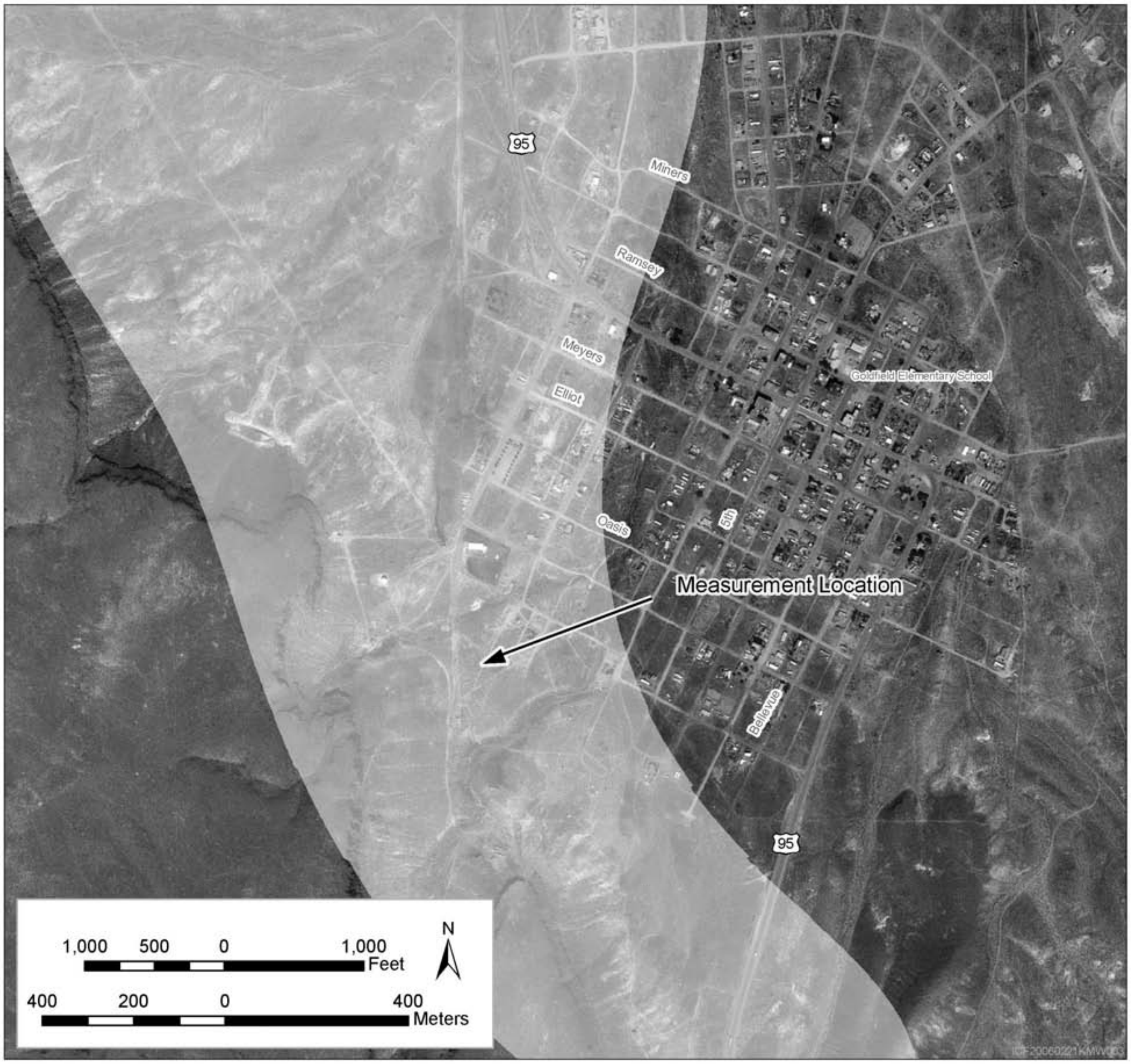


Figure 4-22. 3 dBA increase contour, Goldfield, Nevada.
(Source: DIRS 174497-Keck Library 2004, filename 37114F21.sid.)

This level of vibration is even lower than that which can cause structural damage (126 VdB) (DIRS 175495-Nicholls, Johnson, and Duvall 1971, all). There are no buildings within 3 meters of the proposed rail alignment, so there would be no adverse vibration impacts to buildings.

According to the Federal Transit Administration, a vibration velocity of 80 VdB or above constitutes an impact in terms of human annoyance for infrequent train events (that is, fewer than 70 events per day). For a freight train traveling 80 kilometers (50 miles) per hour, this annoyance impact distance extends approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no residential buildings within this distance of the Caliente, Eccles, Garden Valley, or Goldfield alternative segments; therefore, DOE expects no adverse vibration impacts related to annoyance.

4.2.8.4 Impacts of the Shared-Use Option

The Shared-Use Option could result in increased train operations because DOE would allow commercial shippers to use the rail line. Such increased operations could result in increased noise impacts because DNL is a function of the number of train events per day. Increased train operations would not affect vibration impacts because vibration is evaluated on a maximum-level basis only.

The typical train under the Shared-Use Option would consist of three to four locomotives and up to 60 railcars. The average length of a car would be 18 meters (60 feet) for a total length (railcars only) of 1,100 meters (3,600 feet). Trains would operate along the rail line at a top speed of 80 kilometers (50 miles) per hour. Table 4-99 shows distances to the wayside 65 DNL noise contour, assuming an average of 3.3 trains per day (the Proposed Action plus Shared-Use Option train volumes).

Table 4-99. Summary of distances to 65 dBA DNL under the Caliente rail alignment Shared-Use Option in Caliente, Garden Valley, and Goldfield.[a]

Area	Train speed in kilometers[b] per hour	Distance in meters[c] to 65 dBA DNL contour		Noise level increase (dBA)
		Wayside	Horn	
Caliente	80	20	90	0 to 3
Garden Valley	80	20	90	0
Goldfield	80	20	90	0 to 10

a. dBA = A-weighted decibels and DNL = day-night average noise level.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.

For Goldfield, the Shared-Use Option would cause increases in the noise level of up to 10 dBA. DOE estimated that 37 receptors would be within the 3 dBA increase contour under the Shared-Use Option. However, no receptors would be within the 65 DNL noise contour; therefore, there would be no adverse noise impact. For Caliente, the Shared-Use Option would cause increases in the noise level of up to 3 dBA; there would be no receptors within the 65 DNL contour. For the Eccles alternative segment, there would be two receptors within the 3 dBA increase contour, but there would be no receptors within the 65 DNL contour. For Garden Valley, there would be no receptors within the 3 dBA increase contour or 65 DNL contour. Therefore, there would be no adverse noise impacts associated with railroad operations under the Shared-Use Option.

4.2.8.5 Responsible Opposing Viewpoint and DOE Response

In an opposing viewpoint about noise levels in Garden Valley, a report entitled *Adverse Noise Impacts on "City" Sculpture* (DIRS 174749-Saurenman 2004, all) asserts that construction and operation of the proposed railroad along the Caliente rail alignment would cause noise impacts on *City* on the basis of audibility of train sound. The Saurenman report presents low ambient noise readings, on the order of 12 dBA, and notes that manmade noise sources, such as aircraft, can be heard from long distances away. The ambient noise measurements were taken over a 2-hour period. The Saurenman report asserts that if train horns were sounded in Garden Valley, the sound would be audible and potentially intrusive throughout the valley. The Saurenman report also presents potential options for reducing noise impacts, including sound walls, eliminating horn sounding by developing a quiet zone, and moving the rail line farther away from Garden Valley.

DOE does not agree with the conclusions of the Saurenman report. While locomotive warning horns and wayside noise would likely be audible in the vicinity of *City*, the audibility of noise due to manmade sources would not necessarily constitute an adverse impact. Train noise would not exceed train noise impact criteria under STB noise regulations (49 CFR 1105.7e(6)). Furthermore, special lands that employ impact criteria based on audibility, such as the Grand Canyon National Park, have special noise regulations imposed by the U.S. Congress. This area in Garden Valley does not fall under the jurisdiction of this special type of noise regulation. The Saurenman report presents low ambient noise readings, and DOE measurements also indicate low levels of noise. However, the DOE noise measurements were recorded over a more statistically representative 24-hour period (DNL), and indicate high noise levels due to substantial military aircraft activity. According to the Federal Interagency Committee on Noise, the DNL is the best noise metric with sufficient scientific standing to assess cumulative noise exposure, public health and welfare, and land-use planning (DIRS 174552-Federal Interagency Committee 1992, all). While short-term measurements (such as the 2-hour measurement in the Saurenman report) might indicate low noise levels for certain periods, the more relevant ambient DNL at this location is much higher than the DNL that would be associated with the Proposed Action.

4.2.8.6 Summary

Table 4-100 lists potential noise and vibration impacts related to construction and operation of the proposed railroad along the Caliente rail alignment.

During the construction phase, noise levels at certain receptor locations in Caliente would be higher than impact criteria (see Table 4-93), but lower than impact criteria in the other locations studied. During the operations phase, estimated noise levels at receptor locations would be lower than adverse impact criteria (65 DNL, with a 3 dBA or greater increase from the baseline); therefore, there would be no adverse noise impacts associated with railroad operations.

During the construction and operations phases, vibration levels would not exceed the Federal Transit Administration damage criteria of 0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings (see Table 4-96); therefore, DOE would expect no building damage due to vibration. In addition, train-generated vibration levels would be lower than Federal Transit Administration human annoyance criterion.

Table 4-100. Summary of potential impacts from noise and vibration as a result of constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 1 of 2).

Location (county)	Proposed Action	
	Construction impacts	Operations impacts
Alternative segment		
Caliente (Lincoln County)	Noise from construction activities would exceed Federal Transportation Administration guidelines. Daytime limits would be exceeded by 11 dBA by construction equipment noise and by 7 dBA from pile driving; 30-day DNL limit would be exceeded by 2 dBA by construction equipment noise and by 12 dBA from pile driving. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria. There would be no adverse impact from the operation of construction trains. No receptors would be within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria.	There would be no adverse impacts from noise from operation of trains along the rail alignment. No receptors would be within the 3 dBA increase contour or the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria.

Table 4-100. Summary of potential impacts from noise and vibration as a result of constructing and operating the proposed railroad along the Caliente rail alignment[a] (page 2 of 2).

Location (county)	Proposed action	
	Construction impacts	Operations impacts
Alternative segment		
Eccles (Lincoln County)	Daytime limits would be exceeded by 5 dBA by construction equipment noise. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 65 DNL contours.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. No receptors would be within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria.
Garden Valley 1, 2, 3, and 8 (analyzed because of Special Recreational Management Area status) (Lincoln and Nye Counties)	No adverse impacts. Noise from construction activities would fall below Federal Transportation Administration guidelines. The 30-day average DNL at Garden Valley 1, 2, 3, or 8 would all be below 75 DNL. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 65 DNL contours.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. No receptors would fall within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria.
Goldfield 1 and 4 (Nye and Esmeralda Counties) Goldfield 3 (Nye County)	Noise from construction activities would fall below Federal Transportation Administration guidelines. The 30-day average DNL at Goldfield 1, 3, or 4 would all be below 75 DNL. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 65 DNL contours.	There would be no adverse impacts from the operation of trains along the rail line. No receptors would fall within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria.
Quarries		
CA-8B (Lincoln County)	There would be no receptors in the vicinity of CA-8B.	There would be no receptors in the vicinity of CA-8B.
NN-9A and NN-9B (Nye County)	There would be no receptors in the vicinity of NN-9A or NN-9B.	There would be no receptors in the vicinity of NN 9A or NN-9B.
ES-7 (Nye County)	The nearest receptor would be approximately 1,500 meters[b] away from ES-7; therefore, potential impacts would be small.	The nearest receptor would be approximately 1,500 meters[b] away from ES-7; therefore, potentia impacts would be small.
NS-3A and NS-3B (Esmeralda County)	There would be no receptors in the vicinity of NS-3A or NS-3B.	There would be no receptors in the vicinity of NS- 3A or NS-3B.
Rail line facilities, construction camps, access roads, water wells	There would be no receptors near these facilities.	There would be no receptors near these facilities.

a. Adverse impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.
b. To convert from meters to feet, multiply by 3.2808.

4.2.9 SOCIOECONOMICS

This section describes potential impacts to socioeconomic conditions (employment and income, population and housing, public services, and transportation) from constructing and operating the proposed railroad along the Caliente rail alignment. This section does not attribute socioeconomic impacts to the rail line alternative segments; rather, it describes impacts of the Proposed Action as a whole on the region of influence. Section 4.2.9.1 describes the methodology DOE used to assess potential impacts; Section 4.2.9.2 describes potential construction impacts; Section 4.2.9.3 describes potential operations impacts; Section 4.2.9.4 describes potential impacts under the Shared-Use Option; and Section 4.2.9.5 summarizes potential impacts.

Section 3.2.9.1 describes the region of influence for the socioeconomic analysis.

4.2.9.1 Impact Assessment Methodology

DOE analyzed socioeconomic impacts by comparing projected conditions in the region of influence during the construction and operations phases with projected baseline conditions (without the project) described in Section 3.2.9. While the Timbisha Shoshone Trust Lands are included in the region of influence, they were not included in the socioeconomic analysis because no economic activity or growth is currently taking place or planned on these lands. Sections 4.2.9.1.1 through 4.2.9.1.4 describe the methods DOE used to estimate impacts to socioeconomic conditions.

4.2.9.1.1 Employment and Income

Both the projections of baseline employment and income conditions (without the project) and projections of conditions during the construction and operations phases came from the Regional Economic Models, Inc., *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all) described in Section 3.2.9 and Appendix J, Socioeconomics. Impacts are stated in terms of the number of jobs, ***gross regional product***, ***real disposable income***, and state and local government spending. Direct economic effects are the changes in jobs, gross regional product, and income in sectors that would supply directly needed goods and services, such as heavy-duty equipment, during railroad construction and operations. Indirect or secondary economic effects are the changes in sectors that would supply goods and services to the direct sectors (such as the production of construction material components). Secondary effects also would include the spending of income earned from the project (known as indirect effects). The extent to which a local economy could supply goods and services to the proposed project would be constrained by its level of economic development. DOE has assessed adverse impacts qualitatively in terms of disruption of economic activity, particularly for mining and agricultural operations.

> **Gross regional product** is the value of all final goods and services produced in a specified region.
>
> **Real disposable income** is the value of total after-tax income received; it is the income available for spending or saving.

DOE used runs of the *Policy Insight* model to estimate construction impacts over 5 years and operations impacts over 52 years (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all). The actual construction phase would range from 4 to 10 years. DOE expects the construction phase to last a minimum of 4 years and 6 months, so the Department modeled a fifth year. Because impacts, described in this analysis as peak changes from the baseline (without the project), would be strongest and most concentrated under a shorter construction schedule, DOE modeled only the 5-year construction phase. Construction-related impacts under a 10-year schedule would be bounded by the analysis described. Noteworthy impacts associated with a longer construction phase are identified, as appropriate. For the operations phase, this analysis assumes that the first 2 years represent a transition period. During these 2 years (2015 and 2016), the railroad support facilities would be operational. Starting in 2017, DOE would begin shipping spent nuclear fuel and high-level radioactive waste to Yucca Mountain; the shipping campaign would span up to 50 years, with up to 50 years of active shipping.

Because the socioeconomic impacts would vary depending on the county in which DOE placed the Nevada Railroad Control Center and the National Transportation Operations Center, DOE modeled two different scenarios for both the construction and operation phases. Scenario 1 has the Nevada Railroad Control Center and the National Transportation Operations Center in Lincoln County near the beginning of the rail line; Scenario 2 has these facilities in Nye County near the end of the rail line.

4.2.9.1.2 Population and Housing

DOE estimated population impacts by comparing project-related increases or decreases at the county level against the projected population figures without the project. These estimates came from the same *Policy Insight* model runs used to estimate employment and income. Population changes are related to changes in employment; as employment increases in an area, permanent population could also increase, although increases in population typically lag behind increases in employment. DOE assessed impacts on housing by evaluating worker and permanent population increases associated with railroad construction and operation against county and community housing-capacity information.

4.2.9.1.3 Public Services

DOE assessed impacts to public services as changes to the county or community baseline capacity (assuming no railroad), as described in Section 3.2.9. There would be positive impacts when there were project-related enhancements that the community could also access. Adverse impacts would occur when increased demand exceeded the capacities of public services or hastened the deterioration of a particular public service, resulting in a lower ***level of service*** to community users.

4.2.9.1.4 Transportation Infrastructure

There could be an adverse impact on roadways within the region of influence if construction or operation of the proposed railroad would degrade the level of service of a roadway to unacceptable levels (below a level of service of C) as a result of project-related traffic. Section 3.2.9.3.5.1 includes a definition of level of service. As discussed in Section 3.2.9, existing annual average daily traffic data for the major roadways within the Caliente rail alignment region of influence were provided by the Nevada Department of Transportation. Baseline levels of service of the roadways were then projected using the Highway Capacity Manual guidelines. To assess the impacts the railroad would have on the roadways, DOE added potential project-related vehicles to baseline traffic volumes and then estimated new levels of service. The Department did not calculate road-traffic delays at highway-rail grade crossings because all roads the rail line would cross have very low traffic levels. Section 4.2.10, Occupational and Public Health and Safety, provides the safety analysis (traffic accidents and fatalities) for the proposed railroad along the Caliente rail alignment.

4.2.9.2 Rail-Line Construction Impacts

The Caliente Implementing Alternative includes construction and operation of the rail line and its associated construction and operations support facilities. Inputs to the analysis using the *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all) included construction and operations costs, or labor needs, or both when available. The inputs also accounted for the differences between expected project-related wages and average wages, by county and economic sector, contained in the *Policy Insight* model. Project-related wages would generally be higher than the average wages embedded in the model.

The common social and economic activities and changes associated with the construction of the proposed railroad would include:

- A period of brief, intense elevation in project-related employment
- Population increases
- A slightly slower rate of growth in the level of employment as the economy moved from the construction phase to the operations phase
- Some effects on public services (such as health care), particularly where construction activities were concentrated near communities
- Some effects on transportation resources

The equivalent of 1,100 full-time workers would be required during the grading phase of the construction phase, but fewer workers would be required as construction activities moved toward completion (this number reflects full-time work over a typical annual work year of approximately 2,000 hours [accounting for weekends, holidays, and vacation and sick days], and a construction phase of 54 months). More than 1,100 people would be performing this work, because not all employees would work full time. DOE used *Policy Insight* population projections to assess population-related impacts (for example, impacts to housing stock, ***infrastructure***, public services) related to the total number of actual employees resulting from the project. DOE would establish up to 12 temporary construction camps along the rail alignment to house workers.

Construction impacts for employment, income, and population are drawn from model runs of *Policy Insight* (DIRS 182251-REMI 2007, all; DIRS 180485-Bland 2007, all; DIRS 179558-Bland 2007, all), which used a 5-year modeling period. As mentioned above, the actual construction phase would range from 4 to 10 years; impacts associated with the longer construction phase are noted as appropriate; however, levels of impacts would be higher and more concentrated under the modeled 5-year schedule.

4.2.9.2.1 Employment and Income

Direct employment and income impacts would stem from the hiring of construction workers and their spending of wages. Workers would have the option of shopping in towns near the construction camps, or relying on the cafeterias, drug stores, and non-perishables markets at the construction-camp commissaries (DIRS 174087-Nevada Rail Partners 2005, p. 4-5). Indirect impacts could result from employment of workers by businesses that supply goods and services in support of construction work, including the construction and operation of construction camps, where services such as catering, utility supply, and waste disposal would be needed. For purposes of this analysis, and consistent with the methodology established in the Yucca Mountain FEIS, DOE assumes that most construction workers would live in Clark County (DIRS 155970-DOE 2002, Section 4.1.6.2.1) and reside in construction camps. DOE makes this assumption because the construction sectors in Nye, Lincoln, and Esmeralda Counties are not large enough to provide enough workers for the construction activities.

Table 4-101 lists potential changes in economic measures during the construction phase for the two modeled scenarios. Appendix J describes the analysis in more detail. Each scenario includes the impact of constructing the proposed rail line and railroad construction and operations support facilities. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014. All construction-related economic impact values are presented in 2006 dollars.

Table 4-101. Estimated changes in economic measures during the construction phase – Caliente rail alignment (page 1 of 2).[a]

County/scenario/measure	Construction year				
	2010	2011	2012	2013	2014
Lincoln County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	103	106	127	78	66
State and local government spending	$511,895	$664,402	$803,395	$809,879	$877,898
Real disposable income	$3,615,195	$2,310,965	$2,766,970	$2,172,683	$2,829,060
Gross Regional Product	$25,520,040	$16,081,431	$19,192,542	$8,554,134	$3,871,530
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	100	106	127	78	56
State and local government spending	$505,440	$658,710	$798,300	$805,320	$827,792
Real disposable income	$3,575,520	$2,303,730	$2,761,287	$2,168,167	$2,225,479
Gross Regional Product	$23,563,800	$16,075,800	$19,188,009	$8,550,351	$3,387,124
Nye County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	239	211	269	176	82
State and local government spending	$573,000	$625,000	$766,000	$725,000	$665,000
Real disposable income	$9,487,000	$6,203,000	$9,494,000	$7,287,000	$3,813,000
Gross Regional Product	$34,021,000	$28,256,000	$41,980,000	$24,757,000	$8,609,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	239	211	273	182	85
State and local government spending	$573,000	$625,000	$771,000	$739,000	$682,000
Real disposable income	$9,479,000	$6,202,000	$9,635,000	$7,540,000	$3,955,000
Gross regional product	$34,012,000	$28,256,000	$42,789,000	$26,157,000	$9,087,000

Table 4-101. Estimated changes in economic measures during the construction phase – Caliente rail alignment (page 2 of 2)[a].

	Construction year				
County/scenario/measure	2010	2011	2012	2013	2014
Esmeralda County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	13	13	12	9	8
State and local government spending	$80,801	$107,651	$129,294	$120,868	$117,176
Real disposable income	$1,903,902	$1,985,531	$2,044,025	$1,147,679	$963,027
Gross Regional Product	$2,177,398	$265,243	$271,566	$1,072,654	$403,627
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	13	13	12	9	8
State and local government spending	$80,789	$107,640	$129,335	$120,984	$117,278
Real disposable income	$1,903,590	$1,985,490	$2,045,289	$1,150,005	$963,500
Gross regional product	$2,177,370	$265,239	$271,651	$1,072,830	$403,696
Clark County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County					
Employment	1,786	1,770	1,826	1,035	542
State and local government spending	$1,519,790	$2,835,480	$4,099,750	$4,532,759	$4,514,596
Real disposable income	$99,635,560	$100,639,540	$107,233,881	$64,900,988	$39,286,436
Gross Regional Product	$139,697,420	$144,233,260	$154,007,708	$92,116,874	$51,490,741
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	1,771	1,769	1,832	1,046	548
State and local government spending	$1,506,960	$2,823,210	$4,094,729	$4,538,898	$4,527,982
Real disposable income	$98,783,100	$100,608,300	$107,590,977	$65,557,089	$39,741,624
Gross regional product	$138,528,000	$144,144,000	$154,498,617	$93,063,087	$52,053,066

a. Sources: DIRS 179558–Bland 2007, all; DIRS 180485-Bland 2007, all.

Table 4-101 lists the estimated changes to current trends (without construction of the railroad) in employment and income for each year of the construction phase. The discussion of the data in the table attempts to identify and address the largest deviations ("peak" changes) from the current trends without the railroad as a way to show the upper bounds of potential impacts.

In all four counties, changes to the baseline (conditions without the proposed railroad) would be similar under the two scenarios. In Lincoln County, the increase in peak employment would represent 5.6 percent of the total projected employment levels in Lincoln County in the absence of the project. The peak construction-related impact to real disposable income would be 4.1 percent above the baseline, and the impact to state and local government spending would be 1.9 percent above the baseline. Gross regional product is the one variable for which there is a slight difference between the two scenarios. If the Nevada Railroad Control Center and National Transportation Operations Center were constructed in Lincoln County, gross regional product would be 28.4 percent above the baseline. If these facilities were constructed in Nye County, gross regional product would be 26.2 percent above the baseline. Residents would likely feel the peak changes to employment and gross regional product.

In Nye County, the project-related increase in employment at peak would correspond to 1.2 percent of the total projected employment levels in Nye County without the project. The peak construction-related impact to real disposable income would be a less than 1-percent increase above the baseline, gross regional product would be 3.5 percent above the baseline, and state and local government spending would correspond to less than 1 percent above the baseline.

In Esmeralda County, the project-related increase in employment at peak would correspond to 2.7 percent of the total projected employment levels without the project. The peak construction-related impact to real disposable income would be a 7.6-percent increase above the baseline, gross regional product would be a 9.5-percent increase above the baseline, and state and local government spending would correspond to a 2.2-percent increase above the baseline.

In Clark County, the peak increase in real disposable income, gross regional product, and ***total employment*** would correspond to an increase of slightly more than one-tenth of 1 percent of the baseline in Clark County. The peak construction-related impacts to state and local government spending would correspond to less than one tenth of 1 percent above the respective baselines, meaning that all impacts, if any, would be small in such a large economy.

The major economic activities that could be adversely affected by construction of the proposed railroad along the Caliente rail alignment are mining and grazing interests. Economic activities could be disrupted during the construction phase, which could range from 4 to 10 years. Impacts on private lands (other than patented mining claims) would be small, because as discussed in Section 3.2.2, the Caliente rail alignment would lie almost entirely within BLM-administered public land. DOE would anticipate impacts to private land mainly in the Goldfield area.

There also could be limited disruption of economic activity from construction impacts on the transportation infrastructure as the movement of construction equipment and supplies temporarily disrupted traffic flow along local road systems. Under the 4-year construction schedule, DOE traffic modeling predicts that construction of the rail line itself would not affect traffic volume on local roads, but that construction of facilities might. Construction of the Maintenance-of-Way Headquarters Facility, the Interchange Yard, and the Staging Yard would affect traffic on U.S. Highway 95 between Goldfield and Tonopah and U.S. Highway 93 at Caliente; however, the level of service would remain the same in both locations. DOE would limit the impact of these disruptions by measures such as limiting road closures to low-traffic periods. Construction of the facilities inside the Yucca Mountain Site boundary near the repository (the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and the National Transportation Operations Center) would affect traffic on U.S. Highway 95 at the entrance to the Yucca Mountain Site, resulting in a drop in level of service from a B to a C at peak times during the construction phase. There would be fewer such impacts under a 10-year construction schedule, because worker trips and materials shipments would be spread over a longer period. As discussed in Section 4.2.11, Utilities, Energy, and Materials, the supplies needed for construction would not create shortages at a local, regional, or national level. Primary materials include steel for rails and concrete for rail ties, bridges, and drainage structures. These materials are available regionally and nationally; purchasing would not be expected to create demand and supply impacts, and there should be no harmful price effects.

There could be some reductions in mining- and agriculture-related employment and income because of construction-related land disturbances. The nominal width of the rail line construction right-of-way would include land upon which there are grazing and mining activities. The construction right-of-way might be narrower in certain locations to minimize impacts to lands with mining claims, or wider in other places (such as cut and fill areas and bridges) that could affect parcels adjoining the construction right-of-way where mining and agricultural activities take place.

The only mining claims that would be within the rail line construction right-of-way are associated with South Reveille alternative segments 2 and 3, common segment 3, and the three Goldfield alternative segments (see Figure 3-13). Although DOE would reduce the area of disturbance to minimize impacts to these claims, South Reveille alternative segments 2 and 3 would intersect 72 claims, common segment 3 would intersect 166 claims, Goldfield alternative segment 1 would intersect 474 claims, Goldfield alternative segment 3 would intersect 359, and Goldfield 4 would intersect 538.

If parties with existing mining claims have plans to explore, develop, or produce minerals on claims within the construction right-of-way, these plans might require accommodations to allow for both construction and mining activities to proceed. Such accommodations might have economic consequences. DOE recognizes that mineral exploration and development is strongly tied to the price of mineral commodities. However, foreseeable impacts to mining from railroad construction would be very small because the mineral production in affected districts is only a small percentage of overall mineral production in Nevada and the number of mining claims the rail line would cross would be small. Further, construction would only temporarily affect the filing of new claims. However, individuals and localized areas could feel the impacts more severely.

As described in Section 4.2.2.2.3.2, wherever the rail line would cross a grazing allotment, DOE quantified the amount of forage loss in animal unit months in accordance with BLM standards. Factors that influence the determination of permitted animal unit months include quantity and quality of forage; type of forage; season in which the forage will be grazed; kind and mix of grazing animals; presence of water; topography; soil, climate, and disturbance regimes; wildlife cover; proper use factor; and management objectives. In 2001, the State of Nevada Department of Agriculture commissioned a report, *Nevada Grazing Statistics Report and Economic Analysis for Federal Lands in Nevada,* in which one animal unit month was assigned a value of $53.40 in direct and indirect contributions to the economy (DIRS 176949-Resource Concepts 2001, p. 47). DOE used this value to estimate economic losses due to impacts to grazing. Section 4.2.2, Land Use and Ownership, describes for each potentially affected grazing allotment, the potential impacts to grazing activities from a land-use perspective.

Grazing allotments within the Caliente rail alignment construction right-of-way would be affected in Lincoln and Nye Counties for a total potential loss of up to 1,083 animal unit months and $57,000 to the local economy during each year of construction activity. This is a conservative estimate, because it assumes DOE would select only the most disruptive alternative segments. Table 4-102 summarizes animal-unit-month-loss information presented in Section 4.2.2 and the corresponding economic impact. Table 4-102 only lists portions of the Caliente rail alignment that would result in a loss (for example, the

Table 4-102 Segment-specific annual economic impacts to grazing allotments during construction of the proposed rail line – Caliente rail alignment.

Rail line segment	Animal unit months lost[a,b]	Value ($)
Caliente alternative segment	19	1,000
Eccles alternative segment	38	2,000
Caliente common segment 1	454	24,000
Garden Valley alternative segment 1	125	6,700
Garden Valley alternative segment 2	134	7,200
Garden Valley alternative segment 3	124	6,600
Garden Valley alternative segment 8	154	8,200
Caliente common segment 2	128	6,800
South Reveille alternative segment 2	26	1,400
South Reveille alternative segment 3	30	1,600
Caliente common segment 3	250	13,000
Oasis Valley alternative segment 1	8	400
Oasis Valley alternative segment 3	12	600
Common segment 6	17	900
Totals[c]	1,083	57,000

a. Figures for animal unit months lost for the Facilities at the Interface with the Union Pacific Railroad Mainline and South Reveille alternative segments include impacts from associated quarries and the Staging Yard.
b. The values shown are worst-case values of the animal unit months that would be lost for 1 year (per year during proposed railroad construction and operations). The table lists only those portions of the rail alignment that would result in a loss.
c. Totals might differ from sums of values due to rounding.

Goldfield alternative segments are not included because none would affect animal unit months on nearby allotments). DOE calculated the totals to two significant figures by adding common segments and the most conservative alternative segment losses (shown in bold type).

Of the totals, about 677 of the animal unit months and $36,000 would be lost in Nye County, and 406 animal unit months and $22,000 would be lost in Lincoln County, assuming that losses from portions of the Caliente rail alignment (for example, common segment 1) that would cross parts of both counties were evenly split between the two counties. As presented in Table 3-61, Nye and Lincoln Counties had gross regional products of $1.16 billion and $93.6 million, respectively, in 2007. In economies of these scales, the overall impacts of grazing losses would be small. However, individuals and localized areas could feel the impacts more severely.

The BLM could elect to redraw the boundaries of grazing allotments to address these effects. During the construction phase, there could be an additional impact from construction trains colliding with cattle.

DOE would compensate ranchers for any such losses of cattle in accordance with Nevada Revised Statutes 705.150 to 705.200.

The potential annual economic impacts to prime farmland areas are described in relation to employment and lost market value of crops. As discussed in Section 4.2.1.2.1.3, a total of 0.43 square kilometer (110 acres) of prime farmland soils would be lost under the Caliente Implementing Alternative. This calculated amount of prime farmland is based on the total disturbed area, and is therefore an upper-bound measurement. Table 4-103 lists the estimated impacts to prime farmland.

Table 4-103. Potential annual impacts to prime farmland – Caliente rail alignment.

Rail line segment	Number of acres affected	Market value of crops per acre ($)	Workers per acre	Market value lost ($)	Employment lost
Caliente alternative segment					
Lincoln County	27	276	0.005	7,450	0.13
Eccles alternative segment					
Lincoln County	24	276	0.005	6,346	0.11
Caliente common segment 1					
Nye County	54	106	0.008	5,727	0.42

a. Source: DIRS 173571-USDA 2004, Tables 1 and 7.

Based on data from Nevada's Census of Agriculture, DOE estimated the market value of crops lost as $7,450 in Lincoln County if the Department selected the Caliente alternative segment and $6,346 if the Department selected the Eccles alternative segment. In Nye County, the analysis shows that crops valued at $5,727 would be lost due to Caliente common segment 1. DOE also estimates that less than one job would be lost in Lincoln County and Nye County under the Caliente Implementing Alternative.

4.2.9.2.2 Population and Housing

Population changes are related to changes in employment. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014, and estimated population impacts for the same period. Table 4-104 lists the estimated changes to population during the construction phase for each of the modeled scenarios. Appendix J describes the analysis in more detail. In Esmeralda County, population changes would be identical under either scenario. The peak population increases would be largely due to indirect employment effects.

In Lincoln County, the peak estimated population change attributed to railroad construction along the Caliente rail alignment would be an increase of 87 people, which would correspond to a 1.7-percent increase in the Lincoln County projected 2014 population level without the project. Twenty-one of these would be school-aged children, according to the age distribution of Lincoln County published by the Bureau of Census (DIRS 175922-Bureau of Census 2000, all).

In Esmeralda County, the peak population gain of 12 people would translate to two additional school-aged children, according to the age distribution of Esmeralda County published by the Bureau of Census (DIRS 175922-Bureau of Census 2000, all). The *Policy Insight*-estimated population gain attributed to railroad construction along the Caliente rail alignment represents a 1.1-percent increase over the projected 2014 population level for Esmeralda County without the project (DIRS 174313-Nevada State Demographer [n.d.], all).

Table 4-104. Estimated changes to population during railroad construction – Caliente rail alignment.[a]

Location	2010	2011	2012	2013	2014
Lincoln County					
Scenario 1: Railroad Control Center/National Transportation Operations Center in Lincoln County	42	58	71	77	87
Scenario 2: Railroad Control Center/National Transportation Operations Center in Nye County	41	57	71	77	81
Nye County					
Scenario 1: Railroad Control Center/National Transportation Operations Center in Lincoln County	62	73	105	132	136
Scenario 2: Railroad Control Center/National Transportation Operations Center in Nye County	62	73	106	136	140
Esmeralda County	5	8	10	11	12
Clark County					
Scenario 1: Railroad Control Center/National Transportation Operations Center in Lincoln County	398	732	1,047	1,144	1,125
Scenario 2: Railroad Control Center/National Transportation Operations Center in Nye County	395	730	1,045	1,146	1,128

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

In Nye County, the peak population increase would be 140 people, about 25 of whom would be school-aged children, according to the age distribution of Nye County published by the Bureau of Census (DIRS 171298-Bureau of Census 2004, all). The estimated population gain attributed to construction of the proposed railroad along the Caliente rail alignment would be less than a 1-percent increase over Nye County's projected population level without the project for all construction years.

In Clark County, the peak population increase would be 1,146 people. Of this increase, about 207 would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Bureau of Census 2004, all). The estimated population increase attributed to construction of the proposed railroad along the Caliente rail alignment would represent less than a 1-percent increase over Clark County's projected population level without the project for all construction years.

Impacts on housing infrastructure would be small during the construction phase because most construction workers would be housed in construction camps at strategic locations along the rail alignment, rather than in nearby communities. If construction workers elected not to stay in the camps, motels or recreational vehicle parks could substitute as housing options. As discussed in Section 3.2.9.3.3, lodging is available along U.S. Highway 95 in and around Goldfield, Beatty, and Town of Amargosa Valley. Between Goldfield and the Yucca Mountain Site, these towns offer eight motels with a total of 252 rooms, and six recreational vehicle parks with a total of 230 spaces. These lodging options could not accommodate all workers and completely substitute for construction camps.

Some contractors could elect to use commercially available facilities to house construction personnel, such as those in Caliente, Tonopah, Goldfield, Beatty, and Pahrump. As indicated in Section 3.2.9, it appears there would be sufficient vacant housing stock in these areas to meet the needs of construction personnel.

4.2.9.2.3 Public Services

Impacts to public services at the county level would likely be small because the population projections with the project show very limited increases in overall counts. An additional impact on local health-care capacity would be the primary impact on public services. The area that is likely to experience the greatest impacts is southern Nye County, where possibly the Rail Equipment Maintenance Yard, Cask Maintenance Facility, and the Nevada Railroad Control Center and National Transportation Operations Center would be.

4.2.9.2.3.1 Health Care. As presented in Section 4.2.10, Occupational and Public Health and Safety, during the construction phase, DOE expects approximately 660 total recordable and ***lost workday cases*** among involved and noninvolved workers; that is, fewer than 150 per year. Construction workers would be served by one of the health services centers at each construction camp to be staffed by four medical personnel who would rotate shifts (DIRS 174087, Nevada Rail Partners 2005, p. 4-5). In addition, Nevada Test Site personnel could provide medical services for construction workers along common segment 6 as they do at present for workers at the Yucca Mountain Site. As is the practice at both the Nevada Test Site and the Yucca Mountain Site, medical evacuation services from Las Vegas would transport cases to facilities in Clark County or in Utah as needed.

Nevertheless, to conservatively estimate potential impacts to health-care capacity in the region of influence, DOE assumed that all of the accident and injury cases would be treated at existing facilities in Nye County. This addition of fewer than 100 cases per year (related to the less than 1 percent increase in population attributable to the construction effort) could have a small adverse impact on the existing health-care capacity in Nye County. As described in Section 3.2.9, Nye County is considered medically underserved. The Nye Regional Medical Center in Tonopah has ambulance services, but lacks surgical facilities. The new hospital in Pahrump increased the county capacity to respond to routine and emergency and surgical needs, but the 25-bed increase in capacity might not be sufficient to meet current needs. Thus, any additional number of cases could affect the capacity of Nye County to address the health care needs of local users.

4.2.9.2.3.2 Education. Although there are only 29 schools in Lincoln, Nye, and Esmeralda Counties, it is unlikely that the capacities of these schools would be affected by railroad construction. DOE would not expect workers to be accompanied by their families and children because the availability of work camps and the use of 1- to 2-week work shifts would encourage workers to work from camps and return home on their weeks off to established residences in these counties, Clark County, or other Nevada counties. Any small increase in the number of children could be accommodated by the school systems, which have student-to-teacher ratios that are comparable to the national average.

4.2.9.2.3.3 Fire Protection. As discussed in Section 3.2.9, Lincoln, Nye, and Esmeralda Counties all meet fire-suppression needs with volunteers, with the exception of Pahrump, which has a paid fire department. Although most communities characterized in the region of influence are currently able to provide adequate protection (except for Pahrump, which is currently underserved), any increased demand would move them closer to the limit that existing resources (personnel and equipment) could address. However, each construction camp would have personnel dedicated to fire response, and water wells and a water-tank trailer that would be used to respond to fire emergencies at the camps and construction areas. Because of this and low population increases expected for volunteer-reliant Lincoln and Esmeralda

Counties, construction-phase activities would not have an adverse impact on fire-protection capacity in the region of influence.

4.2.9.2.3.4 Law Enforcement. Because workers would be dispersed along the rail alignment, and given the low crime rate in the counties that would be directly affected (Lincoln, Nye, and Esmeralda) (particularly in comparison to the substantially higher Clark County and national crime rates), it is unlikely that the incidence of crime would increase to the extent that existing law enforcement services became inadequate. Additionally, construction camps would be staffed with security personnel (DIRS 174087-Nevada Rail Partners 2005, pp. 4-4 to 4-7). Although civil or domestic issues requiring law enforcement interface would be handled by the appropriate authorities, there have not been detailed discussions on protocols and working relationships. Accommodations could be made to decrease the possibility of adverse impacts to local law enforcement capacity.

4.2.9.2.4 Transportation Infrastructure

4.2.9.2.4.1 Traffic Impacts. The increased traffic required to support proposed railroad construction would have some additional effects on existing roadways. Key roads likely to be affected are portions of U.S. Highways 95, 6, and 93, and State Route 375. At present, these roads are mainly operating at levels of service A or B as defined in Section 3.2.9, except for a stretch of U.S. Highway 95 south of U.S. Highway 6 in Tonopah that is operating at level of service C. There could be impacts along these routes, particularly in communities that are near construction sites for the railroad operations support facilities. Areas where local road systems could be most affected are Caliente/Eccles in Lincoln County, Tonopah, Beatty, Town of Amargosa Valley, at the entrance to the Yucca Mountain Site in Nye County, and Goldfield in Esmeralda County.

Railroad construction would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. Truck traffic would be highest at the beginning and end of the construction phase while equipment was brought in and taken away, and could therefore adversely impact traffic conditions during specific weeks. However, trucks could be directed to move during off-peak hours to minimize their impacts on local traffic. Additionally, most construction materials for the Interchange Yard, Staging Yard, and Maintenance-of-Way Trackside Facility would be transported by rail; therefore, there would be limited truck trips associated with the movement of materials for these facilities. For both reasons, the analysis does not account for transportation of materials, focusing instead on the transportation of workers to and from the work sites.

Construction of the rail line itself would not be likely to adversely affect traffic volumes on local roads, because much of the construction material would be transported by rail. Additionally, workers would be housed in construction camps close to work sites, so transportation of construction workers along local roads would be minimal. This would place only limited pressure on the transportation infrastructure, mainly at the end of a work week and possibly over the weekend when travel to local towns might increase. Therefore, the analysis of impacts to levels of service focuses on construction of the railroad operations support facilities.

The level of service analysis evaluates the additional traffic volume in terms of the "peak hour," which is the hour with the highest volume of traffic during a study period, usually a peak period. For example, DOE estimated that the movement of employees for the Rail Equipment Maintenance Yard and the Cask Maintenance Facility would require approximately 600 trips per day and 300 trips during the peak hour at the height of construction activities. The traffic analysis assumes that each employee would generate two vehicle trips per day, one of which would be during the peak hour.

The level of service analysis in this section is conservative because it considers construction activities during a peak period when all workers are working simultaneously. DOE estimated the number of workers assigned to each facility (DIRS 180921-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425- MTS 2007, p. 5). Table 4-105 lists the estimated number of vehicle trips during the construction phase.

Based on the estimated increases in traffic volumes listed in Table 4-105, DOE calculated the effect on the level of service of the affected roadways during peak hour traffic for construction of the three key facilities. All affected roadways were assumed to be configured as two-lane, non-divided, paved highways.

Table 4-105. Estimated highway trips during construction of the railroad operations support facilities – Caliente rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for construction of the Interchange Yard and Staging Yard	440	220
Employees for construction of the Maintenance-of-Way Facilities	340	170
Employees for construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility	600	300

a. Sources: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425-MTS 2007, p. 5.

The Interchange Yard would be near the former Union Pacific Railroad Caliente station and adjacent to the existing mainline (Caliente alternative segment) or immediately adjacent to the Union Pacific Railroad Mainline within the confines of Clover Creek Wash (Eccles alternative segment). As a conservative assumption, the analysis considered that the access point to the Interchange Yard would be on U.S. Highway 93 north of Caliente, because it is the busiest road segment for which traffic is measured. Construction of the Interchange Yard would degrade the level of service from A to B during the peak hour. A level of service of B is still considered free flow.

The Maintenance-of-Way Headquarters Facility would be 3 kilometers (5 miles) south of Tonopah, on the east side of U.S. Highway 95. The level of service on this highway would remain the same at C or better during the peak hour (that is, there would be no degradation of level of service). The Maintenance-of-Way Trackside Facility would be 5 kilometers (8 miles) south of U.S. Highway 6 on AR 504, close to the boundary of the Nevada Test and Training Range, and DOE assumed that its access point would be on U.S. Highway 6 east of the Tonopah airport. The level of service on this road would remain at A (that is, there would be no degradation of level of service).

Construction of the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and the National Transportation Operations Center would affect traffic on U.S. Highway 95 near the entrances to the Yucca Mountain Site, degrading its level of service from B to C during the peak hour. Level C would still represent stable traffic flow, but would mark the beginning of the range of flow that would become affected by interactions with others in the traffic stream.

4.2.9.2.4.2 Traffic Delay at Grade Crossings. DOE examined the potential for delays at grade-crossings along the Caliente rail alignment. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. A typical delay analysis at grade crossings accounts for train length, speed, and frequency, and lag time (the interval between the time when the gate goes down and the time the train passes, and the interval between the time the train leaves and the time the gate goes up). Additionally, a delay analysis also requires vehicular arrival and departure rates. Although grade-separated crossings are not mandatory for this project, rail line crossings of U.S. Highway 93, U.S.

Highway 95, State Route 318, and State Route 345 would be grade-separated, as described in Chapter 2. All remaining crossings, which would be at grade, would involve very-low-usage roads, and the impact on vehicle delay at these crossings would be small. A quantitative analysis of delay at grade crossings is not necessary for three reasons: there would be very few construction trains per day, the trains associated with the proposed railroad would be short compared to most freight trains, and vehicular traffic is low.

4.2.9.3 Railroad Operations Impacts

The common social and economic activities and changes associated with the operations phase would include:

- Increases in project-related employment, particularly associated with railroad operations support facilities
- Slight population increases associated with employment increases
- Some pressure on housing in southern Nye County where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, train crew quarters, and possibly the Nevada Railroad Control Center and the National Transportation Operations Center would be
- Continued effects on mining and agriculture
- Possible effects on public services (health and education)
- Possible effects on transportation infrastructure

4.2.9.3.1 Employment and Income

Local impacts during the operations phase would be linked to the location of facilities, size of the workforce, and the extent to which the community would provide goods and services to facilities and workers. Table 4-106 lists the estimated number of full-time-equivalent workers that would be required for each railroad operations support facility. DOE used these employment figures as input to the *Policy Insight* model.

Table 4-106. Estimated average employment by railroad operations support facility – Caliente rail alignment.[a]

Facility	Location	Workforce (full-time equivalent)
Facilities at the Interface with the Union Pacific Railroad Mainline	Eccles or Caliente	50
Cask Maintenance Facility	Collocated with the Rail Equipment Maintenance Yard	30
Nevada Railroad Control Center/National Transportation Operations Center	Staging Yard or at end of line collocated with the Rail Equipment Maintenance Yard	15
Maintenance-of-Way Trackside Facility	Nye County	40
Maintenance-of-Way Trackside Facility	Esmeralda County	10
Rail Equipment Maintenance Yard	Inside Yucca Mountain site boundary near the repository	25
Train crew	Train with overnight stays	10 (per train)

a. Sources: DIRS 179557-Nevada Rail Partners 2007, Table 3-A; DIRS 180921-Nevada Rail Partners 2007, Table 3.

As it did for railroad construction, DOE modeled two scenarios for railroad operations – one with the Nevada Railroad Control Center and the National Transportation Operations Center in Lincoln County (Scenario 1), and the other with these facilities in Nye County (Scenario 2).

DOE modeled employment of operations workers and some support workers as beginning in 2015 and ending in 2067. Table 4-107 lists the economic impacts of both scenarios during the operations phase. All operations-related economic impact values are given in 2006 dollars.

Table 4-107. Estimated changes in average annual economic measures during the operations phase – Caliente rail alignment.[a]

	Total employment	Real disposable income	Gross regional product	State and local government expenditures
Lincoln County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	100	$6.4 million	$8.9 million	$2.0 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	75	$4.3 million	$6.9 million	$1.4 million
Nye County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	75	$6.9 million	$15.9 million	$1.3 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	80	$7.2 million	$16.9 million	$1.4 million
Esmeralda County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	13	$1.1 million	$1.5 million	$207,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	13	$1.1 million	$1.5 million	$206,000
Clark County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	89	$12.5 million	$12.9 million	$1.5 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	96	$13.3 million	$14.2 million	$1.6 million

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

In Lincoln County, increases in economic measures would be similar under the two scenarios; however, the larger increases would be for Scenario 1, with the Nevada Railroad Control Center and the National Transportation Operations Center in Lincoln County. The total increased employment in Lincoln County would average about 100 jobs annually over the operations phase. This would represent a 3.9-percent average annual increase above the projected annual average employment level without the project. See Table 3-57 for baseline population data. The peak operations-related impact to real disposable income, gross regional product, and state and local government spending corresponds to 4.7 percent, 5.2 percent, and 3.2 percent increases above the projected levels for each measure without the project, respectively.

In Nye County, the greater increases in economic measures would be for Scenario 2, with the Nevada Railroad Control Center and the National Transportation Operations Center in Nye County. However, all increases would represent less than a 1-percent average annual increase over the projected annual average without the project.

In Esmeralda County, changes in economic measures during the operations phase would be nearly identical under the two scenarios. The annual average change in employment would be an average increase of 13 jobs over the baseline during the operations phase. The average increases in economic indicators would be $1.1 million above the baseline for real disposable income, $1.5 million above the baseline for gross regional product, and $200,000 above the baseline for state and local government spending.

In Clark County, the greater increases in economic measures would be observed under Scenario 2, with the Nevada Railroad Control Center and the National Transportation Operations Center in Nye County. However, all increases would represent less than a one-tenth of 1-percent average annual increase over the projected annual average without the project.

Section 4.2.11, Utilities, Energy, and Materials, describes impacts related to the use of construction materials and ***fossil fuel*** during the construction and operations phases.

The small economic impacts to mining and agriculture identified for the construction phase would continue during the operations phase. As for the construction phase, there would be a risk of trains colliding with cattle. DOE would compensate ranchers for any loss of cattle during railroad operations in accordance with Nevada Revised Statutes 705.150 to 705.200. Train and track inspection and maintenance activities would be confined to areas disturbed by construction activities, so there would be no additional disturbances to the physical environment. There could be some areas that were disturbed during construction activities that would not be affected during operations (for example, staging areas), and on which agricultural and mining activities could be resumed. Areas disturbed during construction but not needed for operations would be reclaimed in accordance with BLM guidance.

4.2.9.3.2 Population and Housing

Population changes would be related to changes in employment. DOE modeled employment of railroad operations workers and some support workers as beginning in 2015 and ending in 2067. Population impacts are estimated for the same period. Table 4-108 lists estimated population changes for the two modeled scenarios during the operations phase.

In Lincoln County, Scenario 1 would result in an average gain of 181 people annually above the projected levels without the project. Of this increase, about 43 people would be school-aged children, according to the age distribution of Lincoln County published by the Bureau of the Census (DIRS 175921-Bureau of Census 2000, all). The estimated average annual population increase attributed to the operations phase would be 2.9 percent above Lincoln County's projected population annual average without the project.

Table 4-108. Estimated changes to population during railroad operations – Caliente rail alignment.[a]

Location	Average change in population
Lincoln County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	181
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	124
Nye County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	224
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	237
Esmeralda County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	20
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	20
Clark County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Lincoln County	330
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	350

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

At the county level, Lincoln County might be able to absorb the increased demand for housing. At present there are 638 vacant housing units in Lincoln County (see Table 3-62), and plans for new housing development in the Coyote Springs Valley.

In Nye County, the greater average increase in population would be under Scenario 2, with an average gain of 237 people annually above the projected levels without the project. Of this increase, about 42 would be school-aged children, according to the age distribution of Nye County published by the Bureau of the Census (DIRS 171298-Bureau of Census 2004, all). The estimated average annual population increase attributed to the operations phase would be less than 1 percent above Nye County's population projected annual average level without the project.

At the county level, Nye County, with 2,625 vacant housing units, would likely be able to absorb the increased demand for housing. Within the county, workers would likely choose to live in southern Nye County, where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, train crew quarters, and possibly the Nevada Railroad Control Center and the National Transportation Operations Center would be. The 1,058 vacant housing units in Pahrump could accommodate increased demand, though it should be noted that Pahrump has been undergoing a substantial population increase recently (more than 25 percent between 2000 and 2004). Future increases in population are expected, which will place additional demand on the current housing stock. Therefore, project-worker demand for housing in the community would have the potential to create small impacts on the supply of available housing.

No impact is expected on housing availability in the Tonopah area; the number of operations workers residing in that community would likely be small, and there would be adequate vacant housing available in the community to accommodate this increase, as discussed in Section 3.2.9.

In Esmeralda County, the average increase in population would be the same under either scenario, with an average gain of 20 people annually above the projected levels without the project. Of this increase, about three would be school-aged children, according to the age distribution of Esmeralda County published by the Bureau of the Census (DIRS 175922-Bureau of Census 2000, all). The estimated average annual population increase attributed to the operation phase is 2 percent above the baseline.

At the county level, Esmeralda County, with 378 vacant housing units, would likely be able to absorb the increased demand for housing. At the local level, no impact is expected on housing availability in Goldfield or Tonopah, which are both close to where the Maintenance-of-Way Headquarters Facility would be. The number of operations workers residing in either community would likely be small, and there would be adequate vacant housing available, as discussed in Section 3.2.9.

In Clark County, the greater average increase in population would be under Scenario 2, with an average gain of 350 people annually above the projected levels without the project. Of this increase, about 63 would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Bureau of Census 2004, all). The estimated average annual population increase attributed to the operations phase would be a less than one-tenth of 1-percent increase above Clark County's projected population annual average level without the project.

4.2.9.3.3 Public Services

Railroad operations along the Caliente rail alignment would result in small impacts to health-care capacity in Lincoln, Nye, and Esmeralda Counties and on education infrastructure in southern Nye County (Pahrump). The exact extent of impacts to other public services would depend on the total number of workers and their residential locations, and operations activities in relation to existing system capacity. However, workers could create small to moderate impacts in the form of additional demand for fire-protection services in Lincoln, Nye, and Esmeralda Counties.

4.2.9.3.3.1 Health Care. The increased demand for health care associated with the railroad operations support facilities could result in small adverse impacts by straining the existing health service capacity. As discussed in Sections 3.2.9, Lincoln, Nye, and Esmeralda Counties are all considered medically underserved.

In particular, population impacts associated with facilities in southern Nye County could place increased demand on the health-care system in the county. The peak average increase in Nye County's permanent population would be 130 people (0.29 percent above the projected population without the project, or less than one-third of 1 percent), and it is assumed that many of these people would reside in or near Pahrump. Pahrump does have preventive care clinics and a new hospital although, as noted in Section 4.2.9.2.3.1, it is not clear whether the hospital is able to serve the routine and emergency health-care needs of the local population. Increased demand related to project increases in workers and permanent population, however small, could adversely affect the capacity of Pahrump's health-care system to meet local needs. If the Nevada Railroad Control Center and the National Transportation Operations Center were in Lincoln County instead of Nye County, the impacts to the health-care system in Nye County would be slightly less. Under this scenario, Nye County's permanent population would increase by 120 people, which would represent a 0.27 percent average increase.

4.2.9.3.3.2 Education. As indicated in Section 4.2.9.3.2, the annual impact to schools in Lincoln, Nye, and Esmeralda Counties that would result from the increase in population would average about 43, 42, and 3 additional pupils, respectively. The operations phase workforce could place limited strains on the education system in Lincoln and Nye Counties, resulting in small, if any, impact. The exact extent of this impact would depend on the final location of railroad operations support facilities, where workers choose to reside, whether workers relocated families and children, the ages of children, and the capacities of particular schools in 2015 and later.

The location of railroad facilities at the end of the line could result in many workers and their families residing in Pahrump (Nye County). As noted in Section 3.2.9, independent of the proposed railroad, Pahrump is experiencing a fairly rapid increase in its population, and all schools are functioning at or above maximum design capacity. Further baseline population increases are predicted, meaning that even without project-related impacts, school capacity would become strained in the future. While any additional increases to the projected baseline population would increase the need for school capacity, the estimated additional 30 students associated with the proposed railroad would be a small incremental increase in relation to the school population increases Pahrump is experiencing at present. Therefore, the projected increase the project would create would result in only a small impact.

Impacts in Esmeralda County would be limited because the number of resident workers at the Maintenance-of-Way Headquarters Facility would be small; the elementary school system in Esmeralda County can accommodate an additional 100 students (DIRS 174970-Arcaya 2005, all); and students can attend high school in Tonopah, where there are elementary, middle, and high school facilities. The influx of operations-phase workers to Tonopah or Goldfield would not adversely affect school capacities.

4.2.9.3.3.3 Fire Protection. As discussed in Section 4.2.9.2.3.3, Lincoln, Nye, and Esmeralda Counties all meet fire suppression needs with volunteers, with the exception of Pahrump's paid fire department. At present, most communities characterized in the region of influence are able to provide adequate protection (except for Pahrump, which is currently underserved), but increased demand on these services could move them closer to the limit that existing resources (personnel and equipment) could address. Increases to permanent county populations could result in small to moderate impacts in Lincoln, Nye, and Esmeralda Counties, and particularly in Pahrump, where, as noted in Section 3.2.9, fire-protection capabilities are already overextended. With the Cask Maintenance Facility collocated with the Rail Equipment Maintenance Yard, and most workers and their families residing in Pahrump, these additional demands on the fire-protection capabilities of Pahrump could affect the system's ability to meet the community's needs.

4.2.9.3.3.4 Law Enforcement. Given the low crime rates in Lincoln, Nye, and Esmeralda Counties, it is not likely that population increases would increase the incidence of crime to the extent that the existing level of law enforcement services would become inadequate to meet the demand.

4.2.9.3.4 Transportation Infrastructure

4.2.9.3.4.1 Traffic Impacts. There would be fewer road traffic impacts during the operations phase than during the construction phase because there would be considerably fewer workers during the operations phase. DOE estimates that a total of 170 employees would be needed to operate the railroad operations support facilities. A total of 70 employees would be working at the Nevada Railroad Control Center, National Transportation Operations Center, Rail Equipment Maintenance Yard, and Cask Maintenance Facility. Additionally, 50 employees would work at the Interchange Yard and the Staging Yard, and 50 would work at the Maintenance-of-Way Facilities (DIRS 180921-Nevada Rail Partners 2007, Appendix D, Table 4). Table 4-109 summarizes the projected number of vehicle trips that would be generated during the operations phase, assuming that each of these employees would generate two trips

Table 4-109. Projected highway trips during operation of the railroad operations support facilities – Caliente rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for operations of the Staging Yard and Interchange Yard	100	50
Employees for operations of the Maintenance-of-Way Facilities	100	50
Employees for operations of the facilities inside the Yucca Mountain Site boundary near the repository	140	70

a. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 4.

per day, one of them during the peak hour. The affected road segments would be the same as the ones considered in the analysis for the construction phase (see Section 4.2.9.2.4.1).

DOE determined that the projected trips listed in Table 4-109 for the three key areas could result in the following impacts to traffic:

- Operations at the facilities at the Interface with the Union Pacific Railroad Mainline would not degrade the level of service on U.S. Highway 93 at Caliente, which would remain at level A.
- Operations at the Maintenance-of-Way Headquarters Facility would not reduce the level of service on U.S. Highway 95 south of Tonopah, which would remain at level C or better during the peak hour. Operations at the Maintenance-of-Way Trackside Facility would not degrade the level of service on U.S. Highway 6 east of the Tonopah Airport, which would remain at level A.
- Operations at the facilities inside the Yucca Mountain Site boundary near the repository would affect traffic along U.S. Highway 95 near the entrance to the Yucca Mountain Site, which would degrade the level of service from B to C. Level C would still represent stable traffic flow, but would mark the beginning of the range of flow that would become affected by interactions with others in the traffic stream.

Increased traffic from railroad operations along the Caliente rail alignment would be sufficient to change the level of service from B to C on U.S. Highway 95 near the entrances to the Nevada Test Site; however, because this increased traffic volume would still represent stable flow conditions, such impacts would be moderate.

4.2.9.3.4.2 Traffic Delay at Grade Crossings. DOE examined the effects of the Caliente Implementing Alternative on delay at grade-crossings along the proposed alignment. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. A typical delay analysis at grade crossings accounts for train length, speed, and frequency, and lag time (the interval between the time when the gate goes down and the time the train passes, and the interval between the time the train leaves and the time the gate goes up). Additionally, a delay analysis also requires vehicular arrival and departure rates. Although grade-separated crossings would not be mandatory for this project (DIRS 180695-DOT 2002, p. 45), U.S. Highway 93, U.S. Highway 95, State Route 318, and State Route 345 would be grade separated, as described in Chapter 2. All remaining crossings, which would be at grade, would involve very-low-usage roads, and impact on vehicle delay at these crossings would be small. A quantitative analysis of delay at grade crossings is not necessary for three reasons: there would be very few trains per day, the trains associated with the proposed railroad would be short compared to most freight trains, and vehicular traffic is low.

4.2.9.4 Impacts under the Shared-Use Option

The Shared-Use Option could result in additional facilities to support commercial use of the DOE rail line. Shared-use facilities could include access sidings in any of the following areas: Caliente, Panaca/Bennett Pass, Warm Springs Summit, Tonopah, Goldfield, and the Beatty Wash/Oasis Valley area. Consideration of the Shared-Use Option addresses only those impacts that are reasonably foreseeable based on existing conditions in the affected communities.

4.2.9.4.1 Construction Impacts under the Shared-Use Option

Because commercial entities or local governments would build commercial sidings at the locations of selected passing sidings (to the extent practicable), the incremental effort to construct the commercial sidings would be reduced. While there would be a need for some additional materials and labor, the increase over that needed under the Proposed Action without shared use would be small. As discussed in the following sections, DOE would expect impacts on population and housing; employment and income; public services; and transportation resources to be small under the Shared-Use Option, and similar to those under the Proposed Action without shared use.

4.2.9.4.1.1 Population and Housing. Given the minimal increase in economic activity that would be associated with railroad construction under the Shared-Use Option, there would be no to low population changes and attendant pressures on the available housing stock.

4.2.9.4.1.2 Employment and Income. There could be very limited increases in employment and income associated with construction under the Shared-Use Option. These increases would be similar to the changes in employment and income associated with construction under the Proposed Action without shared use. There could be limited loss of economic activity associated with land acquisition for the commercial-siding and parking-area rights-of-way, but DOE would expect such impacts, if any, to be small.

4.2.9.4.1.3 Public Services. Railroad construction under the Shared-Use Option would impact existing public services similar to the Proposed Action without shared use. Given the minimal incremental change in labor and population under the Shared-Use Option, impacts to health, education, law enforcement, and fire protection services would be small.

4.2.9.4.1.4 Transportation Infrastructure. The volume of daily and peak-hour trips that would be generated during railroad construction under the Shared-Use Option would be consistent with the volumes generated under the Proposed Action without shared use. For purposes of this analysis, DOE assumed that commercial access sidings and facilities would be constructed at the same time as the rail line, although it could also occur at a later date. There would be little increased traffic volume beyond that described for the Proposed Action without shared use.

The construction approach under the Shared-Use Option would be the same as that described for the Proposed Action without shared-use, with construction being phased and best management practices implemented. Because, to the extent practicable, commercial sidings would be built at the locations of selected passing sidings, the incremental effort to construct commercial-use sidings would be minimized. There would be no need for additional construction camps and no need for new roads because the temporary access roads would also be used for commercial siding construction. Therefore, although there would be a need for some additional materials and labor under the Shared-Use Option, there would be little increase beyond that described for the Proposed Action without shared use. Based on the lengths of track involved under the Shared-Use Option, the incremental impacts to traffic from constructing the additional sidings would be a small fraction of the overall impacts for railroad construction under the Proposed Action without shared use. Thus, impacts to the transportation infrastructure under the Shared-Use Option would be small.

Traffic delay impacts at highway-rail grade crossings from construction trains would be consistent with the delay impacts under the Proposed Action without shared use. These impacts would be small.

4.2.9.4.2 Operations Impacts under the Shared-Use Option

Under a DOE-funded cooperative agreement, Nye County commissioned a study of the potential economic benefits to Lincoln, Nye, and Esmeralda Counties during construction and operation of the proposed railroad along the Caliente rail alignment (DIRS 174090- Wilbur Smith Associates 2005, all). The impact assessment for railroad operations under the Shared-Use Option draws on information from this report and from a DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), as described in Section 2.2.6. In the near term, commercial shippers using the DOE rail line would be existing nearby companies that currently transport materials and goods by truck.

4.2.9.4.2.1 Population and Housing. It is not likely that there would be noticeable increases in population associated with railroad operations under the Shared-Use Option. Increases in economic activity and associated indicators, particularly in terms of employment, would likely be limited and therefore would not generate substantial changes in permanent population. Therefore, DOE would expect no impacts on housing under the Shared-Use Option.

4.2.9.4.2.2 Employment and Income. Shared use of the DOE rail line could allow business activity to develop and expand in the region of influence, which would result in some employment and income benefits. For some companies, especially those involved in the shipment of heavy or bulk products, the rail line could allow firms to access new markets and to ship greater quantities of products to existing and new markets.

Based on the Nye County report (DIRS 174090-Wilbur Smith Associates 2005, all) and the DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), and as described in Section 2.2.6, overall potential commercial shipments are estimated at 1,050,000 metric tons (1,154,000 tons) or 11,540 carloads annually, with shipments of stone estimated at 169,000 metric tons (186,000 tons) or 1,860 carloads (consisting primarily of outgoing decorative rock); non-metallic mineral at 500,000 metric tons (550,000 tons) or 5,500 carloads (consisting primarily of pozzolan); and petroleum products at 273,000 metric tons (300,000 tons) or 3,000 carloads (consisting of incoming crude oil).

Therefore, access to commercial rail service could support business expansion and revenue increases for firms in Lincoln and Nye Counties. These increases in revenue might generate small direct and indirect employment and income impacts. However, there are a number of factors, such as a firm's overall business objectives and planning decisions, that would influence the extent to which revenue translated into increased hiring or increased income.

Railroad operation under the Shared-Use Option would generate limited employment and income impacts. It is expected that a crew of three people would be needed to operate the commercial train service. As discussed in Section 2.2.4.1, depending on the total travel time for the commercial train, a crew change point might be needed in the Tonopah area. Train crews would use local commercial facilities for sleeping and provision needs, causing some small, but positive, impacts to employment and income. There might also be small economic benefits associated with maintenance of the commercial rail facilities by a commercial contractor.

4.2.9.4.2.3 Public Services. Because the impacts to population and employment would be so small in Lincoln, Esmeralda, Nye, and Clark Counties, impacts to public services under the Shared-Use Option would be unlikely in any of these counties.

4.2.9.4.2.4 Transportation Infrastructure. Under the Shared-Use Option, commercial rail service would begin after the completion of construction. During railroad operations, trains carrying casks would have priority over trains carrying commercial shipments in terms of time in transit. Up to eight one-way commercial trains per week would run along the rail line (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 one-way trains would run between the Staging Yard and the Rail Equipment Maintenance Yard per week carrying casks and other materials for ***maintenance-of-way activities*** (DIRS 175036-BSC 2005, Table 4.2). The commercial trains (not including the locomotives) would consist of up to 60 cars and would be approximately 1,100 meters (3,600 feet) long. Depending on the weight of the train, three or four locomotives would be required (DIRS 176756-Ang-Olson and Khan 2005, all).

Commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials. DOE expects the operating characteristics of these trains to be similar to those typical of freight train operations. The Nevada Railroad Control Center would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line.

The volume of daily and peak-hour vehicle trips that would be generated during operations under the Shared-Use Option would be consistent with operations under the Proposed Action without shared use. There would be little increase in traffic volumes beyond those described in Section 4.2.9.2.4.1.

During operation of commercial service on the rail line, there would be an increase in truck traffic to and from the commercial sidings as compared to the Proposed Action without shared use. DOE assumed that under the Proposed Action without shared use, private companies near the rail line would continue to ship and receive freight using truck-only transport. Under the Shared-Use Option, some of those shipments would be diverted to rail, with trucks accessing the commercial sidings. The reduced number of truck shipments that would result from rail shipment would offset the adverse impacts due to additional increase in number of trucks under the Shared-Use Option. Therefore, DOE would anticipate little increase in adverse impacts to the traffic levels of service of nearby roadways. Also, the increase in the number of workers under the Shared-Use Option at the facilities at the Interchange with the Union Pacific Railroad Mainline and the Rail Equipment Maintenance Yard would be small; therefore, adverse impacts would be small.

Road traffic delay impacts at highway-rail grade crossings would be consistent with the delay impacts under the Proposed Action without shared-use. These impacts would be small.

4.2.9.5 Summary

Table 4-110 summarizes the potential socioeconomic impacts of constructing and operating the proposed railroad along the Caliente rail alignment. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.

Potential impacts to socioeconomics from constructing and operating the proposed railroad along the Caliente rail alignment include the following:

- Population increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in population would be in Lincoln County (1.7 percent) and Esmeralda County (1.1 percent).

- Population increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in population would be in Lincoln County (2.9 percent) and Esmeralda County (2 percent).
- Employment increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in employment would be in Lincoln County (5.6 percent) and Esmeralda County (2.7 percent).
- Employment increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in employment would be in Lincoln County (3.9 percent) and Esmeralda County (3 percent).
- Real disposable income increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in real disposable income would be in Esmeralda County (7.6 percent) and Lincoln County (4.1 percent).
- Real disposable income increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in real disposable income would be in Lincoln County (4.7 percent) and Esmeralda County (2.9 percent).
- Gross regional product increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in gross regional product would be in Lincoln County (28 percent) and Esmeralda County (9.5 percent).
- Gross regional product increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in gross regional product would be in Lincoln County (5.2 percent) and Esmeralda County (3.8 percent).
- State and local government spending increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in state and local government spending would be in Esmeralda County (2.2 percent) and Lincoln County (1.9 percent).
- State and local government spending increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in state and local government spending would be in Lincoln County (3.2 percent) and Esmeralda County (3.1 percent).
- There would be no noticeable impacts to public services during the construction phase.
- There would be small to moderate impacts to some public services during the operations phase (see Table 4-110 for details).
- There would be some impacts to transportation during the construction phase (see Table 4-110 for details).
- There would be some impacts to transportation during the operations phase (see Table 4-110 for details).

Table 4-110. Summary of impacts to socioeconomic conditions – Caliente rail alignment[a] (page 1 of 2)

County	Construction	Operations
Lincoln	Population and housing • Population: 1.7 percent increase Employment and income • Employment: 5.6 percent increase • Real disposable income: 4.1 percent increase • Gross regional product: 28 percent increase • State and local government spending: 1.9 percent increase Public Services: No noticeable impacts Transportation • Traffic impacts to local highways: Level of service on U.S. Highway 93 at Caliente would degrade from A to B • Delay impacts on road traffic at grade crossings: small	Population and housing • Population: 2.9 percent increase Employment and income • Employment: 3.9 percent increase • Real disposable income: 4.7 percent increase • Gross regional product: 5.2 percent increase • State and local government spending: 3.2 percent increase Public Services • Small impacts to health care services due to population increases in a medically underserved area • Small impacts to fire protection services due to population increases Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small
Nye	Population and housing • Population: 0.2 percent increase Employment and income • Employment: 1.2 percent increase • Real disposable income: 0.9 percent increase • Gross regional product: 3.5 percent increase • State and local government spending: 0.4 percent increase Public Services: No noticeable impacts • Addition of fewer than 100 cases per year to health care facilities Transportation • Traffic impacts to local highways: Level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small	Population and housing • Population: 0.3 percent increase • County-wide population increase of 237 could place strain on supply of 1,058 vacant housing units in Pahrump. Employment and income • Employment: 0.3 percent increase • Real disposable income: 0.3 percent increase • Gross regional product: 0.5 percent increase • State and local government spending: 0.3 percent increase Public Services • Moderate impacts to health care services due to population increases in a medically underserved area • Moderate impacts to fire protection services in Pahrump due to population increases in an underserved area • Addition of 30 school-aged children to overcrowded schools Transportation • Traffic impacts to local highways: Level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small

Table 4-110. Summary of impacts to socioeconomic conditions – Caliente rail alignment[a] (page 2 of 2)

County	Construction	Operations
Esmeralda	Population and housing • Population: 1.1 percent increase Employment and income • Employment: 2.7 percent increase • Real disposable income: 7.6 percent increase • Gross regional product: 9.5 percent increase • State and local government spending: 2.2 percent increase • Impacts to mining: Goldfield alternative segment 1 would intersect six patented mining claims; Goldfield 3 would intersect two; and Goldfield 4 would intersect four Public Services: No noticeable impacts Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small	Population and housing • Population: 2 percent increase Employment and income • Employment: 3 percent increase • Real disposable income: 2.9 percent increase • Gross regional product: 3.8 percent increase • State and local government spending: 3.1 percent increase • Impacts to mining: Goldfield alternative segment 1 would intersect six patented mining claims; Goldfield 3 would intersect two; and Goldfield 4 would intersect four Public Services • Small impacts to health care services due to population increases in a medically underserved area • Small impacts to fire protection services due to population increases Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small
Clark	Population and housing[b] • Population: <0.1 percent increase Employment and income • Employment: 0.1 percent increase • Real disposable income: 0.2 percent increase • Gross regional product: 0.2 percent increase • State and local government spending: small increase Public Services: No noticeable impacts	Population and housing[b] • Population: <0.1 percent increase Employment and income • Employment: <0.1 percent increase • Real disposable income: <0.1 percent increase • Gross regional product: <0.1 percent increase • State and local government: <0.1 percent increase Public Services: No noticeable impacts
Throughout region of influence	Employment and income Up to 1,083 Animal Unit Months lost, valued at $57,000	Employment and income Continued lack of access to up to 1,083 Animal Unit Months, valued at $57,000

a. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.
b. < = less than.

4.2.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes potential nonradiological and radiological health and safety impacts to workers and the public from construction and operation of the proposed railroad along the Caliente rail alignment, including ***incident-free transportation*** and transportation accident scenarios. Section 4.2.10.1 describes the impact assessment methodology, Section 4.2.10.2 describes potential impacts associated with the Proposed Action, Section 4.2.10.3 describes potential impacts associated with the Shared-Use Option, and Section 4.2.10.4 summarizes potential impacts.

Incident-free transportation: Routine transportation in which cargo travels from origin to destination without being involved in an accident.

Accident: An unplanned sequence of events that leads to undesirable consequences.

Section 3.2.10.1 describes the region of influence for nonradiological and radiological impacts.

Appendix K, Radiological Health and Safety, describes the methods and data DOE used to assess radiological impacts for this Rail Alignment EIS.

4.2.10.1 Impact Assessment Methodology

4.2.10.1.1 Nonradiological Impact Assessment Methodology

Nonradiological impacts to occupational health and safety would include impacts to workers resulting from physical hazards and exposure to nonradioactive ***hazardous*** chemicals during construction and operation of the proposed rail line and associated facilities. DOE estimated such impacts using occupational incident rates for total ***recordable cases***, lost workday cases, and fatalities. Total recordable cases are defined as the total number of work-related injuries or illnesses that resulted in fatalities, days away from work, job transfer or restriction, or other cases as identified in *Occupational Safety and Health Administration Form 300, Log of Work-Related Injuries and Illnesses* (DIRS 175488-OSHA [n.d.], all). Recordable cases of work-related injury or illness include fatality; loss of consciousness; injury or illness resulting in one or more days away from work; administration of medical treatment other than first aid; and other workplace injury or illness diagnosed by a physician or other health-care professional. The Occupational Safety and Health Administration defines lost workday cases as injuries or illnesses resulting in loss of 1 or more work days, not including the day the injury or illness occurred.

DOE estimated nonradiological occupational impacts by multiplying the number of labor hours worked by involved and noninvolved construction workers and operations workers by workplace health and safety incident rates in units of number of occurrences per hour worked for involved workers and noninvolved workers. The workplace incident rates DOE used for this analysis are U.S. Department of Labor, Bureau of Labor Statistics, data for 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all). The nonradiological occupational health and safety impact analysis is based on health and safety incident statistics defined as follows (DIRS 155970-DOE 2002, p. F-17):

- Fatalities, regardless of the time between the injury and death, or the length of the illness
- Lost workday cases, other than fatalities, that result in lost workdays
- Nonfatal cases without lost workdays that result in transfer to another job, termination of employment, medical treatment (other than first aid), loss of consciousness, or restriction of work or motion

DOE estimated the frequency of occurrence of such incidents based on the specific activity (construction or operations) and the number of activity-specific worker labor hours.

Table 4-111 cites U.S. Department of Labor, Bureau of Labor Statistics, incident rate data DOE used to estimate total recordable cases, lost workday cases, and fatalities for involved and noninvolved workers during construction and operation of the proposed railroad. Involved workers are defined for the purposes of this analysis as personnel who would be directly involved in construction or operations activities. Noninvolved workers are defined for the purposes of this analysis as personnel who would be involved in management and administrative functions. The Bureau of Labor Statistics compiled the health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises Sector; Transportation and Warehousing: Rail Transportation Sector; Support Activities for Transportation Sector; Non-Metallic Mineral Manufacturing (Batch Plant Construction and Operation); and Mining and Support Activities for Mining (Quarry Construction and Operation involved and noninvolved workers). Fatality incident statistics are compiled by employment sector, including Construction; Professional and Business Services; Transportation and Warehousing; Mining (Quarry Construction and Operation); and Manufacturing (Batch Plant Construction and Operation).

Table 4-111. U.S. Department of Labor, Bureau of Labor Statistics, incident rate data for estimating industrial safety impacts common to the workplace.[a]

	Total recordable cases incidents per 100 FTEs[b]		Lost workday cases per 100 FTEs[b]		Fatalities per 100,000 FTEs[b]	
Activity	Involved	Noninvolved	Involved	Noninvolved	Involved	Noninvolved
Construction						
Rail line	5.6	2.4	3.1	1.3	11	3.5
Facilities	5.6	2.4	3.1	1.3	11	3.5
Quarry/ballast site construction and operation	4.1	3.9	2.7	2.2	25.6	3.5
Batch plant construction and operation	9.1		3.8		2.4	
Operations						
Rail line	2.5	2.4	1.9	1.3	17.6	3.5
Facilities	5.5	2.4	3.4	1.3	17.6	3.6

a. Sources: DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all.
b. FTEs = full-time-equivalent workers; one FTE is defined as 2,000 labor hours worked.

The U.S. Department of Labor, Mine Safety and Health Administration, reports occupational non-fatal incident and fatality incident data for stone, quarry and mill operations (surface mining) (DIRS 178746-MSHA 2006, all; DIRS 178747-MSHA 2006, all; DIRS 178748-MSHA 2006, all). In 2005 a total of nine fatalities were reported in sand and gravel surface mining for 37,258 full-time-equivalent workers and a total of five fatalities were reported in stone surface mining for 34,744 full-time-equivalent workers. This corresponds to a total fatal incident rate of 20.3 fatalities per 100,000 full-time-equivalent workers. This is lower than the fatality incident rate of 25.6 fatalities per 100,000 full-time-equivalent workers reported by the Bureau of Labor Statistics for all mining activities. DOE used the Bureau of Labor Statistics fatality incident rate to estimate the fatalities associated with quarry and ballast-site construction, operation, and reclamation for the purposes of maintaining consistency with the Bureau of Labor Statistics incident rate data for other rail line and facilities construction and operations activities.

The statistics for recordable cases and lost workday cases for rail line and associated facility construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector. The statistics for railroad facility operations for involved workers are applicable to the Support Activities for Transportation Sector. The statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers. All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005. Table 4-111 summarizes these statistics. DOE applied them to estimate the total recordable cases, lost workday cases, and fatalities for proposed railroad construction and operations.

DOE performed the following steps as part of the nonradiological occupational health and safety impact calculations:

1. DOE obtained full-time-equivalent data for each phase of construction and operation of the proposed rail line and associated facilities from the following documents: The numbers of full-time-equivalent ***worker years*** for each rail line construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 180921-Nevada Rail Partners 2007), and the Personnel Breakdown Per Camp shown as Table 4-2 and the schedule shown as Figure 7-A, NRL Construction Schedule, from the Construction Plan–Caliente Rail Corridor, Rev 03, May 15, 2007 (DIRS 180922-Nevada Rail Partners 2007). The numbers of full-time-equivalent worker years for each railroad facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 180921-Nevada Rail Partners 2007).
   A "full-time-equivalent" is defined as 2,000 labor hours worked per year. It is not necessarily the case that all 2,000 hours of an annual full-time-equivalent would be worked by the same individual. For example, train engineers operate on a crew schedule based on the number of train trips. Therefore the 2,000 hours per year worked for one full-time-equivalent for the labor category "train engineer" may comprise several individual train engineers.

2. DOE categorized full-time-equivalent workers for construction and operations workers as either "involved" workers or "noninvolved" workers depending on the specific activity of the worker identified. For purposes of this analysis, involved workers are defined as workers directly involved in construction or operations activities. Noninvolved workers are defined as workers performing management, administration, or security functions.

   The incident statistics used in the calculation are reported by the Bureau of Labor Statistics for calendar year 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).

   Incident rate statistics for total recordable cases, lost workday cases, and fatalities differ for involved and noninvolved workers.

   - All railroad operations workers are categorized as involved workers.
   - Facilities operations workers in job categories including "management," "administration," "clerical," and "security" are categorized as "noninvolved" workers.
   - Facilities operations workers in other job categories are categorized as "involved" workers.

   The Bureau of Labor Statistics compiles health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises

Sector; Transportation and Warehousing: Rail Transportation Sector; and Support Activities for Transportation Sector. The statistics for total recordable cases and lost workday cases for rail line and associated facilities construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector and the statistics for railroad facility operations for involved workers are applicable to the Support Activities for Transportation Sector, and for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers. All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005.

3. Full-time-equivalent workers for construction of the rail line include the following activities.

    - Rail line construction

4. Full-time-equivalent workers for construction of railroad facilities include the following facilities.

    - Concrete batch plant construction
    - Concrete batch plant operation
    - Water-well drilling
    - Construction camp construction
    - Construction camp operation
    - Quarry construction
    - Quarry operation
    - Facilities at the Interface with the Union Pacific Railroad Mainline (including ***Interchange Yard*** and Staging Yard)
    - Maintenance-of-Way Trackside Facility
    - Maintenance-of-Way Headquarters Facility
    - Satellite Maintenance-of-Way Facilities
    - Nevada Railroad Control Center and National Transportation Operations Center
    - Cask Maintenance Facility
    - Rail Equipment Maintenance Yard
    - Facility access roads

5. Full-time-equivalent workers for operation of the railroad facilities include the following facilities.

    - Facilities at the Interface with the Union Pacific Railroad Mainline (including Interchange Yard and Staging Yard)
    - Maintenance-of-Way Trackside Facility
    - Maintenance-of-Way Headquarters Facility
    - Satellite Maintenance of Way Facilities
    - Nevada Railroad Control Center and National Transportation Operations Center
    - Cask Maintenance Facility
    - Rail Equipment Maintenance Yard

6. DOE identified construction full-time-equivalent workers for each year of the construction schedule for the rail line and each rail line facility. The full-time-equivalent workers for each year are summed to calculate the total involved full-time-equivalent workers and total noninvolved full-time-equivalent workers for the rail line and each facility.

7. Full-time equivalent worker data for involved workers and noninvolved workers are multiplied by incident rates published by the U.S. Department of Labor, Bureau of Labor Statistics, for various employment sector categories applied to involved and noninvolved construction workers and operations workers to estimate the number of incidents for construction and operation of the rail line and associated facilities for the Proposed Action and Shared-Use Option. Employment sector categories for the Bureau of Labor Statistics incident rate data applied to involved and noninvolved workers are described above in Step 2.

Sections 4.2.10.2 and 4.2.10.3 discuss nonradiological impacts to the public from construction and operation of the proposed rail line and associated facilities under the Proposed Action and the Shared-Use Option. These nonradiological impacts include air quality impacts, noise impacts, and transportation (traffic accident and fatality) impacts. The methodologies for estimating these impacts from specific resource areas are described in the respective sections of this Rail Alignment EIS. Potential impacts from occupational exposure to workplace dust and noise during construction and operation of the Proposed Action and the Shared-Use Option are also discussed in Sections 4.2.10.2 and 4.2.10.3.

4.2.10.1.2 Radiological Impact Assessment Methodology

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called photons, or in the form of high-energy subatomic particles. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. Humans are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation, which heats material when the material and the radiation interact, and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (which are more penetrating) includes ***ultraviolet radiation***, which causes sunburn, and X-rays and gamma radiation.

Ionizing radiation is radiation that has sufficient energy to displace ***electrons*** from atoms or molecules to create ***ions***. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, ***alpha***, ***beta***, or ***neutron radiation***). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called ***radioactive decay***, is the transformation of an unstable atom (a ***radionuclide***) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—***alpha particles***, ***beta particles***, and ***gamma*** or ***X-rays***. Neutrons emitted during nuclear fission are another type of ionizing radiation. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (called radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. Some gamma radiation will pass through the body without interacting with it. Shielding from neutrons, which are also highly penetrating, requires materials that contain light elements such as hydrogen.

In a ***nuclear reactor***, heavy atoms such as uranium and plutonium can undergo another process, called fission, after the absorption of a subatomic particle (usually a neutron). In fission, a heavy atom splits into two lighter atoms and releases energy in the form of radiation and the kinetic energy of the two new lighter atoms. The new lighter atoms are called ***fission products***. The fission products are usually unstable and undergo radioactive decay to reach a more stable state.

Some of the heavy atoms might not fission after absorbing a subatomic particle. Rather, a new ***nucleus*** is formed that tends to be unstable (like fission products) and undergo radioactive decay.

The radioactive decay of fission products and unstable heavy atoms is the source of the radiation from spent nuclear fuel and high-level radioactive waste that makes these materials hazardous in terms of potential human health impacts.

Radiation that originates outside of an individual’s body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials that directly emit radiation, such as radioactive waste or radionuclides in soil. ***Exposure*** to direct radiation can be mitigated by placing shielding, such as lead, between the source of the radiation and the exposed individual. Internal radiation originates inside a person’s body following intake of radioactive material or radionuclides through ingestion or inhalation. Once in the body, the ***fate*** of a radioactive material is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

Exposure to ionizing radiation is expressed in terms of absorbed dose, which is the amount of energy imparted to matter per unit mass. Often simply called ***dose***, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the ***rad***. The different types of radiation mentioned above have different effects in damaging the cells of biological systems. ***Dose equivalent*** is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the ***rem***. In quantifying the effects of radiation on humans, other types of concepts are also used. The concept of ***effective dose equivalent*** is used to quantify effects of radionuclides in the body. It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to ***cancer***. The sum of the products of each affected tissue’s estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long ***half-lives*** and long residence time in the body. The result is called the committed effective dose equivalent. The unit of effective dose equivalent is the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of radiation dose in this Rail Alignment EIS, unless specifically noted otherwise, are total effective dose equivalents, which are quantified in terms of rem or millirem (mrem).

More detailed information on the concepts of radiation dose and dose equivalent are in publications of the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993, all) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) or external exposure to radionuclides (by ***groundshine*** or ***cloudshine*** [immersion]) to radiation dose are called ***dose*** conversion factors or dose coefficients. The International Commission on Radiological Protection and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors (DIRS 172935 ICRP 2001, all; DIRS 175544-EPA 2002, all). They are based on original recommendations of the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The radiation dose to an individual or to a group of people can be expressed as the total dose received or as a ***dose rate***, which is dose per unit time (usually an hour or a year). ***Collective dose*** is the total dose to an exposed population. ***Person-rem*** is the unit of collective dose. Collective dose is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 persons × 0.1 rem).

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period, typically 24 hours or less. Chronic exposures occur over longer periods (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

The radiation dose estimates discussed in this Rail Alignment EIS are associated with exposure to radiation at low dose rates. Such exposures can be chronic (continuous or nearly continuous), such as those to workers who are security escorts. In some instances, exposures to low levels of radiation would be intermittent (for example, infrequent exposures to an individual from radiation emitted from ***shipping casks*** as they are transported). Cancer induction is the principal potential risk to human health from exposure to low levels of radiation. However, this cancer induction is a statistical process because exposure to radiation conveys only a chance of developing cancer, not a certainty. Furthermore, other causes, such as exposure to chemical agents, can induce cancer in individuals.

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. Radiological health impacts are expressed as the incremental changes in the number of expected fatal cancers (referred to as ***latent cancer fatalities***) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose to-health effect conversion factors recommended by the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all). The Interagency Steering Committee on Radiation Standards is comprised of eight federal agencies (the Environmental Protection Agency, the Nuclear Regulatory Commission, DOE, the Department of Defense, the Department of Homeland Security, the Department of Transportation, the Occupational Safety and Health Administration, and the Department of Health and Human Services), three federal observer agencies (the Office of Science and Technology Policy, the Office of Management and Budget, and the Defense Nuclear Facilities Safety Board), and two state observer agencies (Illinois and Pennsylvania). The Committee estimated that, for the general population and workers, a collective dose of 1 person-rem would yield 6×10^{-4} excess latent cancer fatalities.

Sometimes, calculations of the number of latent cancer fatalities associated with radiation dose do not yield whole numbers, and, especially in environmental applications, can yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total radiation dose of 0.001 rem, the collective radiation dose would be 100 person-rem and the corresponding estimated number of latent cancer fatalities would be 0.06 (100,000 persons × 0.001 rem × 0.0006 latent cancer fatalities per person rem). How should one interpret a nonintegral number of latent cancer fatalities, such as 0.06? The answer is to interpret the result as a statistical estimate. That is, 0.06 is the average number of latent cancer fatalities that would result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur a latent cancer fatality from the 0.001 rem radiation dose each member would have received. In a small fraction of the groups (about 6 percent), 1 latent cancer fatality would result; in exceptionally few groups, 2 or more latent cancer fatalities would occur. The average number of latent cancer fatalities over all of the groups would be 0.06. The most likely outcome for any single group is 0 latent cancer fatalities.

DOE estimated radiological impacts for incident-free transportation, transportation accident risks and the consequences of severe transportation accidents, and transportation sabotage events.

The analysis of potential radiological occupational and public health and safety impacts in this Rail Alignment EIS includes all of those potentially exposed individuals discussed in Section 3.2.10 of this Rail Alignment EIS. No construction-related radiation dose is anticipated to workers or the public during repository construction activities.

The DOE Department of Environment Safety and Health guidance in *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements*, Second Edition, December 2004 (DIRS 178579-DOE 2004, all), requires that radiological impacts be estimated, no matter how small the population. Therefore, the radiological impact analyses in this Rail Alignment EIS are applied to various populations of potentially exposed individuals.

4.2.10.1.3 Transportation Impact Assessment Methodology

DOE based the transportation impact analysis on guidelines from the American Institute of Chemical Engineers with respect to chemical transportation risk analyses (DIRS 182284-Center for Chemical Process Safety 1995, all). The methodology presented in this section uses both qualitative and quantitative components. The number of fatalities and accidents resulting from vehicular and train travel were based on fatality and accident rates provided by Federal Railroad Administration and Nevada Department of Transportation statistics. The rates were used in combination with the specifics of an operation (for example, total distance traveled, route length, and number of trips) to estimate the likelihood of accidents and fatalities. The estimated number of potential vehicular traffic fatalities was based on assuming a total distance traveled from workers commuting during both the construction and operational phases. The estimates for potential rail traffic fatalities and accidents were also based on assuming total distances traveled from material/equipment transport during construction and shipment during operations. Traffic accidents under the Shared-Use Option were qualitatively analyzed based on a proportional comparison to the Proposed Action. Rail line fatalities associated with the Shared-Use Option were evaluated by revising the analyses for the additional rail traffic levels.

4.2.10.2 Proposed Action

4.2.10.2.1 Nonradiological Impacts

Nonradiological health and safety addresses potential occupational incidents to construction and operations workers resulting from physical hazards and exposure to nonradioactive chemicals generated from construction and operations. This section also summarizes impacts associated with nonradiological occupational health and safety hazards from specific resource areas, including biological hazards, dust and soils hazards, air quality hazards, and noise hazards.

4.2.10.2.1.1 Workers. Tables 4-112 and 4-113 summarize nonradiological impacts to workers from industrial hazards associated with construction and operation of the proposed rail line and associated facilities under the Proposed Action. Table 4-112 summarizes impacts for construction and operation of the rail line. Table 4-113 summarizes impacts for construction and operation of facilities. In general, rail line construction would create hazards that are common to heavy construction and earthmoving operations. Accidents that commonly occur at construction workplaces are:

- Trip and fall
- Object falls on worker
- Electrocution
- Asphyxiation (confined space or other)
- Penetrating wounds
- Dermal exposure skin injury
- Jobsite vehicle accident injury
- Hearing injury
- Object in eye
- Welding or laser eye injury
- Injury from trench or slope collapse
- Injury from explosion

Similar types of workplace accidents can occur during operation and maintenance of the proposed rail line and facilities. Workplace incidents also include incidents such as heat stress and workplace exposure to hazardous chemicals. These types of workplace accidents and incidents are included in the Bureau of Labor Statistics incident rate statistics for total recordable cases, lost workday cases, and fatalities summarized in Table 4-111.

DOE would adopt a rigorous safety program that would enable workers to avoid most common accidents as required by DOE Order O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, as codified in 10 CFR Part 851. Chapter 7 of this Rail Alignment EIS describes mitigation measures and safety management practices to address workplace hazards. In accordance with 10 CFR Part 851 DOE would also be required to comply with applicable regulations under 29 CFR Part 1910 *Occupational Health and Safety Standards*, 29 CFR Part 1926, *Safety and Health Regulations for Construction*, and 29 CFR Part 1960, *Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters* (Section 11.4, Table 11-4, pp. 1 to 3). Code of Federal Regulations 29 Part 1926 applies to DOE contractors; 29 CFR 1960 (Basic Elements for Federal Employees OSHA) applies to DOE employees; 10 CFR 851.23 also requires DOE to apply American Council of Government Industrial Hygienist Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices when the Threshold Limit Values are lower (more protective) than permissible exposure limits in 29 CFR 1910.

Table 4-112 includes nonradiological impacts from proposed rail line construction and operations, but does not include facilities construction and operation. Rail line construction impacts are estimated for activities occurring during the minimum 4.5-year construction phase, including construction of the rail line (rail roadbed, track)

Rail line operations impacts include impacts to train crews and escort and security personnel.
The numbers of full-time-equivalent worker years for each-rail line construction and operations activity, summarized in Table 4-112, were obtained from Appendix D of the Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor, Rev 03, May 15, 2007 (DIRS 180921-Nevada Rail Partners 2007, Appendix D) and the Personnel Breakdown Per Camp shown as Table 4-2 and the schedule shown as Figure 7-A, NRL Construction Schedule, from the Construction Plan-Caliente Rail Corridor, Rev 03, May 15, 2007 (DIRS 180922-Nevada Rail Partners 2007, Figure 7-A).

Impacts from rail line construction support facilities include:

- Construction of the construction camps
- Operation of construction camps
- Construction of ballast quarries
- Operation of ballast quarries
- Construction of water wells
- Operation of water wells
- Construction of concrete batch plants
- Operation of concrete batch plants

Table 4-112. Estimated impacts to workers from nonradiological industrial hazards during proposed railroad construction and railroad operations under the Proposed Action.[a,b]

Group and industrial hazard category	Construction			Operations		
	FTEs[c]	Labor hours worked	Incidents	FTEs[c]	Labor hours worked	Incidents
Involved workers	5,444	10.9 million		1,471	2.9 million	
Total recordable cases[d]			304			37
Lost workday cases			168			28
Fatalities			0.62			0.26
Noninvolved workers	1,350	2.7 million		0	0	
Total recordable cases[d]			32			0
Lost workday cases			18			0
Fatalities			0.05			0
Totals[e]	6,794	13.6 million		1,471	2.9 million	
Total recordable cases[d]			336			37
Lost workday cases			186			28
Fatalities			0.67			0.26

a. Calculations are based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4-111 and full-time-equivalent worker year data from Appendix D of the Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor, Rev 03, May 15, 2007 (DIRS 180921-Nevada Rail Partners 2007) and Table 4-2 and Figure 7-A, NRL Construction Schedule, from the Construction Plan-Caliente Rail Corridor, Rev 03, May 15, 2007 (DIRS 180922-Nevada Rail Partners 2007). All rail line construction workers are considered to be involved workers with the exception of construction camp operating workers.
b. Totals include rail line construction, quarry construction and operation, concrete batch plant construction and operation, construction camp construction and operation, construction train operation, and water-well construction and operation. Totals do not include construction or operation of rail line facilities.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d. Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

Railroad facility construction and operations impacts include impacts to facility construction workers and facility operations workers during the minimum 4.5-year construction phase and 50-year operations phase for the facilities. Table 4-113 summarizes the nonradiological impacts of constructing and operating rail line construction and operations support facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, the Facilities at the Interface with the Union Pacific Railroad Mainline (including the Interchange Yard and Staging Yard), Nevada Railroad Control Center and National

Table 4-113. Estimated impacts to workers from nonradiological industrial hazards during facility construction and facility operations under the Proposed Action.[a,b]

Group and industrial hazard category	Construction			Operations		
	FTEs[c]	Labor hours worked	Incidents	FTEs[c]	Labor hours worked	Incidents
Involved workers	1,569	3.1 million		6,850	13.7 million	
Total recordable cases[d]			88			377
Lost workday cases			49			233
Fatalities			0.02			1.21
Noninvolved workers	0	0		1,700	3.4 million	
Total recordable cases[d]			0			41
Lost workday cases			0			22
Fatalities			0			0.06
Totals[e]	1,569	3.1 million		8,500	17.0 million	
Total recordable cases[d]			88			418
Lost workday cases			49			255
Fatalities			0.02			1.27

a. Source: Calculations are based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4-111 and full-time-equivalent worker year data from Appendix D of the Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor, Rev 03, May 15, 2007 (DIRS 180921-Nevada Rail Partners 2007, Appendix D).
b. Totals include construction and operation of the Facilities at the Interface with the Union Pacific Railroad Mainline, Maintenance-of-Way Facilities, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center, and Rail Equipment Maintenance Yard. Totals do not include construction or operation of rail line facilities.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d. Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

Transportation Operations Center, Maintenance-of-Way Trackside Facility, Maintenance-of-Way Headquarters Facility, Satellite Maintenance-of-Way Facilities, and Cask Maintenance Facility. The numbers of full-time-equivalent workers for each facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Caliente Rail Corridor*, Rev 03, May 15, 2007 (DIRS 180921-Nevada Rail Partners 2007, Appendix D). Construction and operations workers under the Proposed Action could be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and facility equipment, including maintenance-of-way and management of fleet. Such activities are anticipated to include welding, metal degreasing, painting, and related activities. Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and facilities.

Railroad Construction Construction of the proposed railroad would involve 13.6 million labor hours corresponding to a total of 6,794 full-time-equivalent construction workers over the entire construction phase.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with construction of the proposed rail line are reported separately from the nonradiological impacts associated with construction of the railroad facilities. Table 4-112 summarizes nonradiological occupational health and safety impacts associated with construction of the proposed rail line, not including the Rail Equipment Maintenance Yard and Facilities at the Interface with the Union Pacific Railroad or other facilities.

Facilities Construction Construction of railroad construction support facilities and railroad operations support facilities, including the Facilities at the Interface with the Union Pacific Railroad Mainline (the Interchange Yard and the Staging Yard), Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Trackside Facility and Satellite Maintenance-of-Way Facilities, Maintenance-of-Way Headquarters Facility, Cask Maintenance Facility, and Rail Equipment Maintenance Yard, would involve 3.1 million labor hours corresponding to approximately 1,569 full-time-equivalent construction workers over the entire construction phase. Table 4-113 summarizes the nonradiological impacts of constructing rail line operations support facilities.

Railroad Operations The proposed railroad would operate for up to 50 years and would involve approximately 1,471 operations full-time-equivalent workers over the life of the project, corresponding to approximately 2.9 million labor hours.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with operation of the operations along the rail line are reported separately from the nonradiological impacts associated with operation of the support facilities. Table 4-112 lists nonradiological occupational health and safety impacts associated with operations along the rail line, not including the Rail Equipment Maintenance Yard or Facilities at the Interface with the Union Pacific Railroad or other operations support facilities.

Overall railroad operations, including cask trains, maintenance-of-way trains, and repository construction and supplies trains correspond to approximately 16 million train-kilometers (10 million train-miles) over the 50-year operations phase for the 541-kilometer (336-mile)-long Caliente rail line, based on transporting 9,495 casks (eight cask trains per week) and an additional two maintenance-of-way trains and seven repository construction and supplies trains per week. The 37 total recordable cases and 28 lost-workday cases over the 50-year operations phase (see Table 4-112) correspond to 4.5 total recordable cases and 3.4 lost-workday cases per million train-kilometers traveled.

Railroad Facilities Operations Operation of the operations support facilities under the Proposed Action, including the Facilities at the Interface with the Union Pacific Railroad, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Trackside Facility, Satellite Maintenance-of-Way Facilities and Maintenance-of-Way Headquarters Facility, Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would take place over 50 years and would involve approximately 170 full-time-equivalent operations workers per year of operation (DIRS 180921-Nevada Rail Partners 2007; DIRS 180922-Nevada Rail Partners 2007), corresponding to approximately 17 million labor hours over the 50-year operating phase. Table 4-113 summarizes the nonradiological impacts of operating railroad operations support facilities under the Proposed Action. The 418 total recordable cases and 255 lost-workday cases over the 50-year operating phase (see Table 4-113) correspond to 51 total recordable cases and 31 lost-workday cases per million train-kilometers traveled.

Impacts from Specific Resource Areas Workers constructing the proposed railroad could be exposed to a variety of hazards associated with specific resource areas. These include biological hazards, dust and soils hazards, air-quality hazards, transportation accidents, and noise hazards. Transportation hazards include wild horses, burros, and free-range livestock. Biological hazards include potential human health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human health effects from exposure to inhalable soils and dusts containing hazardous constituents and potential occupational encounters with unexploded ordnance. Construction workers could also be exposed to air quality hazards, including potential human health effects of exposure to fugitive dust, diesel engine exhaust, and other air emissions associated with construction activities. Workers could also be exposed to noise hazards from operation of equipment. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar hazards. Impacts associated with specific resource areas are discussed in the paragraphs that follow.

Biological Hazards: Biological hazards are any virus, bacteria, fungus, parasite, or other living organism that can cause a disease or otherwise harm human beings. Biological hazards that may be encountered by workers constructing and operating the proposed rail line and associated facilities include disease-causing organisms and venomous animals. Diseases potentially encountered when performing construction activities include West Nile Virus, Valley Fever, Hantavirus, and rabies. Venomous animals potentially encountered include spiders, snakes, scorpions, bees, wasps, and other insects. These biological hazards are described in the following sections. The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, as cited below. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

- **Venomous Animals –** Nevada is home to five venomous snake species: Sidewinder, Mohave, Speckled, Western Diamondback and Great Basin rattlesnakes (*Crotalus* spp.). These types of rattlesnakes may inhabit the open grasslands and desert habitat in the construction and operations areas. The Gila Monster, a venomous lizard, also occurs in southern Nevada. There are several types of scorpions (such as *paruroctonus* spp.) native to Nevada that may occur in construction and operations areas. Scorpions are venomous and are most active at night.
A scorpion sting would require medical treatment, but for the specific species of scorpions found in Nevada, would not be fatal. Black widow spiders (*Latrodectus mactans*) and brown recluse spiders (*Loxosceles recluse*) may also occur in construction areas. Bites from these spiders would require medical treatment and are potentially fatal if untreated. Other types of spider bites are generally harmless to most people. Spider bites usually occur when someone is reaching into dark, out-of-the way places. Bees, including Africanized Swarming Bees, and wasps also occur in southern Nevada.

- **West Nile Virus –** West Nile virus is a mosquito-borne virus that can cause illness in humans, including meningitis or arboviral encephalitis, a brain inflammation. Mosquitoes acquire the virus from birds and pass it on to other birds, and occasionally to humans. Mosquitoes spread this virus after they feed on infected birds and then bite other birds, people, or certain domestic animals. The virus is not spread by person-to-person contact. West Nile virus occurs primarily in the late summer or early autumn, although the mosquito season is generally April through October. About 80 percent of people who are infected with West Nile virus exhibit no symptoms, or at most, experience symptoms similar to the flu. People with mild infections, referred to as West Nile fever, may experience fever, headache, body ache, skin rash, and swollen lymph glands. More severe infection can result in more serious symptoms including high fever, headache, disorientation, coma, tremors, occasional convulsions, and paralysis. This form is referred to as West Nile meningitis or encephalitis. In 2004, a total of 44 cases of West Nile virus were reported in Nevada, including 23 cases in Clark County. Of the 44 West Nile virus cases, 19 involved West Nile fever. In 2005, 31 cases of West Nile virus were reported in Nevada, including eight cases in Clark County and three cases in Nye County (DIRS 177618-USGS 2006, all). No human cases of West Nile virus were reported in Nye, Esmeralda, or Lincoln Counties in 2004 (DIRS 175028-USGS 2005, all; DIRS 175026-Nevada State Health Division 2005, all). In 2006 there were a total of 123 reported cases of West Nile virus, including two cases in Nye County, and three cases in Clark County (DIRS 178696-USGS 2007, all). Incident rates of West Nile Virus are affected by the population density and availability of water.

- **Valley Fever –** The technical name for Valley Fever is *Coccidioidomycosis*. It is caused by *Coddidioides immitis*, a fungus that lives in soil. Fungus spores become wind-borne and may be inhaled into the lungs, where infection can occur. Valley Fever is not contagious from person to person.
It appears that after one exposure, the body develops immunity. The Valley Fever fungus is established in the Southern Nevada region of influence. Infection rates, as reflected by positive skin tests, are 2 to 3 percent per year in highly endemic regions, and activities associated with heavy dust exposure (such as

excavation, agricultural labor) increase infection rates (DIRS 175021-Barnato, Sanders, and Owens 2001, p. 1). About 60 percent of people who breathe the spores do not develop any symptoms. About one out of every 200 persons infected with Valley Fever develops the disseminated form, in which the disease spreads beyond the lungs through the bloodstream causing meningitis. Meningitis is a potentially fatal inflammation of the membrane around the brain and the spinal cord.

- **Hantavirus –** A 1993 outbreak of fatal respiratory illness on an Indian Reservation in the Four Corners area (where the states of Arizona, New Mexico, Colorado, and Utah meet) led to the identification of Hantavirus as the causative agent. Hantavirus is a rodent-borne disease. The route of exposure is believed to be inhalation of aerosolized virus, and/or ingestion of rodent excreta through contaminated food or water. Rodent bites and direct contact with broken skin or mucous membranes are also potential sources of infection. Symptoms include pneumonia, fever, and other flu-like symptoms. In 24 to 48 hours after symptoms appear, potentially fatal respiratory failure may occur. As of March 2007, there have been 465 recorded cases of Hantavirus in the U.S., with 18 of the cases recorded in Nevada (DIRS 181391-CDC 2007, all). DOE has implemented procedures for decontamination of any rodent excreta encountered by construction workers during construction activities at the Yucca Mountain Site to prevent Hantavirus infection of workers.

- **Rabies –** Rabies may be a hazard to construction and operation workers through accidental contact with mammalian species in construction and operations areas. The route of exposure is a bite or scratch from an infected animal, or non-bite exposure through inhalation of aerosolized rabies virus. Rabies has been reported in Nevada in bats but not in terrestrial animals (DIRS 177449-Krebs et al. 2005, p. 1917). The incubation period of rabies is variable, ranging from less than 10 days to greater than 6 years, and post exposure treatment is necessary following true exposure unless the subject has been vaccinated. Absent post exposure treatment, the first symptoms may be noted within 30 to 90 days of exposure. Once symptoms occur, death may occur in less than 1 week following the development of initial symptoms, usually as a result of respiratory failure. No human cases of rabies were reported in Nevada between January 2000 and September 2005, the latest period for which data are available (DIRS 177449-Krebs et al. 2005, p. 1920).

Dust and Soils Hazards: Dust and soils hazards include potential occupational exposure to hazardous inhalable soils and dust, including the minerals crystalline silica, cristobalite, and erionite and potential occupational encounters with unexploded ordnance. These hazards are discussed below.

- **Inhalable Dust –** Construction activities such as blasting, scarifying, and excavating create dust that can be inhaled by workers.

Some types of rock and associated soils may contain hazardous minerals such as crystalline silica, cristobalite, and erionite. It is unlikely that any fugitive particulates generated in the construction areas would contain a concentration of crystalline silica, eronite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Inhaling dust originating from these types of rock and containing these minerals can lead to disease such as silicosis if adequate precautions are not taken when working in dusty areas. However, DOE recognizes the potential for exposure to crystalline silica, cristobalite, or erionite during the development of quarries for production of hard rock ballast, in ballast placement, rock cuts, and other types of excavation. Of the three mineral dust hazards mentioned above, crystalline silica is the most common in hard rock ballast because it is a material of relative abundance in granite and quartz. DOE would be required to comply with Occupational Safety and Health Administration workplace guidance for mineral dusts (29 CFR 1910-1000, Table Z-3, Mineral Dusts).

DOE would therefore conduct routine monitoring of occupational dust exposure during quarry construction and operation and during rail alignment construction activities, such as ballast placement, with the potential for such exposure. DOE would apply best management practices and engineering controls such as application of water for dust suppression and washing the ballast before placement in order to minimize the potential for occupational exposure to dust, and an industrial hygienist would take mineral dust measurements to identify if any potential exposure hazards are present. In the event that these monitoring activities identify potential occupational exposure at levels exceeding Occupational Safety and Health Administration occupational exposure standards for silica, DOE would implement additional processing and engineering controls to mitigate, prevent, or reduce exposures to silica to below occupational exposure standards. Therefore, impacts associated with occupational exposure to these materials are anticipated to be small.

- **Unexploded Ordnance –** Portions of the construction area may have unexploded ordnance in surface or in subsurface locations. The potential areas of concern for unexploded ordnance are sections west of the Nevada Test and Training Range and within the Nevada Test Site. These include areas south of Goldfield and north of Beatty Wash. Unexploded ordnance may include shell casings, projectiles, or fragments, and may include live small arms ammunition, bombs, and rockets. These types of unexploded ordnance may have been generated from historical Air Force and other military training activities in the region. Sections of rail alignment and associated facility locations north and east of Goldfield are considered clear of unexploded ordnance at this time. DOE would coordinate with the U.S. Air Force concerning proposed construction activities and would follow standard and established procedures for unexploded ordnance. An unexploded ordnance specialist would develop a plan, including evaluation of types of unexploded ordnance possible, depths, etc. Unexploded ordnance technicians would be present and screen ahead of the construction crew in areas where there is potential for unexploded ordnance.

Air Quality Hazards: Construction workers could be exposed to air quality hazards, including potential human health effects of occupational exposure to stationary and area source emissions associated with construction activities. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar air quality hazards.

Stationary and area source emissions associated with the construction phase would include exhaust emissions from on-site vehicles and heavy construction equipment, and fugitive dust from excavation and construction activities. Stationary and area source exhaust emissions associated with the operations phase would include emissions from locomotive fueling stations and locomotive and rail line maintenance operations. Section 4.2.4, Air Quality and Climate, describes stationary source and area source emissions associated with the construction and operations phases.

Exposure of construction and operations workers to vehicle exhaust emissions and other air emissions would be subject to exposure standards, including standards established under 10 CFR 851. Threshold Limit Values established by the Occupational Safety and Health Administration and American Council of Government Industrial Hygienists would apply to occupational exposure to vehicle exhaust emissions and other air emissions. DOE would apply administrative controls and conduct workplace monitoring to control exposure to below applicable standards.

Noise Hazards: Workers conducting construction and operation activities under the Proposed Action could be exposed to noise from operation of heavy construction equipment, operation of locomotives, or from conducting blasting operations. Potential sources of occupational noise exposure, applicable noise exposure standards, and requirements for controlling noise exposure are described in this section and further described in Section 4.2.8.

- **Roadbed/Track Structure Construction Noise Exposure –** DOE would require employers of construction workers exposed to heavy equipment noise to comply with Occupational Safety and Health Administration regulation 29 CFR 1910.95 to avoid effects of excessive noise exposure. Hearing damage is related to absolute noise level and duration of exposure. Table 4-114 shows Occupational Safety and Health Administration noise level limits that would require hearing protection. Code of Federal Regulations 10 Part 851 requires DOE to use American Conference of Governmental Industrial Hygienists Threshold Limit Values as occupational exposure standards. Table 4-114 also shows the Threshold Limit Values.

DOE would be required to administer a continuing, effective hearing conservation program whenever employee noise exposures equal or exceed an 8-hour time-weighted average sound level of 85 A-weighted decibels.

- **Railroad Worker Noise Exposure –** Railroad operators are required to comply with Federal Railroad Administration Regulation 49 CFR 229.121 for worker exposure to locomotive cab noise. Applicable noise levels, the exceedance of which would require hearing protection, are shown in Table 4-114.

Table 4-114. Occupational noise exposure limits.[a]

Duration per day, hours	Sound level (decibels slow response)	ACGIH[b] Threshold Limit Value
8	90	85
6	92	86
4	95	88
3	97	89
2	100	91
1.5	102	92
1	105	94
0.5	100	97
0.25 or less	115	100

a. Source: 29 CFR 1910.95 and 30 CFR 62.130 and 10 CFR 851.
b. ACGIH = American Conference of Governmental Industrial Hygienists.

- **Ballast Quarry Noise Exposure –** Employers of quarry workers supplying ballast for the rail bed would be required to comply with Mine Safety and Health Administration Regulation 30 CFR 62. Applicable Mine Safety and Health Administration noise levels, the exceedance of which would require hearing protection, are shown in Table 4-114. Noise levels above 115 dBA are not permitted under the regulation (30 CFR 62.130).

4.2.10.2.2 Radiological Impacts

This section discusses the radiological impacts for workers and members of the public during construction and operation of the railroad and facilities such as the Staging Yard, the Rail Equipment Maintenance Yard, the Maintenance of Way Trackside Facility, and the Cask Maintenance Facility. Both incident-free impacts and radiological accident risks are discussed. Also discussed are the impacts from severe transportation accidents and from acts of sabotage.

Risk Terms

A risk value of 1×10^{-4} is equivalent to 1 in 10,000.
A risk value of 1×10^{-6} is equivalent to 1 in 1,000,000.
A risk value of 1×10^{-8} is equivalent to 1 in 100,000,000.

4.2.10.2.2.1 Workers.

Rail line and Facilities Construction DOE does not anticipate that there would be any radiological occupational health and safety impacts associated with construction of the proposed rail line or facilities for the Proposed Action.

Railroad Operations Occupational radiological impacts associated with incident-free operation of the rail line and rail line facilities are described below. Occupational radiological impacts are quantified in terms of latent cancer fatalities. Occupational radiation doses (effective dose equivalent) are also reported.

Incident-Free Transportation: During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente-Upland, Caliente-Indian Cove, or Eccles-North Staging Yard to the repository, workers would be exposed to direct radiation from 9,495 shipping casks. These workers would include rail transportation crew members, security escorts, workers exposed when trains with loaded shipping casks passed the Maintenance-of-Way Trackside Facility, and workers exposed when trains with loaded shipping casks passed trains with unloaded casks or other materials at sidings. The methods and data used to estimate the radiation doses for these workers are described in Appendix K.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from the Interchange Yard to the repository. For the radiological impacts analyses, four specific alignments were evaluated: 1) the alignment with the highest exposed population, 2) the shortest alignment, 3) the longest alignment, and 4) the alignment with the lowest exposed population. These alignments are described in Table 3-67.

Table 4-115 lists the radiation doses and impacts for these workers along these four alignments. The collective radiation dose for these workers is estimated to be 310 to 320 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.19.

Table 4-115. Estimated radiological impacts for workers along the proposed rail alignment.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.50 rem per year	0.00030
Maximally exposed worker (50-year operation)	25[a] rem	0.015[a,b]
Worker population	310 to 320 person-rem	0.19[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

The maximally exposed worker would be a security escort. This worker is estimated to receive a radiation dose of 25 rem over the entire operations phase, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming that a person could work for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Security escort workers and other rail line workers would be subject to a radiation protection program. Workers, including security escort workers, would not be exposed to radiation in excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work as security escorts to less than 2,000 hours per year.

- **Staging Yard at Caliente-Indian Cove, Caliente-Upland, or Eccles-North, Rail Workers, Inspectors, and Escorts –** When shipping casks arrived at the Staging Yard, the railcars containing the shipping casks would be removed from the train, an inspection would be conducted, and the railcars would be transferred to the train for transport to the Rail Equipment Maintenance Yard. The escorts that had accompanied the shipping cask from its origin would also be present during this inspection. These rail workers, inspectors, and escorts would be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The methods and data used to estimate the radiation doses for these workers are described in Appendix K.

Table 4-116 lists the radiation doses and impacts for the workers involved with these activities. The analysis assumed that noninvolved workers would also be exposed to direct radiation during these activities.

Table 4-116. Estimated radiological impacts for rail workers, inspectors, and escorts at the Staging Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.50 rem per year	0.00030
Maximally exposed worker (50-year operation)	25[a] rem	0.015[a,b]
Worker population (involved workers)	240 person-rem	0.14[c]
Worker population (noninvolved workers)	12 person-rem	0.0074
Worker population (total)	250 person-rem	0.15

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

The collective radiation dose for involved and noninvolved workers is estimated to be 250 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15. The maximally exposed worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming that a person could work for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Staging Yard workers and other facilities workers would be subject to a radiation protection program. Workers, including Staging Yard workers, would not be exposed to radiation in excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work at the Staging Yard to less than 2,000 hours per year.

- **Rail Equipment Maintenance Yard –** Under the Proposed Action, a Rail Equipment Maintenance Yard would be constructed and operated to transfer cask cars to the repository. The workers at this facility would be exposed to direct radiation from handling 9,495 shipping casks over 50 years of shipping. The radiation doses for these workers would be similar to the radiation doses for handling dedicated rail shipments at other railyards and are described in Neuhauser et al. The methods for estimating these radiation doses are described in Neuhauser et al. (DIRS 155430- Neuhuaser, Kanipe, and Weiner 2000, Section 3.5.2).

Table 4-117 summarizes the radiation doses and impacts for workers involved in these activities. The collective radiation dose for these workers is estimated to be 16 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0096.

Table 4-117. Estimated radiological impacts for workers at the Rail Equipment Maintenance Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.013 rem per year	7.6×10^{-6}[b]
Maximally exposed worker (50-year operation)	0.64[a] rem	0.00038[,b]
Worker population	16[a] person-rem	0.0096[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

The individual radiation dose for workers at this facility was estimated to be 0.013 rem per year. The probability of a latent cancer fatality for this worker is estimated to be 7.6×10^{-6}. If this individual worked at the facility for 50 years, their radiation dose would be 0.64 rem. The probability of a latent cancer fatality for this worker is estimated to be 0.00038.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to workers from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, PA. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are described in *Environmental Assessment for Alaron Corporation* (DIRS 181886-NRC 1989, all) and *Environmental Assessment Renewal of Materials Licenses for ALARON Corp* (DIRS 151227-Blasing et al. 1998, all).

Radiation dose from cask handling and maintenance activities at the Cask Maintenance Facility could result in radiation dose to workers, primarily as a result of exposure to "crud." Crud is the term used to describe contamination on the outside of spent nuclear fuel and would consist of the radionuclides Co-60, Mn-54, Fe-55, and Zn-65. Crud may be present in reactor spent nuclear fuel pools and may contaminate the inside of the cask during loading, even if the spent nuclear fuel has been placed in canisters. For the radionuclides contained in crud, average radionuclide inventories at the Alaron Regional Service Facility would consist of about 4.7 Ci of Co-60, 0.32 Ci of Mn-54, 7.6 Ci of Fe-55, and 0.061 Ci of Zn-65. Not all of this radionuclide inventory would be from the decontamination of spent nuclear fuel casks; some of the radionuclide inventory would be as a result of other services provided at the Alaron Regional Service Facility.

Workers at Alaron were estimated to receive an individual radiation dose of 0.04 rem per month. Over the course of a year, a worker would receive a radiation dose of 0.480 rem. This radiation dose was used to estimate the radiation dose to a worker at the Cask Maintenance Facility. The probability of a latent cancer fatality for this worker is estimated to be 0.00029.

Based on the total number of workers at the Cask Maintenance Facility, the collective radiation dose at the Cask Maintenance Facility would be 14 person-rem per year. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0086. Table 4-118 summarizes these impacts and also presents impacts for the entire duration of operations (50 years).

Table 4-118. Estimated radiological impacts for rail workers, inspectors, and escorts at the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.48 rem per year	0.00029[b]
Maximally exposed worker (50-year operation)	24[a] rem	0.014[a,b]
Worker population (annual)	14 person-rem per year	0.0086[c]
Worker population (50-year operation)	720[a] person-rem	0.43[a,c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

- **Other Rail Line Facility Operations –** Under the Proposed Action, other railroad facilities would be constructed and operated, including the Maintenance-of-Way Trackside Facility, Maintenance-of-Way Headquarters Facility, Satellite Maintenance-of-Way Facilities, and Nevada Railroad Control Center and National Transportation Operations Center. Radiological health impacts to workers operating these facilities are anticipated to be minimal, as casks would not be loaded or unloaded at these facilities. Note that the dose impacts for rail facility operations workers in Table 4-118 include radiological exposure to workers at the Maintenance-of-Way Trackside Facility and at workers at sidings who would be exposed when the cask train passes by.

4.2.10.2.2.2 Public.

Construction DOE does not anticipate that there would be any radiological public health and safety impacts associated with construction of the proposed rail line or associated facilities under the Proposed Action.

Operations

Incident-free Rail Transportation:

- **Public along the Proposed Rail Line –** During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente-Upland, the Caliente-Indian Cove, or the Eccles-North Staging Yard to the Rail Equipment Maintenance Yard, people along the proposed rail line would be exposed to direct radiation from 9,495 shipping casks. These people would include people along the transportation route. Because shipments would be made using dedicated trains, there would be no exposures of members of the public sharing the transportation route or members of the public at stops along the route. The methods and data used to estimate the impacts from direct radiation for these people are described in Appendix K.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from Caliente-Indian Cove, Caliente-Upland, or Eccles-North to the Rail Equipment Maintenance Yard. For the radiological impacts analyses, four specific alignments were evaluated. These alignments are described in Table 3-67.

Table 4-119 lists the radiation impacts for these people. The collective radiation dose for members of the public is estimated to be 0.087 to 0.21 person-rem. In the exposed population, the probability of a latent cancer fatality is estimated to be 5.2×10^{-5} to 1.3×10^{-4}.

Table 4-119. Estimated radiological impacts for the public along the proposed rail line.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.00016 rem	9.4×10^{-8}[a]
Maximally exposed worker (50-year operation)	0.0078 rem	4.7×10^{-6}[a]
Population	0.087 to 0.21 person-rem	5.2×10^{-5} to 1.3×10^{-4}[b]

a. The estimated probability of a latent cancer fatality for an exposed individual worker.
b. The estimated number of latent cancer fatalities in an exposed worker population.

- **Public near the Staging Yard at Caliente-Indian Cove –** The public around the Staging Yard location at Caliente-Indian Cove would be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-120 lists the radiation doses and impacts for these people. The collective radiation dose is estimated to be 0.026 person-rem. In the exposed population, the probability of a latent cancer fatality is estimated to be 1.6×10^{-5}. The ***maximally exposed individual*** is a resident who lives 1,600 meters

(5,200 feet) from the Staging Yard. This individual was assumed to be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.0×10^{-6} rem for the 9,495 casks over the entire shipping campaign. The probability of a latent cancer fatality for this individual is estimated to be 1.8×10^{-9}.

Table 4-120. Estimated radiological impacts for the public at the Staging Yard at Caliente-Indian Cove.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual	3.0×10^{-6} rem[a]	1.8×10^{-9}[b]
Population	0.026 person-rem	1.6×10^{-5}[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual.
c. The estimated number of latent cancer fatalities in an exposed population.

- **Public near the Staging Yard at Caliente-Upland –** The public around the Staging Yard location at Caliente-Upland would be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-121 lists the radiation doses and impacts for these people. The collective radiation dose is estimated to be 0.0064 person-rem. In the exposed population, the probability of a latent cancer fatality is estimated to be 3.9×10^{-6}. The maximally exposed individual is a resident who lives 400 meters (1,300 feet) from the Staging Yard. This individual was assumed to be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 0.0027 rem over the entire shipping campaign. The probability of a latent cancer fatality for this individual is estimated to be 1.6×10^{-6}.

Table 4-121. Estimated radiological impacts for the public at the Staging Yard at Caliente-Upland.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual	0.0027 rem[a]	1.6×10^{-6}[b]
Population	0.0064 person-rem	3.9×10^{-6}[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual.
c. The estimated number of latent cancer fatalities in an exposed population.

- **Public near the Staging Yard at Eccles-North –** The public around the Staging Yard location at Eccles-North would be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-122 lists the radiation doses and impacts for these people. The collective radiation dose is estimated to be 0.0039 person-rem. In the exposed population, the probability of a latent cancer fatality is estimated to be 2.4×10^{-6}. The maximally exposed individual is a resident who lives 1,500 meters (4,900 feet) from the Staging Yard. This individual was assumed to be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.4×10^{-6} rem over the entire shipping campaign. The probability of a latent cancer fatality for this individual is estimated to be 2.1×10^{-9}.

Table 4-122. Estimated radiological impacts for the public at the Staging Yard at Eccles-North.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual	3.4×10^{-6} rem[a]	2.1×10^{-9}[b]
Population	0.0039 person-rem	2.4×10^{-6}[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual.
c. The estimated number of latent cancer fatalities in an exposed population.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to members of the public from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in *Environmental Assessment for Alaron Corporation* and *Environmental Assessment Renewal of Materials Licenses for ALARON Corp* (DIRS 181886-NRC 1989, all; DIRS 151227-Blasing et al. 1998, all).

At the Alaron Regional Service Facility, the maximally exposed member of the public was located 300 meters (984 feet) from the facility. The radiation dose for this individual from emissions through all environmental pathways was estimated to be 2.0×10^{-9} rem per year. The probability of a latent cancer fatality for this individual is estimated to be 1.2×10^{-12}. The radiation dose and latent cancer fatality risk for members of the public from emissions from the Cask Maintenance Facility would be much smaller, because the public is located much further from the facility. For example, the nearest site boundary is 11 kilometers (7 miles) from the repository, while at Alaron, the maximally exposed member of the public was located 300 meters from the facility.

The ***total population*** within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the maximally exposed member of the public, the resulting collective radiation dose would be 0.00023 person-rem per year. In this exposed population, the probability of a latent cancer fatality is estimated to be 1.4×10^{-7}. Table 4-123 summarizes these impacts and also presents impacts for the entire duration of operations.

Table 4-123. Estimated radiological impacts for the public from the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Individual member of the public (annual)	2.0×10^{-9} rem per year	1.2×10^{-12}[b]
Individual member of the public (50 years)	1.0×10^{-7}[a] rem	6.0×10^{-11}[a,b]
Collective members of the public (annual)	0.00023 person-rem per year	1.4×10^{-7}[c]
Collective members of the public (50 years)	0.012[a] person-rem	7.0×10^{-6}[a,c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual.
c. The estimated number of latent cancer fatalities in an exposed population.

Accidents: To quantify the potential radiological impacts of transportation accidents, DOE performed two types of analyses. The first analysis provided an estimate of the radiological accident risks associated with transporting spent nuclear fuel and high-level radioactive waste along the Caliente rail alignment. The analysis of radiological accident risks takes into account a spectrum of accidents ranging from higher-probability accidents of low severity to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. Included are accidents in which no release of radioactive material occurred, but where there was a deformation of shielding because of lead shield displacement, and accidents in which radioactive material was released from the shipping cask. Radiological accident risks were defined as the probability of occurrence of an accident multiplied by the consequences of the accident, summed over a complete spectrum of accidents. This quantity is known as "dose risk."

The second analysis provided an estimate of the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents. Historically, maximum reasonably foreseeable transportation accidents were defined as transportation accidents with a frequency of about 1×10^{-7} per year.

Accidents in which no release of radioactive material and no deformation of shielding occurred are discussed in Section 4.2.10.2.3 below.

- **Accident Risks –** The methods and data used to estimate radiological accident risks are discussed in Appendix K. The impacts from these accidents are listed in Table 4-124. The risks from accidents where a release of radioactive material or shielding deformation occurred are estimated to be 6.7×10^{-7} to 1.3×10^{-6} latent cancer fatalities.

Table 4-124. Estimated radiological accidents risks from potential transportation accidents along the proposed rail line.

Risk	Accident dose risk[a]	Latent cancer fatality
Radiological accident risk	1.1×10^{-3} to 2.2×10^{-3}	6.7×10^{-7} to 1.3×10^{-6}

a. Radiological accident dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents. This sum is converted to latent cancer fatalities using the conversion factor of 0.0006 latent cancer fatality per person-rem.

- **Severe Accidents –** Severe accidents having a frequency of about 1×10^{-7} per year are known as ***maximum reasonably foreseeable accidents***. Accidents with frequencies below 1×10^{-7} per year are generally not reasonably foreseeable. In this Rail Alignment EIS, the maximum reasonably foreseeable transportation accident has a frequency of about 6×10^{-7} per year. This accident involves a long duration, high-temperature fire that would engulf a cask. The methods and data used to estimate the impacts of this accident are discussed in Appendix K.

For the four evaluated rail alignments described in Table 3-67, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Suburban areas are defined as areas with a population density between 139 and 3,326 people per square mile. Rural areas were defined as areas with a population density less than 139 people per square mile. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 226 people per square kilometer (585 people per square mile), near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.515 people per square mile).

Table 4-125 lists estimates of the impacts of this severe accident. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 770 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 0.46. If the maximum reasonably foreseeable accident were to occur in a rural area, the collective radiation dose would be 2.0 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 1.2×10^{-3}.

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the maximally exposed individual located 330 meters from the accident would be 34 rem. The probability of a latent cancer fatality for that individual is estimated to be 0.020.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of a latent cancer fatality for this first responder is estimated to range from 8.2×10^{-5} to 0.0012.

- **Accidents at the Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks.

Table 4-125. Estimated radiological impacts from the maximum reasonably foreseeable transportation accident scenario for suburban and rural areas.[a,b]

Impact	Suburban area[c]	Rural area[c]
Impacts to population		
Population dose (person-rem)	770	2
Latent cancer fatalities	0.46	1.2×10^{-3}
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	34	34
Probability of a latent cancer fatality	0.020	0.020
Impacts to a first responder		
Maximally exposed responder dose (rem)	0.14 to 2.0	0.14 to 2.0
Probability of a latent cancer fatality	8.2×10^{-5} to 0.0012	8.2×10^{-5} to 0.0012

a. There are no urban areas for the four specific alignments.
b. Accident frequency is estimated to be 6×10^{-7} per year.
c. Radiological impacts were based on low wind speeds and stable atmospheric conditions. These were defined as Class F stability and a wind speed of 0.89 meters per second.

Impacts to members of the public from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, Pennsylvania. This facility provides treatment, decontamination, compaction, and repackaging services for generators of

SEVERE TRANSPORTATION ACCIDENTS: AN OPPOSING VIEWPOINT

The State of Nevada has provided analyses that indicate that the consequences of severe transportation accidents would be much higher than those in this Rail Alignment EIS. For example, the state has estimated that the long-term consequences of a rail accident in a rural area could result in 7 to 614 latent cancer fatalities in the exposed population (DIRS 181756-Lamb et al. 2001, Table 41), while DOE estimates that about 1 latent cancer fatality would occur in the exposed population.

The State estimated these consequences using computer programs that DOE developed and uses. However, the state's analysis used values for parameters that would be at or near their maximum values. DOE guidance for the evaluation of accidents in environmental impact statements (DIRS 172283-DOE 2002, p. 6) specifically cautions against the evaluation of scenarios for which conservative (or bounding) values are selected for multiple parameters because the approach yields unrealistically high results.

DOE's approach to accident analysis estimates the consequences of severe accidents having frequencies as low as 1×10^{-7} per year (1 in 10 million) (DIRS 172283-DOE 2002, p. 9) using realistic yet cautious methods and data. DOE believes that the State of Nevada estimates are unrealistic and that they do not represent the reasonably foreseeable consequences of severe transportation accidents.

radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in *Environmental Assessment for Alaron Corporation* and *Environmental Assessment Renewal of Materials Licenses for ALARON Corp* (DIRS 181886-NRC 1989, all; DIRS 151227-Blasing et al. 1998).

A fire at the Alaron Regional Service Facility was estimated to result in a radiation dose of 0.00045 rem to a member of the public at a distance of 50 meters (164 feet) from the facility and a radiation dose of 0.000011 rem to a member of the public at a distance of 300 meters (984 feet) from the facility. The probability of a latent cancer fatality for these individuals is estimated to be 2.8×10^{-7} and 6.5×10^{-9}, respectively. For a similar fire at the Cask Maintenance Facility, the impacts would be much lower, because the public is located much further from the facility, about 11 kilometers (7 miles), as opposed to 50 to 300 meters at Alaron.

The total population within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the member of the public located 300 meters (984 feet) from the facility, the resulting collective radiation dose would be 1.3 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 7.6×10^{-4}.

- **Sabotage** – In response to the terrorist attacks of September 11, 2001, and to intelligence information that has been obtained since then, the United States Government has initiated nationwide measures to reduce the threat of sabotage. These measures include security enhancements intended to prevent terrorists from gaining control of commercial aircraft, such as (1) more stringent screening of airline passengers and baggage by the Transportation Security Administration, (2) increased presence of federal air marshals on many flights, (3) improved training of flight crews, and (4) hardening of aircraft cockpits. Additional measures have been imposed on foreign passenger carriers and domestic and foreign cargo carriers, as well as charter aircraft.

Beyond these measures to reduce the potential for terrorists to gain control of an aircraft, DOE has adopted an approach that focuses on ensuring that safety and security requirements are adequate and effective in countering and mitigating the effects of sabotage events that involve transportation casks. The Federal Government has greatly improved the sharing of intelligence information and the coordination of response actions among federal, state, and local agencies. DOE has been an active participant in these efforts; it now has regular and frequent communications with other federal, state, and local government agencies and industry representatives to discuss and evaluate the current threat environment, to assess the adequacy of security measures at DOE facilities and, when necessary, to recommend additional actions. In addition to its domestic efforts, DOE is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of sabotage events and exploring opportunities to enhance the physical protection of casks.

In addition, the Nuclear Regulatory Commission NRC has promulgated rules (10 CFR 73.37) and interim compensatory measures (67 *FR* 63167, October 10, 2002) specifically to protect the public from harm that could result from sabotage of spent nuclear fuel casks. The purposes of these security measures are to minimize the possibility of sabotage and to facilitate recovery of spent nuclear fuel shipments that could come under the control of unauthorized persons. These measures include the use of armed escorts to accompany all shipments, safeguarding of the detailed shipping schedule information, monitoring of shipments through satellite tracking and a communication center with 24-hour staffing, and coordination of logistics with state and local law enforcement agencies, all of which would contribute to shipment security. The Department has committed to following these rules and measures (see 69 *FR* 18557, April 8, 2004).

The Department, as required by the NWPA, would use Nuclear Regulatory Commission-certified shipping casks. Each cask design must meet stringent requirements for structural, thermal, shielding, and criticality performance and confinement integrity for routine (incident-free) and accident events. Spent nuclear fuel is protected by the robust metal structure of the shipping cask, and by cladding that surrounds the fuel pellets in each fuel rod of an assembly. Further, the fuel is in a solid form, which would tend to reduce dispersion of radioactive particulates beyond the immediate vicinity of the cask, even if a sabotage event were to result in a breach of the multiple layers of protection.

Based on this knowledge, the Department has analyzed plausible threat scenarios, required enhanced security measures to protect against these threats, and developed emergency planning requirements that would mitigate potential consequences for certain scenarios. DOE would continue to modify its approach to ensuring safe and secure shipments of spent nuclear fuel and high-level radioactive waste, as appropriate, between now and the time of shipments.

For the reasons stated above, DOE believes that under general credible threat conditions the probability of a sabotage event that would result in a major radiological release would be low. Nevertheless, because of the uncertainty inherent in the assessment of the likelihood of a sabotage event, DOE has evaluated events in which a military jet or commercial airliner would crash into a spent nuclear fuel cask or a modern weapon (high energy density device or) would penetrate a spent nuclear fuel cask.

In the Yucca Mountain FEIS (Appendix J, Section J.3.3.1), DOE evaluated the ability of large aircraft parts to penetrate shipping casks. In that analysis, DOE determined that the parts having the highest probability of penetrating a cask are jet engines and jet engine shafts. Accordingly, DOE undertook a penetration analysis using these parts from military aircraft (F-15/16) and from a commercial airliner (B-767), which found that neither the engines nor shafts would penetrate a cask and cause a release of radiological materials if an aircraft were to crash into a spent nuclear fuel cask.

To estimate the potential consequences of a sabotage event in which an high energy density device penetrates a rail or truck cask, DOE, in the Yucca Mountain FEIS, referred to *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* to obtain estimates of the fraction of spent nuclear fuel materials that would be released (release fractions) (DIRS 104918-Luna et al. 1999, all). In this Rail Alignment EIS, the Department used the more recent release fraction estimates from *Release Fractions from Multi-element Spent Fuel Casks Resulting from HEDD* [high energy density device] *Attack* (DIRS 181279-Luna 2006, all) to estimate the consequences of such events involving spent nuclear fuel in rail casks. These more recent estimates of release fractions (DIRS 181279-Luna 2006, all) are based on the release fractions estimated in 1999 from *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* (DIRS 104918-Luna et al. 1999, all), but they also incorporate data from additional tests sponsored by *Gesellschaft für Anlagen - und Reaktorsicherheit* in Germany and conducted in France in 1994 that were not available for the 1999 report.

The potential impacts of sabotage were assessed for rail shipments from the Caliente-Upland, Caliente-Indian Cove, or Eccles-North Staging Yard to the repository. As with the maximum reasonably foreseeable accidents discussed in the Accidents section, four specific rail alignments were evaluated. The methods and data used to estimate the impacts of sabotage events are described in Appendix K.

For the four specific alignments there were no urban areas, as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 226 people per square kilometer (585 people per square mile), near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.515 people per square mile).

The impacts of a sabotage event are listed in Table 4-126. If a sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 1,800 person-rem. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be 1.1. If the sabotage event occurred in a rural area, the collective radiation dose is estimated to be 4.7 person-rem. The total latent cancer fatalities for people exposed during this sabotage event is estimated to be 0.0028.

In either a suburban area or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for the maximally exposed individual is estimated to be 0.016.

Table 4-126. Estimated radiological impacts for a sabotage event involving a rail shipping cask for suburban and rural areas.[a]

Impact	Suburban area[b]	Rural area[b]
Impacts to populations		
Population dose (person-rem)	1,800	4.7
Latent cancer fatalities	1.1	0.0028
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	27	27
Probability of a latent cancer fatality	0.0016	0.016

a. There are no urban areas for the four specific alignments
b. Based on neutral atmospheric conditions and moderate wind speeds; defined as Class D stability and a wind speed of 4.47 meters per second.

4.2.10.2.3 Transportation Impacts

4.2.10.2.3.1 Construction Impacts.

Nonradiological Roadway Accidents During construction, personnel and equipment would be moved initially by truck and other vehicles, and could be moved by rail once portions of the rail line were completed. Such movements of equipment and personnel could lead to roadway accidents.

DOE estimates that the construction phase would involve approximately 2,160 full-time-equivalent workers during the first three years, 1,080 full-time-equivalent workers in the fourth year, and 540 full-time-equivalent workers in the last year, for a total of 8,100 full-time-equivalent workers, not including the Cask Maintenance Facility (DIRS 174083-WPI 2003, all; DIRS 180921-Nevada Rail Partners 2007, Appendix D, Tables 1 and 2). The construction phase would take a minimum of 4 years and 6 months. The Cask Maintenance Facility construction would involve an additional 150 workers for 88 weeks.

In total, there would be 8,100 full-time-equivalent workers involved in the construction of the rail line and associated facilities and an additional 263 full-time-equivalent workers for construction of the Cask Maintenance Facility. The exact distribution over time is not significant for the traffic safety calculations, which are aggregated over the total construction time. In other words, if the construction phase were assumed to take place over a 10-year period, this would only mean that fewer workers would be making more trips; this would result in a similar total number of trips as the minimum 4.5-year construction phase.

For each year, it is assumed that each worker would make two trips per day over five days a week for 50 weeks a year (that is, 2,000 hours per year full-time-equivalent workers). To provide a conservative upper bound estimate of roadway accidents, DOE assumed that all workers would individually make daily vehicle trips on roadways, even though it is likely that many rail line construction workers would reside in construction camps linked to work sites by access roads. Each trip is assumed to be 80 kilometers (50 miles) in length, which translates to approximately 40,000 kilometers (25,000 miles) per year per worker. While the distances involved for portions of this construction project are obviously much greater, a worker might travel hundreds of miles each way every one to two weeks and stay in the construction camps between these longer trips. This travel pattern would result in approximately the same distance traveled per worker. Collectively, the total distance driven by all workers would be approximately 335 million kilometers (200 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2) traveled for light trucks or passenger cars in rural areas in Nevada, approximately six fatalities could occur due to the movement of workers during construction of the rail line and facilities.

These estimates would not vary among the proposed specific alignments, because the number of potential fatalities is based on the total distance traveled and is not dependent on the minor difference in the length or location of the alternative segments. Therefore, the predicted accident rates are the same for each specific alignment.

Nonradiological Rail Line Accidents During the construction phase, there are expected to be up to 992 loaded trains servicing the Caliente area, 1,116 for Garden Valley, and 1,984 near Goldfield (DIRS 180923-Nevada Rail Partners 2007, Appendix A, p. A-9) as the portions of the rail line that had already been completed were used to bring critical materials to the various staging areas (the length of line constructed from a particular staging area would influence the number of trains used on each segment of the partially completed rail line). A shorter construction phase would result in more trains per day, and a more extended construction phase would likely experience the lower end of the range of expected train volume.

Given the variability in the number of trains per day or year, this analysis focuses on the total number of inbound loaded and outbound unloaded construction trains, which is predicted to be 8,184 ([992 + 1,116 + 1,984] × 2). These trains would travel at speeds between 24 and 64 kilometers (15 and 40 miles) per

TRANSPORTATION SABOTAGE: AN OPPOSING VIEWPOINT

The State of Nevada has provided analyses that assert that a sabotage event using a high-energy density device such as an antitank missile would completely penetrate a spent nuclear fuel cask, which would result in consequences 10 times higher than those DOE estimated (DIRS 181892-Lamb, Hintermann, and Resnikoff 2002, p. 19).

Because of the requirements of the DOE classification policy, the Department cannot disclose specifically the devices that the analyses in Luna, Neuhauser, and Vigil (DIRS 104918-1999, all) and Luna (DIRS 181279-2006, all) considered. However, the analyses encompassed the damage that modern weapons could produce in an optimally successful sabotage event. The assertion that modern weapons can produce full penetration of both cask walls is not confirmed by calculations from Luna, Neuhauser, and Vigil (DIRS 104918-1999, all).

In addition, in scoping comments, the State of Nevada recommended that the sabotage analysis address factors such as attacks that involve multiple weapons, attacks that use combinations of weapons designed to maximize release and dispersal of radioactive materials, attacks that involve large groups of well-trained adversaries, suicide attacks, attacks that involve the infiltration of trucking an railroad companies, and attacks at locations with high symbolic value.

Because DOE assumed that the sabotage event would occur, most of the factors listed by the state could affect the chances that such an event could occur but not the outcome of the sabotage event. In addition, even though attacks that use multiple weapons and combinations of weapons designed to maximize release and dispersal of radioactive materials are possible, DOE believes that the sabotage event it analyzed encompasses the damage that modern weapons might produce were a sabotage event to occur.

hour depending on both the load carried and the area in which they operate. DOE assumes that each train would travel one-half of the total route length, or approximately 270 kilometers (170 miles) on average. Therefore, the total number of train kilometers would be approximately 2.2 million train-kilometers (1.4 million train-miles). The total expected number of loaded railcars (including locomotives) during the construction phase are 22,240 for Caliente area, 25,020 for Garden Valley, and 44,480 for Goldfield. The total number of inbound loaded and outbound unloaded construction railcars is predicted to be 183,480 ([22,240 + 25,020 + 44,480] × 2), resulting in approximately 50 million railcar-kilometers (31 million railcar-miles).

The transportation safety impacts of concern during construction focus on rail-related accidents and worker and public fatalities. Based on the same rail accident rates described in the operations phase (Section 4.2.10.2.3.2), accidents associated with train-kilometers and railcar-kilometers are calculated. A total of three rail accidents would be expected to occur for the entire set of estimated train and railcar movements during construction.

Based on Federal Railroad Administration statistics, the fatality rate for workers is 3.46×10^{-10} fatality per railcar kilometer traveled, and the rate for occupants of other vehicles and pedestrians is 1.11×10^{-8} fatality per railcar-kilometer traveled (DIRS 178016-DOT 2005, Chapter 1, all). Rates were derived by considering fatalities associated with freight train operations only (fatalities associated with passenger train operations were omitted for more applicable rates). As a result, the worker category considers *worker-on-duty*, *worker-not-on-duty*, *contractor-on-duty*, and *contractor-other*. Public fatalities include both *trespassers* and *non-trespassers*. Because passenger operations are not relevant to the Proposed Action, there is no consideration of the *passengers-on-train* category.

Based on these fatality rates, a total of 0.6 fatality (that is, not more than one) would be expected to occur for the entire set of estimated railcar movements during construction. No detectable difference is expected for the specific alignments, as the total variation in route lengths is minimal (greatest difference would be between Goldfield alternative segment 1 and Goldfield alternative segment 4, which is a 5-kilometer [3-mile] difference).

Many movements of rail-mounted construction equipment are also anticipated. This equipment would travel fairly short distances each day to conduct such activities as setting out railroad ties or preparing the ballast. These movements have not been included in the count of train-kilometers as they would occur in controlled work areas and in very small increments, rather than at any measurable speed in a publicly accessible area.

4.2.10.2.3.2 Operations Impacts.

Nonradiological Roadway Accidents The assessment of impacts to transportation safety begins with accidents, such as may be experienced by any vehicle, independent of cargo. These accidents typically result in injuries or fatalities to drivers or operators, other motorists, or pedestrians, and could result from the movement of cargo.

Approximately 230 workers would be involved in the operation of the rail line and the facilities. Each year it is assumed that each worker would make two trips per day, over five days a week, for 50 weeks a year. It is assumed that each trip would be 80 kilometers (50 miles). This would result in 40,000 kilometers (25,000 miles) per year per worker. Collectively, over the 50-year operations phase, the total number of kilometers driven by workers would be approximately 460 million kilometers (288 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) traveled for light trucks or passenger cars in rural areas in Nevada (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2), approximately eight fatalities would be expected due to the movement of workers during operation of the rail line and facilities over 50 years of operation. These estimates are not specific to the specific alignments, because the small variations in length and location of the alternative segments would not significantly affect the total distance traveled.

Nonradiological Rail Line Accidents The rail transportation safety analysis for the operations phase of the Proposed Action assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The proposed rail line would range from 528 to 541 kilometers (approximately 328 to 336 miles) in length, depending on which alternative segments are chosen. Given the similarities in the lengths of the alternative segments, the longest specific alignment has been selected to conservatively estimate the overall accident risks for the rail line.

This analysis includes both dedicated railcar cask trains and other trains not involving casks from the Interchange and Staging Yard to the Rail Equipment Maintenance Yard. A typical spent nuclear fuel or high-level radioactive waste train would have two to three locomotives, followed by a buffer car, one to five cask cars, another buffer car, and an escort car. The actual number of casks per train could vary from one to five, while the number of locomotives could vary from two to three. The total number of casks that would be moved by rail is 9,495. Based on Total System Model runs, there would be 2,833 trains carrying loaded casks and an equal number carrying empty casks. Therefore, to determine the impacts of moving cask cars, the analysis considers 5,666 trains (2,833 × 2) involving cask cars. The Model runs also give the total number of railcars involved in cask trains, with an average of 8.54 cars per train (3.35 cask cars, 2.19 locomotives, two buffer cars, and one escort car). Over the 50-year operations phase, there would be approximately 48,408 railcars associated with cask trains.

In addition to trains involving cask cars, there are also other types of trains that would be operating along the rail line, including maintenance-of-way trains (two one-way trains per week), and repository supply and construction trains (seven one-way trains per week). The total number of trains not involving casks would be 23,400 over 50 years of operation. The total number of railcars not carrying casks would be 58,338, accounting for both loaded and unloaded cars (DIRS 180923-Nevada Rail Partners 2007, Section 4.0, Table 1).

The total number of railcars (all kinds) moved under the Proposed Action would be approximately 106,746 (48,408 + 58,338), considering both directions of travel. Based on the same fatality rates used in the construction analysis, namely 3.46×10^{-10} fatality per worker per railcar-kilometer, and 1.11×10^{-8} fatality per pedestrian per railcar-kilometer, 0.7 fatality (that is, not more than one) would be expected to occur for the entire set of estimated railcar movements during operation.

The Interchange Yard would operate like a typical large siding or other similar types of rail yards, so the hazards associated with its operation would be the potential for transport accidents. However, because the buffer cars, cask cars, and escort car would be separated as a unit from the trains used to transport the casks from their origins, there would be limited chances for derailments involving the cask cars in the Interchange Yard. Accidents in yards typically occur as individual cars are handled, not with complete sets of cars. Accidents during the handling of railcars also occur at very low speeds, further limiting the chance of an accident. Because the trains are expected to enter the Interchange Yard from the Union Pacific Railroad Mainline at normal track speed, the accident rate for the Interchange Yard would be based on mainline accident rates rather than yard accident rates.

Accident rates for rail transportation are generally presented as either accidents per train-kilometers or a combination of accident rates based on both accidents per train-kilometer traveled and accidents per railcar-kilometer traveled, considering these two classes of accident causes separately. Review of Federal Railroad Administration statistics and industry data on the distribution of track classes produced the accident rates given in Table 4-127 for Track Class 3 (DIRS 180220-Bendixen and Facanha 2007, all).

Table 4-127. Estimated rail accident rates.[a]

Accident location	Accident rate per train-kilometer	Accident rate per car-kilometer	Combined accident rate per kilometer for 8-car train
Mainline track	7.50×10^{-7}	0.17×10^{-7}	8.95×10^{-7}

a. Source: DIRS 180220-Bendixen and Facanha 2007, all.

These rates include derailments and collisions from a variety of causes, including track failures resulting from geological hazards. These accident rates reflect railroad operations involving general freight service. Dedicated train service, which would be used to move cask railcars to the Yucca Mountain Repository, would follow stringent safety regulations. Additionally, dedicated train service has increased control and command capabilities, since shorter trains allow better visual monitoring from the locomotive and the escort car. Therefore, the accident rates here included provide a conservative estimate of the number of accidents involved in the operations of the rail line.

While not all accidents would lead to derailments of any railcars, any accident is likely to require the train to be inspected and other precautions to be taken. Hence, this analysis conservatively considers all accidents. In addition, a number of design and operating changes for dedicated trains have been predicted to reduce accident rates for dedicated trains, but to maintain conservatism, these potential benefits are not considered here.

Based on the lengths of each alternative segment and common segment, and the combined accident rate for an 8.54-car train (that is, 8.95×10^{-7} accident per train-kilometer), the predicted accident counts are given in Table 4-128 for the full set of cask shipments expected during the entire operations phase (that is, the analysis considers the 5,666 trains involving cask cars, which includes trains traveling in both directions). For accidents not involving cask trains, the total number of accidents was calculated by adding the accidents associated with the number of trains and the accidents associated with the number of railcars. For purposes of this analysis, DOE used the longest specific alignment. Because the upper bound of the accident rate is so small for the specific alignments, there would be no discernable difference.

As shown in Table 4-128, a total of approximately three accidents involving cask trains could occur over the 50-year operations phase. While potential consequences could involve environmental damage, evacuation costs, and human health impacts, the focus of the frequency analysis is on scenarios that could lead to human health impacts as discussed in greater detail elsewhere in this section. The total number of accidents involving trains that do not carry casks would be 10 for 50 years of operation. Therefore, the total number of predicted rail accidents would be approximately 13.

Rail Facilities: The analysis of potential incidents at rail facilities was based on the types of activities and operations that are expected to be carried out at such facilities. The scenarios of concern relate primarily to transportation accidents at the Interchange and Staging Yards. The likelihoods of accidents are based on both available failure and accident rates, and on the number of switchovers that would need to be made. The results for accident potential at the Interchange and Staging Yards are included within the calculations for Table 4-128 (alternative segments at the Interface with Union Pacific Mainline).

The Rail Equipment Maintenance Yard and the geologic repository operations area interface are essentially rail yards in terms of the operations that would occur there: train make-up and car switching. Casks would be removed from the railcars at the geologic repository operations area and empty casks would be placed back onto railcars at the Rail Equipment Maintenance Yard. The results for accident potential at the Rail Equipment Maintenance Yard and the geologic repository operations area interface are also included within the calculations for Table 4-128 (common segment 6).

Grade Crossings: DOE also examined the consequences of the Proposed Action on delay and safety conditions for at-grade crossings along the proposed rail alignment. Delay considerations are discussed in Section 4.2.9. The examination of grade-crossing safety typically considers the expected numbers and locations of grade crossings, the volume of both vehicle and rail traffic at the crossings, the nature of road traffic (for example, trucks versus passenger vehicles), the design and safety features of the crossings, and train and vehicle speeds in the vicinity of any crossings. Grade crossing collisions reported as train accidents are included in the number of rail accidents estimated in Table 4-128.

Table 4-128. Estimated number of predicted rail accidents.[a]

Rail alignment segment	Segment length (longest alternative segment, in kilometers)[d]	Predicted number of accidents	
		Involving cask trains	Not involving cask trains
Interface with Union Pacific Mainline alternative segments (including the Interchange and Staging Yards)	19[b]	0.10	0.35
Caliente common segment 1	110	0.56	2.04
Garden Valley alternative segments	37[c]	0.19	0.69
Caliente common segment 2	50	0.25	0.93
South Reveille alternative segments	19	0.10	0.35
Caliente common segment 3	110	0.56	2.04
Goldfield alternative segments	53	0.27	0.98
Caliente common segment 4	11	0.06	0.20
Bonnie Claire alternative segments	21	0.11	0.39
Common segment 5	40	0.20	0.74
Oasis Valley alternative segments	14	0.07	0.26
Common segment 6 (including the Rail Equipment Maintenance Yard)	51	0.26	0.95
Totals	541	2.71	9.92

a. During 50-year operation.
b. Eccles alternative segment.
c. Garden Valley alternative segment 3 or 8.
d. To convert kilometers to miles, multiply by 0.62137.

Grade-crossing safety is influenced by the type of protection installed at each crossing. Most of the crossings for this project would involve very low-usage unpaved roads that would mainly involve passive warning systems (such as cross-bucks and stop signs). Public at-grade crossings (paved roads) may have active warning systems that would include flashing lights and gates. Generally, DOE would employ active warning devices for crossings at paved county roads and passive systems at unpaved roads. Although grade-separated crossings are not mandatory for this project, DOE would be providing up to five grade-separated crossings on state and federal highways as identified in Chapter 2. The numbers of crossings with primary roads with each type of protection are listed in Table 4-129 for each rail line-specific alignment and alternative and common segment. Table 2-22 provides a detailed list of grade crossings.

Table 4-129. Number of grade crossings with primary roads.[a]

Rail line segment	Passive protection	Active protection	Grade separation
Alternative segments at the Interface with Union Pacific Mainline (Caliente/Eccles)	None	1	1
Caliente common segment 1	6	None	1
Garden Valley alternative segments	3-4[c]	None	None
Caliente common segment 2	2	None	1
South Reveille alternative segments	2-5[c]	None	None
Caliente common segment 3	2	1	None
Goldfield alternative segments	None	None	None-2[c]
Caliente common segment 4	None	None	None
Bonnie Claire alternative segments	None	None	None
Common segment 5	None	1	None
Oasis Valley alternative segments	1	None	None
Common segment 6	None	None	None
Totals	16/20[b]	3	3/5

a. This list does not include all grade crossings.
b. First number represents scenario under which South Reveille alternative segment 2 and Garden Valley alternative segment 1, 2, or 3 are the selected alternative segments. Second number represents scenario under which South Reveille alternative segment 3 and Garden Valley alternative segment 8 are the selected alternative segments.
c. This depends on the specific alternative segment.

4.2.10.3 Shared-Use Option

4.2.10.3.1 Nonradiological Impacts

4.2.10.3.1.1 Impacts to Workers. Railroad construction and operation nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

Rail line facility construction and operation nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line and associated facilities. It is assumed that the construction of the railroad facilities under the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the railroad facilities under the Proposed Action, and that the configuration and operation of the facilities, including emergency response systems, would be the same for both the Proposed Action and Shared-Use Option.

4.2.10.3.1.2 Impacts from Specific Resource Areas. Rail line construction and operation nonradiological occupational health and safety impacts related to the specific resource areas discussed in Section 4.2.10.2.1 would be approximately the same for the Shared-Use Option as for the Proposed Action, based on the construction and operation of the proposed rail line.

4.2.10.3.2 Radiological Impacts

4.2.10.3.2.1 Impacts to Workers. It is anticipated that worker health and safety impacts under the Shared-Use Option would be similar to those under the Proposed Action, with the exception of radiological occupational exposure impacts. One difference would be the number of times a loaded cask train would pass workers at sidings. For the Proposed Action, there could be up to about 50 passes involving loaded cask trains and other trains (DIRS 180923-Nevada Rail Partners 2007, all). Over the life of the rail shipping campaign, a cask train could pass more than one shared-use train between the Staging Yard and Yucca Mountain site boundary. This would result in a collective radiation dose of 0.0024 person-rem for these workers. This is equivalent to a probability of a latent cancer fatality of 1.4×10^{-6}. Under the Shared-Use Option, there could be up to about 100 passes involving loaded cask trains and other trains. This would result in a collective radiation dose of 0.0051 person rem for these workers. This is equivalent to a probability of a latent cancer fatality of 3.0×10^{-6}.

4.2.10.3.2.2 Impacts to the Public. It is anticipated that radiological health and safety impacts for the Shared-Use Option would be similar to those for the Proposed Action with the exception of radiological occupational exposure impacts. The additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials and therefore there would be no additional exposure of the public.

4.2.10.3.3 Transportation Impacts

4.2.10.3.3.1 Construction Impacts.

Nonradiological Roadway Accidents Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal.
The collective impact would be expected to be less than 1 percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

Nonradiological Rail Line Accidents No commercial rail transportation would be conducted during construction of the Shared-Use Option. Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for rail line accidents and fatalities would be minimal.
The collective impact would be expected to be less than one percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

4.2.10.3.3.2 Operations Impacts.

Nonradiological Roadway Accidents Under Shared-Use Option operations, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal. Impacts are considered to be the same as those identified for the Proposed Action.

Nonradiological Rail Line Accidents The rail transportation safety analysis for the operations phase of the Shared-Use Option assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The Shared-Use Option differs from the Proposed Action only in the amount and type of traffic that would use different portions of the proposed rail line and the composition of some of the trains in terms of both length and materials categories. Up to eight one-way commercial train trips (four round trips) a week would be expected, with each train consisting of up to four locomotives and up to 60 railcars (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 trains would run one way between the Proposed Action Staging Yard and the geologic repository per week carrying casks, repository construction materials and supplies, and other materials for maintenance-of-way activities. It is anticipated that the trains would travel at 64 kilometers per hour (40 miles per hour). The addition of the commercial trains would have a small impact on the potential for an accident involving a cask car, as operational procedures and controls regarding both scheduling and the use of sidings would restrict the interactions of the two types of trains. Trains carrying cask cars would take precedent. The overall density of trains on the proposed rail line would still be considered low, even with the commercial trains added in, so additional risk of an accident involving cask cars due to increased traffic densities would be minimal.

During the peak level of transportation operations along the rail line, there could be 17 one-way trains servicing the repository each week (8 cask trains, 7 repository construction and supplies trains, and 2 maintenance-of-way trains), and eight one-way commercial trains (four round trips). During these peak years, the transportation safety impacts associated with nonradiological risks might increase by approximately 50 percent. Over the full 50-year operating lifetime of the rail line, the Shared-Use Option could result in additional 20,800 trains, considering each direction separately (eight one-way trains per week). All trains are assumed to travel the full length of the rail line, generating roughly 11.3 million train-kilometers over 50 years. Based on a list of potential shippers, demand estimates were developed (DIRS 180694-Ang-Olson and Gallivan 2007, all). A total of 225 weekly carloads would be expected to be shipped along different portions of the rail line. According to the location and demand of each potential shipper, it was estimated that each loaded car would travel an average of 200 kilometers (124 miles). Considering both directions of travel, this would result in approximately 234 million car-kilometers over 50 years (225 cars × 52 weeks × 50 years × 200 kilometers × 2). Assuming the same rail fatality and accident rates included in Sections 4.2.10.2.3.1 and 4.2.10.2.3.2, respectively, a total of three additional fatalities and 13 additional accidents would be expected to occur for the entire set of estimated railcar movements during Shared-Use Option operations. Rail accidents are not allocated to specific rail line segments due to the uncertainty of where those accidents will occur.

In general, the operating characteristics of these commercial trains are unknown at this time; therefore, the travel times and operational movements of these trains cannot be described. However, the Nevada Railroad Control Center described under the Proposed Action would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line to minimize potential rail accidents.

Rail Facilities: The Rail Equipment Maintenance Yard and the geologic repository operations area interface would not be affected by any shared use of the proposed rail line because commercial shippers would not use the DOE Rail Equipment Maintenance Yard. Many of the commercial railcars would be dropped off along the way at intermittent commercial facilities. As a result, the commercial service end-of-line facility would have significantly less car handling than the Rail Equipment Maintenance Yard, and operations at the commercial facility would have no impact on the number of accidents involving the cask cars.

Grade Crossings: The increased number of trains under the Shared-Use Option would slightly increase the potential for accidents because of the increased number of trains crossing each at-grade crossing (at three round trips per week). However, because this volume of commercial traffic would be low, adverse impacts would be small. Delay considerations were included in Section 4.2.9.

4.2.10.4 Summary

This section summarizes nonradiological occupational health and safety impacts, public and occupational radiological impacts, and nonradiological transportation impacts under the Proposed Action and the Shared-Use Option for the Caliente rail alignment.

Alignment segments and facility locations are not relevant to the nonradiological transportation impacts analysis or to the nonradiological occupational health and safety impacts analysis. Nonradiological occupational health and safety impacts depend on the number of construction and operations full-time-equivalent works. Nonradiological transportation impacts depend on the number of construction and operations full-time-equivalent workers and the number of casks transported. Therefore, there are no important differences among alignments or facility locations in relation to nonradiological transportation impacts or nonradiological occupational health and safety impacts.

Radiological impacts for the Caliente rail alignment are estimated based on the longest-distance alignment, the shortest-distance alignment, the alignment with the highest population density, and the alignment with the lowest population density. Radiation dose to the public is estimated for Staging Yard locations (options) for the Caliente rail alignment. There are no important differences among alignments or among Staging Yard locations in relation to radiological impacts for the Caliente rail alignment.

All nonradiological transportation impacts for construction and operation, including vehicle-related fatalities, rail-related accidents, and rail-related fatalities, are considered to be long-term impacts. Nonradiological occupational health and safety incidents for construction and operation could be either short term (such as lost-workday cases involving short-term disability) or long term (such as workday cases involving long-term disability); however, because there is no way to know the duration of a specific lost-workday case, for example, all nonradiological occupational health and safety impacts are deemed to be long-term impacts. All radiological impacts from railroad and facility operations are considered long-term impacts because such impacts would be experienced over the 50-year operating life of the railroad. Nonradiological transportation impacts, nonradiological occupational health and safety impacts, and radiological impacts are direct impacts.

4.2.10.4.1 Nonradiological Impacts

A summary of nonradiological impacts to workers from industrial hazards associated with construction and operation of the proposed rail line and associated facilities under the Proposed Action is included in Table 4-130 and Table 4-131. Impacts to involved workers and noninvolved workers and total impacts are shown in Table 4-112 for rail line construction and operation and in Table 4-113 for associated facility construction and operation. No construction or operation activities would occur under the No-Action Alternative. Therefore, there would be no occupational or public health and safety impacts associated with the No-Action Alternative.

Table 4-130 includes nonradiological impacts of construction and operation of the railroad under the Proposed Action including construction of the rail line, construction and operation of the construction work camps, construction and operation of quarries to produce ballast for construction activities, construction and operation of wells to produce water for construction activities, operation of construction trains, and construction and operation of batch plants to produce concrete for construction activities. Operations impacts include impacts to train crews and escort and security personnel. Table 4-131 summarizes the nonradiological impacts of construction and operation of railroad facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, Facilities at the Interface with the Union Pacific Railroad Mainline, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facilities, and Cask Maintenance Facility. Table 4-132 summarizes the total impacts from railroad construction and operations under the Proposed Action.

4.2.10.4.1.1 Workers. Nonradiological occupational health and safety impacts from railroad construction and operations under the Proposed Action involve approximately 880 recordable incidents, approximately 520 lost-workday accidents, and approximately three fatalities.

Rail line construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

Construction and operations workers under the Proposed Action and Shared-Use Option could potentially be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and facility equipment, including maintenance-of-way and maintenance of casks. Such activities are anticipated to include welding, metal degreasing, painting, and related activities.

Table 4-130. Estimated impacts to workers from nonradiological industrial hazards during railroad construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	13.6 million		2.9 million	
Total recordable cases		336		37
Lost workday cases		186		28
Fatalities		0.67		0.26

Table 4-131. Estimated impacts to workers from nonradiological industrial hazards during railroad facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	3.1 million		17.0 million	
Total recordable cases		88		418
Lost workday cases		49		255
Fatalities		0.02		1.27

Table 4-132. Total estimated impacts to workers from nonradiological industrial hazards during railroad and facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	16.7 million		19.9 million	
Total recordable cases		424		455
Lost workday cases		235		283
Fatalities		0.69		1.53

Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and associated facilities. The recorded incident rates of these exposure hazards during construction work at the Yucca Mountain Site has also been small and is anticipated to be small for construction and operation of the rail alignment and facilities under the Proposed Action.

Dust and soils hazards include potential occupational exposure to hazardous inhalable dust, including the minerals crystalline silica, cristobalite, and erionite, and potential occupational encounters with unexploded ordnance. It is unlikely that any fugitive particulate generated in the construction areas would contain a concentration of crystalline silica, erionite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Therefore, impacts associated with occupational exposure to these materials are not anticipated from construction and operation of the railroad and facilities under the Proposed Action.

Impacts to construction or operations workers from unexploded ordnance would be small due to implementation of inspection procedures and mitigation measures if necessary.

Workers may also be exposed to biological hazards including infectious diseases (such as Hantavirus, West Nile Virus) and other biological hazards (such as venomous animals). The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, and the recorded incident rates of these biological hazards during construction work at the Yucca Mountain Site has also been small. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

4.2.10.4.1.2 Public. Nonradiological impacts to the public from the construction and operation of the rail line and facilities (other than impacts from transportation accidents) are presented in the air quality section and noise section of this Rail Alignment EIS and are therefore not further discussed in Section 4.2.10. Impacts to the public from transportation accidents (those transportation accidents not involving release of radiation) are discussed in Section 4.2.10.4.3.

4.2.10.4.2 Radiological Impacts

Occupational and public radiological impacts and accident risk of rail line and associated facility operations for the Proposed Action and Shared-Use Option are summarized in Table 4-133. For the radiological impacts analyses, the four specific alignments described in Table 3-67 were evaluated. Table 4-133 summarizes the radiation doses and impacts for these workers along these four classes of alignments.

Table 4-133. Summary of occupational and public estimated radiological impacts for the Proposed Action (expressed as latent cancer fatality units).[a,b,c]

Case	Staging Yard	Workers	Public	Accident risk	Total
Highest population	Caliente-Indian Cove	0.34	1.4 × 10-4	1.3 × 10-6	0.34
Highest population	Caliente-Upland	0.34	1.3 × 10-4	1.3 × 10-6	0.34
Shortest distance	Caliente-Indian Cove	0.34	1.2 × 10-4	1.1 × 10-6	0.34
Shortest distance	Caliente-Upland	0.34	1.1 × 10-4	1.1 × 10-6	0.34
Longest distance	Eccles-North	0.34	6.6 × 10-5	7.6 × 10-7	0.34
Lowest population	Eccles-North	0.34	5.5 × 10-5	6.7 × 10-7	0.34

a. Radiation doses modeled from the point where the proposed railroad would meet the existing Union Pacific Railroad Mainline.
b. The highest population route and the shortest distance route would originate at Caliente-Indian Cove.
c. The lowest population route and the longest distance route would originate at Eccles-North.

Radiological occupational and public health and safety impacts to workers and the public for the Shared Use Option would be approximately the same as those for the Proposed Action, as the additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials that would result in additional occupational or public exposure to radiation.

4.2.10.4.2.1 Workers. For workers, the radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.2.10.4.2.2 Public. For members of the public, radiation doses and radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.2.10.4.2.3 Accidents. For members of the public, radiological impacts of the Proposed Action are estimated to result in less than one latent cancer fatality.

4.2.10.4.3 Transportation Impacts

Table 4-134 summarizes impacts from nonradiological transportation accidents, including vehicular-related accidents and rail-related accidents, from railroad construction and operation under the Proposed Action and Shared-Use Option. Impacts under the Shared-Use Option are considered to be the same as those identified for the Proposed Action for the construction phase.

Table 4-134. Summary of estimated transportation accident impacts.

	Construction	Operations	
	Proposed Action and Shared-Use Option	Proposed Action	Shared-Use Option
Vehicular-related fatalities	6	8	8
Rail-related fatalities	0.6	0.7	4
Rail-related accidents	3	13	26
Rail-related accidents involving cask trains	Not applicable	3	3

4.2.11 UTILITIES, ENERGY, AND MATERIALS

This section describes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.11.1 describes the methodology DOE used to assess potential impacts to utilities, energy, and materials; Section 4.2.11.2 describes potential impacts; Section 4.2.11.3 describes potential impacts under the Shared-Use Option; and Section 4.2.11.4 summarizes potential impacts.

Section 3.2.11.1 describes the regions of influence for utilities, energy, and materials. To aid reader understanding, the regions of influence are repeated throughout Section 4.2.11 where appropriate.

4.2.11.1 Impact Assessment Methodology

The utilities, energy, and materials impacts analysis considered whether construction and operation of the proposed railroad along the Caliente rail alignment would:

- Cause utility service outages as a result of construction activities
- Affect the capacity of ***public water systems***, directly or indirectly
- Require extension of water mains involving off-site construction for connection to a public water source
- Impact water-supply capacity needed for fire suppression
- Affect the capacities of public wastewater treatment facilities, directly or indirectly
- Require extension of sewer mains involving off-site construction for connection with a public wastewater treatment system
- Require expansion of telecommunications systems involving off-site construction for connections with the network (including construction of communications towers)
- Affect the capacity and distribution capabilities of local and regional suppliers of fossil fuel
- Cause new sources of construction materials and operations supplies to be built, such as new mining areas, processing plants, or fabrication plants
- Affect the capacity of existing materials suppliers and industries in the region

4.2.11.2 Construction and Operations Impacts

This section describes potential impacts to utilities, energy, and materials resources from constructing and operating the proposed railroad along the Caliente rail alignment. The analysis of impacts to existing utilities considers:

- Potential impacts of constructing the rail line in or near existing utility lines or rights-of-way
- Potential impacts on the capacities of public utilities
- Potential impacts on the availability of fossil fuels (the focus of the energy analysis)
- Potential impacts on the availability of construction materials

4.2.11.2.1 Construction Impacts

4.2.11.2.1.1 Potential Interfaces with Public Utility Corridors and Rights-of-Way. Potential utility conflicts would arise if construction activities could interfere with a public utility's ability to continue service or could prevent future expansion of that utility or its use of a right-of-way. Conflicts could arise in areas where the rail line and its construction and operations support facilities would either cross or overlap an existing utility corridor or right-of-way.

Utility crossings are common to linear projects such as roads, railroads, and pipelines, and they can be accomplished with minimal impact using standard engineering procedures and appropriate design specifications (see Chapter 2).

Utilities that would require the construction of crossings either above or beneath the rail line (new grade crossings) might be subject to temporary interruption as the switch is made from the existing infrastructure to the new routing. Service interruptions for electrical and telephone service, if necessary, could be limited to the time required to throw a transfer switch or to disconnect and reconnect. Service interruptions to pipelines might be longer, but to the greatest extent practicable, would be limited to a few hours.

4.2.11.2.1.2 Public Utility Systems. Potential impacts to public utility systems during the construction phase would be related to the demands on these systems to support construction activity and sustain construction workers. DOE would establish 12 temporary construction camps along the rail alignment within the construction right-of-way to house construction workers, and would fully operate a maximum of six construction camps at any one time (DIRS 180921-Nevada Rail Partners 2007, Table D-1). DOE estimates that 2,160 construction personnel would be employed full-time. Each construction camp would have the capacity to house 360 people (254 construction workers and 106 support staff) for such functions as construction administration, utilities, emergency services, and other support. The personnel at each camp would comprise 40 professional staff, 20 clerical staff, and 300 craftsmen (DIRS 180922-Nevada Rail Partners 2007, p. 4-4). The utilities sector of each construction camp would include areas dedicated to power, wastewater treatment, water treatment, and trash disposal. DOE expects that most construction workers would live in and spend most of their time in these camps, thereby reducing the impacts that these individuals would have on public water and wastewater systems and the use of fuel for travel.

As described in Section 4.2.9, Socioeconomics, population changes are related to changes in employment. DOE expects that most of the full-time construction workers would live in the construction camps, but the Department estimates 40 construction workers might live in Lincoln County, 5 in Esmeralda County, and 15 in Nye County (DIRS 180921-Nevada Rail Partners 2007, Table D-1). There would be some population increases in nearby towns attributable to construction workers and indirect support workers. Because increases in population affect future demand on public utilities in a community, the utilities impacts analysis uses the basic assumptions and expectations regarding population change during the construction phase, as described below.

For purposes of this analysis, and consistent with the methodology described in Section 4.2.9 of this Rail Alignment EIS, DOE assumes that most construction workers would come from outside the region of influence rather than the more sparsely populated Lincoln, Nye, and Esmeralda Counties. Any changes in the populations of Lincoln, Nye, Esmeralda, and Clark Counties and towns within those counties would be small (see Section 4.2.9). Therefore, associated infrastructure impacts at the county and local levels during the construction phase would be small.

Public Water Systems The region of influence for ***public water systems*** is Lincoln, Nye, and Esmeralda Counties and communities within those counties. However, water requirements for the project during the construction phase would be met by new wells.

Because DOE does not plan to rely on ***public water systems*** as primary sources of water during the construction phase, direct impacts to ***public water systems*** would be those related to permanent population increases within the region of influence attributable to the construction phase.

Because, as previously discussed in Section 4.2.9, permanent population increases would be expected to be minor for most areas during the construction phase, DOE expects that existing ***public water systems*** in the region of influence could accommodate the increased demand within existing system capacities without adverse impacts.

Wastewater Treatment Systems The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lincoln, Nye, and Esmeralda Counties and communities within those counties.

DOE estimated that up to 626,000 liters (165,000 gallons) per day of sanitary wastewater could be generated during the construction phase, as summarized in Table 4-135. However, because construction activities would be phased, actual daily maximums would be less. The Department estimates that the amount of sanitary wastewater that would be generated at each construction camp would peak at 95,000 liters (25,000 gallons) per day. Most of this wastewater would be generated from flush toilets and showers. Sanitary sewage generated at the construction camps would be treated on site using portable wastewater treatment facilities, and treated wastewater would be recycled and used for construction purposes (such as soil compaction and dust suppression). DOE would recycle about 90 percent of all construction-generated wastewater. Therefore, there would be no impacts to existing wastewater treatment capacity in the region of influence.

Table 4-135. Wastewater generation during the construction phase – Caliente rail alignment.

Facility	Number of personnel (maximum)	Wastewater generation (liters per day per person)[a,b]	Total wastewater (liters per day)[c]
Construction camps[d]	2,160[e]	265	570,000
Interchange Yard and Staging Yard	220[e]	76	16,700
Maintenance-of-Way Headquarters and Trackside Facilities	170[e]	76	12,900
Rail Equipment Maintenance Yard	150[e]	76	11,400
Cask Maintenance Facility	150[f]	76	11,400
Concrete batch plants	20[e]	76	1,500
Total			626,000

a. Sources: Daily wastewater generation rates from DIRS 176172-Nevada Rail Partners 2006, Section 4.1 (for construction camps); Nevada Administrative Code 444.8312 as an estimated per person wastewater flow from an office (for other facilities).
b. To convert liters to gallons, multiply by 0.26418.
c. Numbers in column are rounded to three significant figures.
d. Six construction camps of a total of 12 would be in operation at one time.
e. Source: DIRS 180921-Nevada Rail Partners 2007, Appendix D.
f. Source: DIRS 181425-MTS 2007, p. 4.

Commercial vendors would provide portable restroom facilities where needed and would transport wastewater off site for treatment, which could include the use of permitted wastewater treatment facilities in the region of influence. As shown in Table 3-72, permitted wastewater treatment facilities in the region of influence have adequate capacity. Therefore, any impacts to those wastewater treatment facilities during the construction phase would be small.

DOE expects permanent population increases would be small for most areas during the construction phase (see Section 4.2.9); therefore, existing publicly owned wastewater treatment works in the region of influence could accommodate the increased wastewater within existing system capacities without adverse impacts.

Telecommunications Systems The region of influence for telephone and fiber-optic telecommunications systems is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Lincoln County Telephone System, Inc.

During preliminary grading, construction communications would be provided via short-wave radio and satellite telephone (DIRS 180922-Nevada Rail Partners 2007, p. 2-3). Communications systems during construction would be designed to not interfere with other licensed services operating in the same geographic areas and would remain in place until the communications systems for railroad operations were in place and commissioned. Little or no landline telecommunications service would be required during the construction phase. The installation and use of telecommunications systems would have a small impact on local telecommunications utilities.

Electricity The region of influence for electric power includes areas serviced by the southern Nevada electrical grid operated by Nevada Power Company, Sierra Pacific Power Company, Valley Electric Association, Inc., Caliente Public Utilities, and Lincoln County Power District No. 1. Electric energy demand for initial construction activities would be satisfied with portable generators until electrical connections were established. This section discusses energy needs that would be satisfied through the use of existing electrical utilities.

During the construction phase, DOE proposes to lay an underground 25-kilovolt distribution line under the rail roadbed (DIRS 180922-Nevada Rail Partners 2007, p. 4.6). The primary purpose of the distribution line would be to provide electric power to facilities and equipment needed for routine railroad operations (such as signals, switches, and radio communication towers), and to be able to provide the capacity to meet expected power needs for support facilities; a secondary purpose would be to provide an alternative to diesel-powered generators or local power sources.

Although power might be required during construction or operations only in specific areas along the rail alignment (such as at sidings, radio communication towers, construction camps, and quarries), for purposes of analysis DOE assumed that the 25-kilovolt distribution line would be laid end-to-end in a trench along the entire length of the rail alignment. At the same time the Department was laying the power distribution line, it would also lay the fiber-optic cable to be used as part of a telecommunications system (encased in a polyvinyl-chloride [commonly referred to as PVC] duct), and place it in the same trench as the 25-kilovolt distribution line. Once the cables were placed, the trench would be backfilled to grade.

Based on initial planning studies, power to the distribution system would be fed from locations where the rail line would intersect existing high-voltage transmission lines (DIRS 180922-Nevada Rail Partners 2007, p. 4-6). At this stage in the design process, DOE has not identified specific locations. DOE would construct substations within the nominal width of the construction right-of-way to feed the 25-kilovolt distribution line from the higher-voltage transmission lines at such intersections. At locations along the rail line where lower-voltage power was required for railroad systems, DOE would place step-down transformers from the 25-kilovolt distribution line on the trackside.

Construction camps would be powered one of three ways: (1) from existing transmission or distribution lines where they run alongside the camp sites, (2) from the 25-kilovolt distribution line, or (3) from diesel-powered generators. Option (1) would require access to pre-existing nearby transmission or distribution lines at construction-camp sites and their contracted use. Option (2) would depend on the availability of an energized 25-kilovolt distribution line during the period in which a construction camp would be operated. For options (1) and (2), DOE would place a substation at the construction camp. If neither option (1) nor (2) was available, DOE would select option (3). In addition, for options (1) and (2), the Department would use backup diesel-powered generators at each camp during unexpected power outages. Energy use at each camp during the peak output year would approach 54,000 kilowatt-hours per day, or 20 million kilovolt-hours per year.

Quarry sites would require electric power for conveyor belts, machinery, lighting, and support services. That need would be met by either of three options: (1) from nearby transmission or distribution lines if available, (2) from diesel-powered generators, or (3) from the 25-kilovolt distribution line. DOE would build a substation at each quarry site. Temporary power lines would distribute power at the quarry facility. If DOE selected option (1) or (3), diesel-powered backup generators would always be available at each quarry site for emergencies. Each quarry would be expected to use 27,600 kilowatt-hours of power per day and energy use at each quarry site during the peak output years would approach 10 million kilowatt-hours per year (DIRS 180922-Nevada Rail Partners 2007, p. 3-2).

DOE plans to have 24-meter (80-foot)-long rails delivered by rail from manufacturing plants to Caliente. DOE would set up a portable welding plant at Caliente and would later relocate the plant along the rail alignment at 80- to 160-kilometer (50- to 100-mile) increments to weld 24-meter-long rail into 438-meter (1,440-foot)-long strings to be distributed along the rail alignment by dedicated welding trains (DIRS 180922-Nevada Rail Partners 2007, p. 3-10). Typically, such welding units are powered by diesel generators generating 375 kilowatts of electrical power. DOE might build a substation connected to existing transmission lines to supply this need at Caliente, but this is conceptual at this stage of design. Yard and siding areas would be likely candidate relocation sites, and at these sites DOE would use portable diesel-powered generators, or conceptually, the 25-kilovolt distribution line if available and energized. (Alternatively, off-line welding of the rail would be possible, but would require dedicated welding trains to support track construction activities.)

The major electrical providers in the project region, including Nevada Power Company, Sierra Pacific Power Company, Valley Electric Association, Inc., and Lincoln County Power District No. 1, would have adequate generating capacity or power-purchase capabilities (see Section 3.2.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. As discussed in Section 3.2.11, demand is expected to remain relatively stable in the serviced areas, increasing at about 1 to 2 percent annually, and is not expected to impact the capacity of service providers. In cooperation with the affected utilities, DOE would perform electrical-capacity analyses to ensure adequate capacity exists, including evaluation of the conditions of existing electric facilities and determination of appropriate interface equipment to meet the needs of both parties, prior to any connection to a transmission or distribution line; therefore, any impact to electric services would be small.

For purposes of analysis, DOE assumed that electricity requirements for construction of the railroad operations support facilities (Interchange Yard, Staging Yard, the Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facilities, the Rail Equipment Maintenance Yard, and the Cask Maintenance Facility) would be met with portable generating equipment, but could later be met through substations connected to the 25-kilovolt distribution line when it was completed.

4.2.11.2.1.3 Fossil Fuels. At this point in project planning, DOE has not identified specific providers of fossil fuels. However, for purposes of analysis, DOE expects that regional supply systems and suppliers could economically supply the project.

Fossil-fuel consumption during the construction phase would primarily consist of diesel fuel for construction equipment and vehicles. Heavy construction equipment would be diesel-powered, as would electric generators. Fuel and oil would be transported by truck and stored at the hazardous materials storage areas at the construction camps. These materials would be stored in accordance with applicable state and federal regulations (DIRS 176172-Nevada Rail Partners 2006, Section 6.2). DOE estimated that annual consumption of diesel fuel would be 117 million liters (31 million gallons) (DIRS 180921-Nevada Rail Partners 2007, Appendix D, Table 5b). The annual consumption of diesel fuel for the region of influence, as represented by the State of Nevada, is approximately 1.8 billion liters (480 million gallons) (DIRS 176397-EIA 2005, Table 4, 2004 data). Construction fuel consumption would represent 6.5 percent of diesel fuel used annually in Nevada.

Construction of the proposed railroad would have a small impact on the capacity of regional suppliers or the availability of fuel resources. The fuel supply system is such that it can flexibly respond to changes in demand. Fuel consumption for construction of the railroad operations support facilities would be lower; therefore, fuel consumption during construction of those facilities would have a small impact on the capacity of regional suppliers or the availability of fuel resources.

4.2.11.2.1.4 Materials. As described in Section 3.2.11, the region of influence for necessary raw materials is limited to the distribution networks and suppliers that can economically service the general project area. For cast-in-place concrete and subballast, the region of influence is limited to the State of Nevada. DOE would need a ***free-use permit*** from the BLM to use common varieties of sand, stone, and gravel from BLM-administrated public lands during the construction phase, pursuant to the regulations implementing the Materials Act of 1947 (30 U.S.C. 601 through 603) as codified in 43 CFR Part 3600. As described in Chapter 2, the Department could obtain ballast materials from up to four of the six potential quarry sites within Nevada that would be close to the Caliente rail alignment construction right-of-way. Therefore, the region of influence for obtaining ballast would be limited to the immediate area in Nevada. However, if DOE selected the Eccles alternative segment, there would not be a suitable quarry location available along this portion of the rail alignment and the Department would have to obtain ballast from an existing commercial quarry, which most likely would be the Milford Quarry in Utah, approximately 200 kilometers (120 miles) east of Caliente. In this case, the region of influence would extend to Utah. Other materials, including steel, steel rail, concrete ties, and other precast concrete could be procured and shipped from anywhere in the continental United States. Therefore, the region of influence for these materials is considered to be national.

Material needs for construction of the rail line along the Caliente rail alignment would vary among the alternative segments roughly in proportion to their lengths. The primary materials that would be consumed in rail line construction include steel; concrete, principally for rail ties, bridges, and drainage structures; and rock for ballast and subballast. Table 4-136 lists the rail line construction material requirements and current production rates within the respective regions of influence.

Steel DOE has calculated that construction of the proposed rail line along the Caliente rail alignment of approximately 550 kilometers (340 miles), including sidings and yard tracks, would require 2,834 strings of 136 RE welded rail, each string being 439 meters (1,440 feet) long (DIRS 180922-Nevada Rail Partners 2007, p. 3-10). This would correspond to a requirement for 82,000 metric tons (90,000 tons) of steel over an estimated construction period of 4 to 10 years. DOE would acquire the sections of rail from national commercial sources.

Because DOE would purchase steel rail from national suppliers in staggered preordered phases over a 2- to 3-year period, the impact on availability of steel rail would be small.

DOE would need additional steel for rail hardware, bridges, and facility structures. Existing commercial fabricators would supply the steel required for the bridges. The designs of bridges and rail facilities are not sufficiently advanced to tabulate materials needs; however, the quantities required would be substantially less than required for rail line construction.

Table 4-136. Rail line construction material requirements – Caliente rail alignment.

Material	Total requirements	Annual requirements over a 4- to 10- year construction period	Region of influence	Region of influence annual production	Percent of region of influence production
Steel rail	82,000 metric tons[a]	21,000 to 8,200 metric tons	U.S. (all steel)	86,000,000 metric tons	0.024 to 0.01
			U.S. (steel rail)	518,000 metric tons	4.0 to 1.6
Concrete, cast-in-place	120,000 metric tons	30,000 to 12,000 metric tons	Nevada	16,000,000 metric tons[d]	0.19 to 0.07
Concrete, precast (including concrete ties)	450,000 metric tons	113,000 to 45,000 metric tons	U.S.	15,000,000 metric tons[d]	0.75 to 0.03
Concrete ties	1,020,000 ties	250,000 to 100,000 ties	U.S.	1,000,000 ties	25 to 10
Ballast	3.2 million metric tons	800,000 to 320,000 metric tons	Nevada and Utah	24,000,000 metric tons [b,c,d]	3.2 to 1.3
Subballast	2.7 million metric tons	675,000 to 270,000 metric tons	Nevada	9,200,000 metric tons [b,c,d]	7.3 to 2.9

a. To convert metric tons to tons, multiply by 1.1023.
b. Based on use of concrete ties only.
c. Includes granite and traprock production only, 2003 data. Some data withheld to avoid disclosing company proprietary information (DIRS 173393-Tepordei 2003, Table 9).
d. Includes crushed stone of all types, 2003 data (DIRS 173393-Tepordei 2003, Table 6).

Concrete DOE has estimated that 50,000 cubic meters (65,000 cubic yards) of cast-in-place concrete would be required for Caliente rail alignment structures (DIRS 180921-Nevada Rail Partners 2007, p. B-19). Concrete weighs approximately 2.4 metric tons per cubic meter (145 pounds per square foot) and 50,000 cubic meters would translate to an approximate requirement of 120,000 metric tons (132,000 tons) over the 4- to 10-year construction phase. As described in Chapter 2, DOE would obtain concrete for site placement activities at proposed bridges and other structures from two portable batch plants set up near the construction sites. DOE would truck all aggregate and cement from the portable batch plants to the construction sites. Annual production of cast-in-place concrete in Nevada equals approximately 16 million metric tons (18 million tons) per year (DIRS 173400-NRMCA 2004, p. 2).

Based on Yucca Mountain FEIS estimates (DIRS 155970-DOE 2002, Table 6-34), the total precast concrete demand for a rail line along the Caliente rail alignment (that is, the longest alignment at approximately 550 kilometers [340 miles]) would be approximately 450,000 metric tons (500,000 tons). The estimated requirement for precast concrete roadbed ties is approximately 1,020,000 ties for standard track construction (DIRS 176172-Nevada Rail Partners 2006, Section 3.2). Using 318-kilogram (700-pound) ties at 0.61-meter (2-foot) intervals would require 324,000 metric tons (357,000 tons) of concrete to produce the ties. Precast concrete ties would either be supplied through national manufacturers or potentially through a dedicated tie production facility established locally by a commercial manufacturer (DIRS 176172-Nevada Rail Partners, 2006, Section 3.2). Additional precast concrete requirements would include manufactured elements such as culverts, bridge beams, and overpass components. These precast concrete elements would be obtained from commercial sources nationally.

Annual national production of concrete railway ties has been increasing from about 620,000 ties in 2000 (DIRS 173572-RTA 2000, p. 22) to about 720,000 ties in 2004, and is projected to grow to about 1.2 million ties in 2007 (DIRS 173573-Gauntt 2004, p. 17). The 324,000 metric tons (357,000 tons) of concrete ties that would be required to construct the rail line along the Caliente rail alignment represent 10 percent to 25 percent of the annual national production of concrete ties. Although this might seem like a significant requirement, the national production volume for concrete ties does not reflect manufacturing capacity. Concrete tie production is a very scaleable industry, and recent data suggests that, if needed, the industry has the capacity to increase concrete tie production rapidly (DIRS 173573-Gauntt 2004, p. 17). For example, the current national production of concrete ties represents only approximately 0.3 percent of all manufactured (precast) concrete production, which is 15 million metric tons (17 million tons) per year (DIRS 173392-van Oss 2003, Table 15). Because DOE would purchase precast concrete components from national suppliers in staggered preordered phases, and because construction would involve a small amount of cast-in-place concrete via the use of onsite batch plants, the impact on availability of concrete would be small.

Ballast and Subballast Ballast and subballast are essentially crushed rock such as that required for the development of the rail roadbed. DOE has estimated that a total of approximately 3.2 million metric tons (3.5 million tons) of rail roadbed ballast would be required for track construction along the Caliente rail alignment (DIRS 176176-Nevada Rail Partners 2006, p. 4-2). DOE would obtain ballast from new quarries. As discussed in Chapter 2 and Section 3.2.11, the Department has identified six potential quarry sites along the Caliente rail alignment with the potential to provide more than 90 million metric tons (100 million tons) of ballast, and has identified a commercial quarry at Milford, Utah, approximately 200 kilometers (120 miles) east of Caliente, that would be required if DOE selected the Eccles alternative segment. Of the six potential quarry sites, DOE would develop up to four. Each of the potential quarries could produce approximately 3,100 metric tons (3,400 tons) of useable ballast per day. Therefore, the impact to availability of ballast from constructing the rail line along the Caliente rail alignment would be small.

Ballast: Gravel or broken stone laid in a rail roadbed to distribute train weight uniformly across the bed.

Subballast: Gravel or broken stone that does not have to meet the ballast specifications, layered beneath the ballast as a transition between the ballast and the compacted subgrade.

DIRS 180922-Nevada Rail Partners 2007, p. 3.1.

DOE has estimated that a total of approximately 2.7 million metric tons (3.0 million tons) of subballast would be required for track construction along the Caliente rail alignment (DIRS 176176-Nevada Rail Partners 2006, p. 4-2). Material specifications for subballast are less restrictive than for ballast. DOE would obtain subballast from materials excavated during rail roadbed construction or from crushing rock in quarries. To minimize transportation costs, the Department would use multiple source areas. Available quantities of subballast materials in the Caliente rail alignment region of influence should be more than sufficient to supply the project. Thus, impacts on the availability of subballast materials would be small.

DOE would construct 7.3-meter (24-foot)-wide gravel access roads parallel to the rail line and within the construction right-of-way. The rail line and the alignment access roads would be accessed via existing public roads where the rail line would cross an existing roadway. DOE would construct additional access roads to reach features like wells and quarries that are not immediately accessible to the rail alignment. The quarry sites identified would be within 3 kilometers (2 miles) of the alignment, thereby minimizing access-road construction requirements.

Materials for access-road construction or improvement would be obtained primarily from locally available materials such as stone, and gravel resulting from cuts and fills along the alignment and overburden at quarries. Access roads would likely have gravel surfaces. The native material would be supplemented by crushed rock screenings as necessary to provide a serviceable roadway surface.

Sand and Gravel There is a high likelihood DOE would find sands and gravels on the alluvial fans along cuts for the line that would be suitable for construction purposes and road making. Sand and gravel also would be generated from overburden at quarry and borrow sites. DOE would use some natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 176034-Shannon & Wilson 2006, pp. 24 to 26). The Department would determine the prime sand and gravel deposits needed before beginning construction. Using locally available sand and gravel would result in the consumption of a nonrenewable resource that could be used as a supply of construction materials for other construction projects in the area. However, alluvial deposits of sand and gravel are commonplace in the Caliente rail alignment region of influence, and their use to construct the rail line would not substantially reduce the area's resources; thus, impacts would be small.

Other Materials Requirements In addition to the materials needed for the rail line, DOE would also need construction materials for railroad operations support facilities. An estimated total of approximately 11,000 square meters (119,000 square feet) of building space would be required for operations support facilities (DIRS 180919-Nevada Rail Partners 2007, Tables 5-B, 6-B, 6-C, 6-D, 7-A, and 7-B; DIRS 181425-MTS 2007, p. 1). By comparison, the Las Vegas market alone had over 186,000 square meters (2 million square feet) of industrial space under construction in 2004 (DIRS 173390-Colliers International Partnership 2004, p. 1) and 160,000 square meters (1.7 million square feet) of office space completed in the 12-month period ending in March 2004 (DIRS 173391-Colliers International Partnership 2004, p. 1). Materials for the construction of rail yards at the operations support facilities are included in the rail line material estimates described in this section. Materials requirements for buildings would not be substantial in comparison to regional demand and would have a small impact on the regional supply system.

4.2.11.2.2 Operations Impacts

4.2.11.2.2.1 Utility Systems. None of the potential utility interfaces identified in Section 4.2.11.2.1.1 would prevent the future expansion of a utility service area. Impacts on infrastructure at the county level associated with railroad operations would be small because regional population projections anticipate modest growth (see Section 4.2.9.3.2). However, there could be some impacts on infrastructure in towns near the proposed railroad operations support facilities. Areas that would be likely to experience the greatest impacts include:

- Caliente/Eccles (Lincoln County), where the Interchange Yard, Staging Yard, and train crew quarters would be located, and which is also a possible location for the Nevada Railroad Control Center and National Transportation Operations Center
- Tonopah (Nye County) and Goldfield (Esmeralda County), the towns that would be closest to the Maintenance-of-Way Headquarters and Trackside Facilities
- Southern Nye County, the location of the Rail Equipment Maintenance Yard, Cask Maintenance Facility, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center

Public Water Systems Water would be needed for railroad operations, particularly at operations support facilities. Because they would be reclaimed after the end of the construction phase, there would be no water demands associated with the quarries.

DOE estimates water consumption at the Rail Equipment Maintenance Yard would be about 23,000 liters (6,000 gallons) per day for personnel and an additional 11,000 liters (3,000 gallons) per day for building and railyard uses, including irrigation and vehicle washing. At the Rail Equipment Maintenance Yard, water needs would be met by using the repository's well system, which would eliminate the need for service by any local public water system. The Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, and Maintenance-of-Way facilities would all obtain their water from local wells tapping into nearby groundwater systems (see Section 4.2.61, Groundwater Resources). Where water connections into local public systems would be needed, usage would be primarily from employees at the facilities.

Public water systems in Lincoln, Esmeralda, and Nye Counties could be affected by incremental changes in population attributable to railroad operations. Because the population increase attributable to employees at the Interchange Yard and Staging Yard would be relatively small (see Section 4.2.9.3.2), any impacts to ***public water systems*** in Lincoln County that could be attributed to population increase would be small.

As discussed in Section 3.2.11, Lincoln County is able to meet current and future demands for water. Goldfield, in Esmeralda County, has the groundwater resources and infrastructure available to triple the number of users served by its public water system and thus has the potential to meet increased demand for water by additional residential users and by commercial users such as the Staging Yard.

In Nye County, given the level of demand and the limited capacity of groundwater resources (particularly in the Pahrump Valley hydrographic area), water needs could strain supply. Although the Cask Maintenance Facility would be collocated with the Rail Equipment Maintenance Yard and the geologic repository operations area interface in Nye County, the estimates for population increase attributable to the employees at the Yucca Mountain Site (see Section 4.2.9.3.2) would represent a small incremental increase. Therefore, impacts to the ***public water systems*** in Nye County from the demands associated with these potential new residents would be small.

Wastewater Treatment Facilities DOE would dispose of sanitary wastewater in accordance with State of Nevada regulations. Under the Statutory Authority of Nevada Revised Statutes (NRS) 445A.300 through 445A.730, and pursuant to the Nevada Administrative Codes (NAC) 445A.810 through 445A.925, and NAC 444.750 through 444.828, the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, issues wastewater discharge permits, administers loans to publicly owned treatment works, and oversees the certification program for sewer-treatment plant employees. In most cases, DOE would construct onsite sanitary wastewater treatment systems within the railroad operations right-of-way and they would be permitted by the State of Nevada. These would likely be ***package plants***, as described in Section 3.2.11.2.3. If access to nearby existing permitted wastewater treatment facility capacity was available to any on-site facilities, DOE would discharge sanitary waste to those existing facilities. Impacts to existing wastewater treatment capacities of jurisdictions in the region of influence during the operations phase would be small.

Table 4-137 lists the rates of wastewater generation that would be associated with railroad facilities during the operations phase.

Wastewater from the Interchange Yard and the Staging Yard would be disposed of at the permitted wastewater treatment facility in Caliente. Wastewater from the train crew quarters in Caliente, Goldfield, or near the Rail Equipment Maintenance Yard would be disposed of through septic systems or wastewater-treatment facilities (DIRS 180919-Nevada Rail Partners 2007, p. 3-5). The Maintenance-of-Way Headquarters Facility would be 8 kilometers (5 miles) south of Tonopah on U.S. Highway 95, and it would include maintenance work areas, office space, and a material storage area.

Employees at this facility and employees in crew cars that would be outfitted with washing and showering facilities would generate wastewater, which would be disposed of through local septic systems and leach fields (DIRS 180919-p. 3-5). The Nevada Railroad Control Center and National Transportation

Operations Center would be either at the Rail Equipment Maintenance Yard or at the Staging Yard. These facilities would consist primarily of office space, and would generate small amounts of sanitary wastewater.

Table 4-137. Wastewater generation during the operations phase – Caliente rail alignment.

Facility	Number of personnel (maximum)	Total wastewater generation (liters per day)[a]
Facilities at the Interface with the Union Pacific Railroad Mainline (Interchange Yard and Staging Yard)	50[b]	21,000
Maintenance-of-Way Facilities (including staff for the Satellite Maintenance-of-Way Facilities)	50[b]	22,000
Rail Equipment Maintenance Yard, including the Nevada Railroad Control Center and National Transportation Operations Center	70[b,c]	23,000
Totals	170	66,000

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 180921-Nevada Rail Partners, 2007, p. D-7.
c. Source: DIRS 181425-MTS 2007, p. 5.

The Rail Equipment Maintenance Yard would provide a staging area for delivery of loaded cask cars to the repository, construction materials, and fuel. The facility would include office space, and train crew and escort personnel quarters, all of which would generate sanitary wastewater. Sanitary wastewater disposal at this facility would consist of septic systems or wastewater treatment facilities at the Yucca Mountain Site (DIRS 180919-Nevada Rail Partners 2007, p. 3-5).

The numbers of employees projected to reside in the communities near railroad operations support facilities would represent small fractions of the existing populations (see Section 4.2.9.3). Also, as shown in Table 3-72, most of the existing wastewater treatment facilities are operating well below their capacities, and these facilities would be capable of accommodating the anticipated increases in wastewater attributable to railroad facility employees. In addition, as described in 3.2.11.2.3, a 2003 grant from the U.S. Department of Agriculture Rural Development Nevada allowed Caliente, in Lincoln County, to complete the rehabilitation of its wastewater collection system, and Goldfield has recently been awarded a Water Resource Development Act grant of approximately $3 million for renovations and upgrades. Therefore, the impact on public wastewater systems from operating railroad support facilities would be small.

Telecommunications Systems The communication system required to support railroad operations would utilize four distinct communication technologies: synchronous optical network fiber-optic backbone, very high frequency (VHF) land mobile radio, geosynchronous satellite dispatch radio, and possibly satellite telephone service (DIRS 180923-Nevada Rail Partners 2007, Section 6.1.3). The fiber-optic cable laid along the length of the rail alignment would allow the installation of a VHF land mobile radio system comprising a series of base stations located at points approximately 16 to 32 kilometers (10 to 20 miles) apart along the rail alignment to provide full radio coverage communications with locomotive and maintenance crews. Base stations would consist of an equipment room that would house the radio and fiber-optic electronics and a monopole radio tower to mount an elevated VHF antenna. The Nevada Railroad Control Center would also have a private branch exchange telephone system. In the event of a failure of all or part of the primary VHF radio system, operations would continue via a geosynchronous satellite dispatch radio system. As a backup, DOE could utilize satellite telephone hand sets.

At the Nevada Railroad Control Center, the system would be configured to allow the dispatcher easy access to all of the various communication modes available, including the ability to patch communication modes together if required. However, for external communications, the Staging Yard, the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Facilities, the Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would each require digital subscriber line and telephone service. The Rail Equipment Maintenance Yard would require the greatest telecommunications capacity, with approximately 75 conventional telephone lines, 50 broadband internet connections, five secure telephone lines, a fiber optic line for closed-circuit television and data communication, and radio communications for railroad operations in conjunction with the centralized traffic control rail signal system (DIRS 180919-Nevada Rail Partners 2007, Section 6.6). The radio communication systems would be designed not to interfere with other licensed systems operating in the same area. The levels of commercially provided service would be small, and would not adversely affect the capacities of commercial telecommunication providers.

Electricity Impacts associated with the underground 25-kilovolt distribution line would be related to utility interfaces, as discussed in Section 4.2.11.2.1.1, and in Section 4.2.2, Land Use and Ownership.

Operation of the proposed railroad would require electricity for buildings, signaling, communications, and control. Twelve-kilovolt electrical service would be required for each facility. Depending on the distance from available power sources, larger distribution lines and intermediate substations might be needed. In addition to commercial sources, electric power could be supplied from the installed power distribution system. Each facility site would require a 12-kilovolt/480-volt transformer with a 480-volt distribution system to power industrial equipment and feed each building where a 480-volt/120-volt transformer would supply the building power (DIRS 180919-Nevada Rail Partners 2007, p. 3-5). Additional transformers could be required for other site requirements such as site lighting, power to yard switches and signals, or power for communications equipment. Each site would require a diesel-powered emergency generator to supply electrical power in case of an outage.

DOE estimates that the Staging Yard facilities (yard office, crew change facility, a Satellite Maintenance-of-Way Facility, and the Nevada Railroad Control Center and National Transportation Operations Center if in Caliente rather than at the Rail Equipment Maintenance Yard) would have a normal power demand of 386 kilowatts (or 290 kilowatts without the Nevada Railroad Control Center and National Transportation Operations Center) (DIRS 180919-Nevada Rail Partners 2007, p. 5-11). DOE would build a substation connected to existing transmission lines to service this power need at the selected alternative for the Staging Yard (Caliente-Indian Cove or Caliente-Upland, or Eccles-North). Diesel-powered generators would provide backup power.

DOE estimates that the Maintenance-of-Way Trackside Facility would have a normal power demand of 78 kilowatts, and the Maintenance-of-Way Headquarters Facility would have a normal power demand of 406 kilowatts (DIRS 180919-Nevada Rail Partners 2007, p. 7-10). Commercial electrical power from nearby Nevada Power Company distribution lines to Tonopah would be available to both the Maintenance-of-Way Headquarters Facility and the Maintenance-of-Way Trackside Facility. In addition, electric power from the proposed railroad distribution line could be available for use at the Maintenance-of-Way Trackside Facility, as would diesel-powered standby generators.

DOE has made separate estimates of power demand at the Rail Equipment Maintenance Yard that range between 722 and 815 kilowatts (DIRS 180919-Nevada Rail Partners 2007, p. 6-20). The Department has established an 8 megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray 2007, all). DOE could obtain power from a newly constructed substation connected to the existing supply system providing power to the Yucca Mountain Site, or from a new 138-kilovolt transmission line DOE plans to build to the geologic repository operations area. The 2003 peak load for the Nevada Power Company was 4,808 megawatts (DIRS 172302-Nevada Power Company 2004, all), whereas DOE has estimated there would be approximately an 8-megawatt demand to operate the proposed railroad. The Department would perform an electrical capacity analysis before connecting into local transmission or distribution lines, and consistent with the demonstration of available capacity. Therefore, impacts to other regional needs for electric power during the railroad operations phase would be small.

4.2.11.2.2.2 Fossil Fuels. DOE has estimated that 119 million liters (31.5 million gallons) of diesel fuel would be consumed over an anticipated 50-year operations phase, and that the annual consumption rate would peak at 4.3 million liters (1.1 million gallons) (DIRS 180921-Nevada Rail Partners 2007, Appendix D, Table 5a), a rate that would be less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Therefore, potential impacts to capacities of national and regional fuel producers and distributors during the operations phase would be small.

4.2.11.2.2.3 Materials. Materials use during the operations phase would be limited to materials for repair and maintenance of the railroad, including the locomotives, railcars, casks, and operations support facilities. The annual rate of material use over the 50-year operations phase would be substantially less than during the construction phase, and materials requirements would be expected to remain well below available capacity.

DOE would reclaim the quarries developed during the construction phase and would not use them during the operations phase. Therefore, the relatively minor amounts of ballast required for repairs and replacements during the operations phase would be met through existing commercial sources that at this stage of the design process have been identified as quarries in Milford, Utah, and Oroville, California, as described in Section 3.2.11.4. The impacts to available supplies of ballast at these existing quarries would be small.

4.2.11.3 Impacts under the Shared-Use Option

Railroad construction under the Shared-Use Option would include all of the features described in Section 4.2.11.2, but would include the construction of commercial sidings and support facilities. All such construction would occur on lands immediately adjacent to the rail alignment within the rail line construction right-of-way and would have impacts related to interfaces with utility corridors and rights-of-way similar to those under the Proposed Action without shared use.

The incremental demands on ***public water systems***, wastewater systems, telecommunications systems, electric power systems, fossil fuels, and materials for construction of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Railroad operations under the Shared-Use Option would be the same as described in Section 4.2.11.2 for the Proposed Action without shared use, but commercial shippers would add to traffic on the rail line.

The incremental demands on ***public water systems***, wastewater systems, telecommunications systems, electric power systems, and materials for the operation and maintenance of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as those for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Fossil-fuel requirements for transporting general freight under the Shared-Use Option would depend on the volume and distance of shared-use traffic. It has been estimated that the incremental annual diesel consumption for commercial shared-use traffic would be 5.5 million liters (1.5 million gallons) (DIRS 180921-Nevada Rail Partners 2007, Appendix D, Table 5a), a rate that is less than 0.3 percent of current annual diesel fuel usage in Nevada. Most, if not all, of this fuel consumption would be offset by diesel fuel that would otherwise be used if the goods or materials were shipped by truck. Therefore, the impact to the capacities of national and regional fuel producers and distributors under the Shared-Use Option would be small.

4.2.11.4 Summary

Table 4-138 summarizes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Caliente rail alignment. DOE determined that those impacts would be small.

Table 4-138. Summary of potential impacts to utilities, energy, and material resources – Caliente rail alignment.[a]

Resource	Construction impacts	Operations impacts
Utility interfaces	Potential for short-term interruption of service. No permanent or long-term loss of service or prevention of future service-area expansions.	None.
Public water systems	Most water would be supplied by new wells; small effect on ***public water systems*** from population increase attributable to construction employees.	Most water for operations would be supplied by new wells; small effect on ***public water systems*** from population increase attributable to operations employees.
Wastewater treatment systems	Dedicated treatment systems would be provided at construction camps; small impact on public systems from population increase attributable to construction employees.	Dedicated treatment systems would be provided at operations facilities; small impact on public systems from population increase attributable to operations employees.
Telecommunications systems	Dedicated systems; minimal reliance on communications providers.	Dedicated system along rail line; minimal reliance on communications providers.
Electricity	Peak demand would be within capacity of regional providers.	Peak demand would be within capacity of regional providers.
Fossil fuels	Demand would be approximately 6.5 percent of statewide use and could be met by existing regional supply systems and suppliers. Under the Shared-Use Option, demand would be less than 0.3 percent of statewide use during operations. Demand would be met by existing regional supply.	Demand would be less than 0.25 percent of statewide use.
Materials	Requirements generally would be very small in relation to supply capacity.	Requirements would be very small in relation to supply capacity.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use, except as noted for fossil fuels.

4.2.12 HAZARDOUS MATERIALS AND WASTES

This section describes potential impacts of the use of hazardous materials and the management of nonhazardous wastes, ***hazardous wastes***, and ***low-level radioactive wastes*** that would be generated during construction and operation of the proposed railroad along the Caliente rail alignment. The section identifies the types of hazardous materials DOE would use and the hazardous, nonhazardous, and low-level radioactive wastes that would be generated during the construction and operations phases. The applicable guidelines, regulations, and available methods for treatment or ***disposal*** are identified for each waste. DOE evaluated the potential impacts of hazardous materials, hazardous wastes, nonhazardous wastes, and low-level radioactive wastes based on this information.

Section 4.2.12.1 describes the methodology DOE used to assess potential impacts; Section 4.2.12.2 describes potential construction impacts; Section 4.2.12.3 describes potential operations impacts; Section 4.2.12.4 describes potential impacts under the Shared-Use Option; and Section 4.2.12.5 summarizes potential impacts related to the use of hazardous materials and the generation of wastes.

DOE could purchase hazardous materials necessary for railroad construction and operations, such as engine coolant and solvents, through the federal supply chain or through local vendors. The Department anticipates local distributors in Nevada would supply propane and natural gas. The required hazardous materials would consist primarily of products consumers could purchase at most hardware, building-supply, or home-improvement stores. Therefore, DOE does not expect the supply of such products to be limited. As a consequence of using hazardous materials, associated hazardous wastes would be generated.

Section 3.2.12.1 describes the region of influence for hazardous materials and wastes.

4.2.12.1 Impact Assessment Methodology

DOE developed a list of anticipated types of hazardous materials and wastes to evaluate potential impacts from the use of hazardous materials or generation of wastes (see Table 4-139). To avoid or limit adverse impacts, DOE emphasizes adhering to applicable laws, regulations, policies, standards, and directives. The storage and disposal of hazardous and nonhazardous wastes is largely governed by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*) and State of Nevada waste regulations (see Chapter 6, Statutory, Regulatory, and Other Applicable Requirements).

4.2.12.2 Construction Impacts

This section summarizes the types of hazardous materials DOE would use and the wastes that would be generated during construction of the proposed railroad. DOE would handle all wastes in accordance with applicable federal, state, and local environmental, occupational safety, and public health and safety requirements to minimize the possibility of adverse impacts to plants, animals, soils, and water resources inside or outside the region of influence. Because DOE would manage the use of hazardous materials and the disposal of wastes in accordance with applicable regulations and would implement best management practices (see Chapter 7), adverse impacts to environmental resources would be small.

4.2.12.2.1 Nonhazardous Waste

A total of approximately 2,300 metric tons (2,500 tons) per year of nonhazardous solid waste (such as general trash from kitchens and dormitories) would be generated during the construction phase, for a daily rate of approximately 6.3 metric tons (6.9 tons). Most of the solid waste would be generated at

Table 4-139. General considerations for assessing potential impacts from the use of hazardous materials and the generation of hazardous and nonhazardous wastes.

Material	Basis for assessing adverse impacts
Hazardous materials	Determine if the use of hazardous materials would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous materials resulting from not adhering to storage and use standards set in applicable guidelines and regulations
Hazardous waste	Determine if the quantity of hazardous wastes generated would adversely affect the capacity of hazardous-waste collection and disposal services
Nonhazardous waste	Determine if the volume of solid and industrial and special wastes generated would adversely affect the capacity of solid-waste collection service and landfills
Low-level radioactive waste	Determine if the quantity of low-level radioactive wastes generated would adversely affect the capacity of available disposal facilities

construction camps. DOE would dispose of all solid waste in permitted landfills. Table 4-140 summarizes the solid-waste generation rate during the construction phase.

Construction activities would generate approximately 4,020 metric tons (4,380 tons) of ***industrial and special wastes*** (such as construction debris, used tires, and other materials with specific management requirements) per year, for an approximate daily rate of 11 metric tons (12 tons) (DIRS 176172-Nevada Rail Partners 2006, p. 6-6). DOE would minimize the amount of these wastes as much as possible by ordering construction materials in correct sizes and amounts, reusing leftover materials, and recycling appropriate types of materials (DIRS 152540-Hoganson 2000, all).

Almost 1.8 million metric tons (2 million tons) of industrial and special wastes were disposed of in Nevada in 2002, which was 90 percent of the total solid waste (all categories) generated state-wide (DIRS 174663-State of Nevada 2005, slide 8). Nevada has 23 operating municipal landfills that combined accept more than 12,700 metric tons (14,000 tons) of waste per day (DIRS 174663-State of Nevada 2005, slide 5; DIRS 181625-Simpson 2007, all). However, most of this capacity is available through the Apex Landfill, which serves the Las Vegas Valley, and receives an average of 8,000 metric tons (8,800 tons) per day (DIRS 174041-State of Nevada 2004, pp. 6 and 7). Some of the landfills in Esmeralda, Lincoln, and Nye Counties are quite small by comparison, and receive less than 2.7 metric tons (3 tons) of waste per day (DIRS 174041-State of Nevada 2004, p. 6).

It is likely that while some of the larger landfills would not see an appreciable change in the amount of waste received if they were utilized, some of the smaller landfills might see a substantial, although manageable, change in daily receipt of solid and industrial and special wastes if utilized during the construction phase.

As shown in Table 3-74, landfills in Lincoln, Nye, Esmeralda, and Clark Counties accept more than 8,100 metric tons (9,000 tons) of waste per day combined. The addition of about 6.3 metric tons (6.90 tons) per day of solid waste anticipated during the construction phase (see Table 4-140) would raise the total amount disposed of in the four-county area by approximately 0.077 percent. DOE anticipates that about 11 metric tons (12 tons) per day of industrial and special wastes would need to be disposed of due to construction activities, which would result in an increase of approximately 0.13 percent in waste receipt to local landfills (DIRS 176172-Nevada Rail Partners 2006, p. 6-6). Therefore, impacts to local landfills from the disposal of solid and industrial and special wastes would be small (for the relatively large Apex Landfill) to moderate (for the smaller landfills).

Table 4-140. Solid waste generation during the construction phase – Caliente rail alignment.

	Number of personnel (maximum)	Solid-waste generation (kilograms per day per person)[a,b]	Total solid waste (metric tons per day)[c,d]	Total solid waste (metric tons per year)[d]
Workforce	2,160[e]	2.9	6.3	2,300

a. Source: Per person solid waste generation rate is from DIRS 174041-State of Nevada 2004, p. 13.
b. To convert kilograms to pounds, multiply by 2.2046.
c. To convert metric tons to tons, multiply by 1.1023.
d. Numbers are not exact due to rounding.
e. Source: DIRS 176170-Nevada Rail Partners 2006, Appendix D.

The geotechnical exploration program would include drilling approximately 3,200 boreholes at depths of 15 to 60 meters (50 to 200 feet). These borings would generate more than 1,500 cubic meters (2,000 cubic yards) of drill cuttings (DIRS 181867-Holder 2007, all). DOE would not dispose of these drill cuttings in landfills, but would dispose of them through land application, which would involve spreading the drill cuttings on the land surface. All drilling fluids would meet the requirements for standard land disposal. Therefore, there would be no impacts to waste treatment or disposal facilities as a result of the generation of drill cuttings.

Construction activities would include some clearing of land. Wastes generated from this activity, including soil and plant material, would be used to construct fill slopes and contours within the rail line construction right-of-way; therefore, no waste would need to be disposed of and there would be no impacts to local waste disposal facilities from clearing of land (DIRS 176172-Nevada Rail Partners 2006, p. 6-3).

Earthwork cuts and fills for rail line construction would be expected to equal each other or nearly equal each other (DIRS 176165-Nevada Rail Partners 2006, Appendix E). In the event that more cut material was generated than would be needed as fill, DOE would use the excess to strengthen access roads and rail embankments. Therefore, no excess cut material would need to be disposed of and there would be no impacts to disposal facilities from the generation of excess cut material.

4.2.12.2.2 Hazardous-Materials Use and Hazardous-Waste Generation

DOE would store and use hazardous materials such as oil, gasoline, diesel fuel, and solvents during the construction phase primarily for the operation and maintenance of equipment and cleaning of equipment and facilities. The Department would implement an Environmental Management System and a Pollution Prevention/Waste Minimization Program during the construction and operations phases, which would include an evaluation of alternatives to eliminate, reduce, or minimize the amounts of hazardous materials used and hazardous wastes generated. As part of the Environmental Management System, DOE would regularly perform assessments to identify opportunities to reduce the generation of waste (DIRS 182385-Burns 2007, all). The Department would formulate and implement Spill Prevention Control and Countermeasures plans, including the use of secondary containment, to prevent releases of hazardous materials, such as diesel fuel, to the environment.

Table 4-141 lists the anticipated hazardous materials and the waste types that could be generated. The Department expects some materials (such as diesel fuel, lubricants, and hydrocarbons) would be used at each of the construction support facilities. However, most materials used and wastes generated would be specific to certain activities and facilities.

Hazardous wastes, such as used lubricants and solvents, would be accumulated and disposed of in accordance with Resource Conservation and Recovery Act regulations.

Table 4-141. Summary of anticipated types of hazardous materials that would be used and wastes that would be generated during railroad construction and operations – Caliente rail alignment.[a,b]

	Railroad construction	Construction camps	Concrete batch plants	Asphalt plants	Railroad operations[c]
Materials					
Fuel	X	X	X	X	X
Lubricants	X	X	X	X	X
Hydrocarbons (oils, greases)	X	X	X	X	X
Solvents	X	X	-	X	X
Compressed gas (flammable and nonflammable)	X	X	X	-	X
Batteries (such as lead, acid, nickel-cadmium)	X	X	X	-	X
Battery acid	X	X	-	-	X
Reactive (magnesium welding/fusing)	X	X	-	-	X
Explosives	X	X	-	-	-
Flammables (such as paints, coatings)	X	X	X	X	X
Herbicides/pesticides	X	X	-	-	X
Cleaning supplies (such as bleach, ammonia)	X	X	X	-	X
Lithium lubricants	X	-	-	-	X
Wastes					
Refuse	X	X	X	X	X
Industrial/construction waste	X	X	X	-	X
Hazardous waste	X	X	-	X	X
Recyclable/biodegradable	X	X	-	X	X
Universal waste (such as fluorescent lighting)	X	X	X	X	X
Tires	X	X	X	X	X
Asphalt	X	-	-	X	-
Antifreeze	X	X	X	X	X
Hydrocarbon-contaminated soils	X	X	X	X	X
Sewage	X	X	X	X	X
Gray water	-	X	-	-	X
Low-level radioactive waste	-	-	-	-	X

a. Source: DIRS 176750-Bishop 2006, all.
b. An X indicates that the listed material would be used or the listed waste would be generated during that specific activity or at that specific facility; a dash indicates that the listed material would not be used or the listed waste would not be generated during that specific activity or at that specific facility.
c. Includes only the proposed railroad activities; does not include DOE facilities at the Yucca Mountain Repository.

Hazardous wastes would be shipped in accordance with 49 CFR Parts 171 and 172 and U.S. Department of Transportation Hazardous Materials 215D regulations. The disposal capacity for hazardous wastes in western states has been estimated at 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50); thus, there would be ample capacity available to dispose of any hazardous wastes. Through compliance with applicable state and federal regulations, adverse impacts from the use of hazardous materials, generation of hazardous waste, and the disposal of hazardous waste would be small.

DOE could use explosives during quarry, access-road, and rail line construction, and would develop a safety program specifically for the storage, transportation, and handling of these materials. The Department would adhere to the requirements of DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees* (as described in Chapter 6), which specifies that explosives operations must comply with the DOE Explosives Safety Manual (DOE M 440.1-1A). The manual provides guidance on the storage and transportation of explosives and refers to Occupational Safety and Health Administration safety requirements for routine construction and tunnel-blasting operations.

There could be impacts if hazardous materials, such as fuels, lubricants, and antifreeze, were released and spread. DOE would store such materials at construction camps, and supply trucks would routinely bring new materials and remove used lubricants and coolants from the construction sites. These activities could result in local spills and releases of contaminants. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (see Chapter 6).

4.2.12.2.3 Low-Level Radioactive Waste

No low-level radioactive waste would be generated during the construction phase.

4.2.12.3 Operations Impacts

DOE would purchase hazardous and nonhazardous products and materials during the operations phase. The use of hazardous materials and products would lead to the generation of hazardous wastes. Table 4-141 lists the anticipated hazardous materials and the waste types that could be generated during the operations phase.

4.2.12.3.1 Nonhazardous Waste

Railroad operations would generate solid wastes, which DOE would dispose of at facilities along the rail line. Amounts of such wastes would be very small and would not impact disposal capacity in Clark, Esmeralda, Nye, and Lincoln Counties.

Amounts of industrial and special wastes generated during maintenance of fixed equipment such as signals and rail crossings would be very small (DIRS 155560-Hoganson 2001, all). Crossties, ballast, rails, and bridges would not be likely to require replacement before 2033 (DIRS 152540-Hoganson 2000, all). However, when these materials did require maintenance or replacement, they would be reused wherever possible or recycled if reuse was not an option. Therefore, no impacts to local landfills would be anticipated from the disposal of industrial and special wastes during the operations phase.

The anticipated quantity of solid waste generated at all railroad operations support facilities is 190 metric tons (210 tons) per year or 0.51 metric ton (0.56 ton) per day (Table 4-142). DOE would transport solid waste to permitted solid-waste landfills. As shown in Table 3-74, landfills in Lincoln, Nye, Esmeralda, and Clark Counties accept more than 8,100 metric ton (9,000 ton) of waste per day combined.

Table 4-142. Solid waste generation at proposed railroad operations support facilities – Caliente rail alignment.

Facility	Number of personnel (maximum)	Solid-waste generation (kilograms[a] per day per person)[b]	Total solid waste (metric tons per day)[c]	Total solid waste (metric tons per year)
Cask Maintenance Facility	30[d]	2.9	0.087	32
Facilities at the Interface with the Union Pacific Railroad Mainline (Interchange Yard and Staging Yard)	50[d,e]	2.9	0.15	55
Rail Equipment Maintenance Yard (including the Nevada Railroad Control Center and the National Transportation Operations Center)[f]	40[d,e]	2.9	0.12	44
Headquarters, Satellite, and Trackside Maintenance-of-Way Facilities	50[e]	2.9	0.15	55
Totals[g]	170		0.51	190

a. To convert kilograms to pounds, multiply by 2.2046.
b. Sources: Per person solid waste generation rate is from DIRS 174041-State of Nevada 2004, p. 13.
c. To convert metric tons to tons, multiply by 1.1023.
d. Includes four rail-crew members.
e. DIRS 176170-Nevada Rail Partners 2006, Appendix D.
f. The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard and the National Transportation Operations Center could be anywhere in the continental United States; for purposes of analysis, DOE assumed these Centers would be at the Rail Equipment Maintenance Yard.
g. Totals might not equal sums of values due to rounding.

The addition of about 0.51 metric ton (0.56 ton) of solid waste anticipated during the operations phase (see Table 4-142) would raise the total amount disposed of in the four-county area by less than 0.01 percent. Nevada has enough landfill capacity to accommodate this additional solid waste; therefore, impacts to landfill capacities would be small.

4.2.12.3.2 Hazardous-Materials Use and Hazardous-Waste Generation

Maintenance of rolling and stationary railroad equipment and track would generate some hazardous wastes, including lubricants from equipment and machinery, solvents, paint, and other hazardous materials typical of railroad operations.

The Facilities at the Interface with the Union Pacific Railroad Mainline would use limited quantities of hazardous materials, such as oils, solvents, and lubricants, and associated wastes would be generated. An off-site contractor would perform diesel fueling at the Staging Yard using a tank truck to service the yard switcher locomotive. DOE would also store propane and natural gas at the Staging Yard (DIRS 176168-Nevada Rail Partners 2006, pp. 5-1 and 5-11).

The Maintenance-of-Way Headquarters Facility would include maintenance work areas, office space, and a material-storage area. DOE would store limited quantities of hazardous materials such as lubricants, solvents, and possibly pesticides (for example, herbicides and rodenticides), at this facility, and associated wastes would be generated. The Department would also store propane or natural gas onsite in tanks (DIRS 176168-Nevada Rail Partners 2006, pp. 7-1 and 7-2).

DOE would store and use hazardous materials, including diesel fuel, gasoline, propane, oils, paints, and solvents, at the Cask Maintenance Facility and associated hazardous wastes (such as oily rags and solvent wastes) would be generated (DIRS 174083-WPI 2003, pp. 30, 39, and 52). Compressed flammable gas and oxygen would also be stored at the Cask Maintenance Facility.

The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard and the National Transportation Operations Center could be anywhere in the continental United States, although for purposes of analysis, DOE assumed these Centers would be at the Rail Equipment Maintenance Yard. The Centers would consist primarily of office space (DIRS 176168-Nevada Rail Partners 2006, p. 6-3). DOE would store general cleaning supplies at these facilities.

There would be a diesel fuel storage tank with a 190,000-liter (50,000-gallon) capacity and a diesel fueling depot at the Rail Equipment Maintenance Yard (DIRS 181033-Hamilton-Ray 2007, all). There would also be a staging area where fuel oil and construction materials could be delivered to the repository. DOE would store and use hazardous materials, including lubricating oil, diesel fuel, natural gas or propane, and solvents, at the Rail Equipment Maintenance Yard and associated hazardous wastes would be generated (DIRS 176168-Nevada Rail Partners 2006, Section 6). Locomotive maintenance activities would generate approximately 420 liters (110 gallons) of used oil for each locomotive maintained. During peak operations, a maximum of 442 locomotives would travel on the rail line each year (DIRS 175036-BSC 2005, Table 4-2), which would generate approximately 190,000 liters (50,000 gallons) per year of used oil from locomotive maintenance. The used oil would be reclaimed rather than disposed of (DIRS 155970-DOE 2002, p. 6-89).

There could be small spills of hazardous materials such as oils and fuel along the rail line during the operations phase. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (see Chapter 6).

DOE would manage the use of hazardous materials and would follow all federal, state, and local regulations, and would transport hazardous wastes to appropriately permitted disposal facilities that have ample capacities to receive such wastes, as discussed in Section 4.2.12.2.2. Therefore, impacts from the use of hazardous materials and the disposal of hazardous wastes during the operations phase would be small.

4.2.12.3.3 Low-Level Radioactive Waste

Activities at the Cask Maintenance Facility would generate from 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) of Class A low-level radioactive waste throughout the operations phase (DIRS 181425-MTS 2007, p. 6). The Department would control and dispose of site-generated low-level radioactive waste in a DOE low-level waste disposal site, a site in an ***Agreement State***, or in a U.S. Nuclear Regulatory Commission-licensed site.

The Nevada Test Site accepts low-level radioactive waste for disposal and has an estimated disposal capacity of 3.7 million cubic meters (130 million cubic feet). DOE has estimated that approximately 1.1 million cubic meters (39 million cubic feet) of low-level radioactive wastes will be disposed of at the Nevada Test Site by 2070 from all potential sources, but not including Cask Maintenance Facility-generated wastes (DIRS 155970-DOE 2002, Section 3.1.12.4). Commercial disposal capacity for low-level radioactive wastes is currently available in the United States.

Relatively small amounts of low-level radioactive wastes would be generated and the aforementioned potential disposal options would have ample capacities to accept these wastes; therefore, impacts to low-level radioactive waste disposal facilities would be small.

4.2.12.4 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be similar to those described for the Proposed Action without shared use. The only difference would be the construction and operation of additional sidings and a slight increase in overall rail traffic. Waste characteristics, generation rates, and disposal requirements would vary only slightly. Therefore, any additional adverse impacts associated with the Shared-Use Option would be small.

4.2.12.5 Summary

Table 4-143 summarizes potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad along the Caliente rail alignment. Chapter 7 describes mitigation measures DOE could employ to reduce impacts.

Impacts from nonhazardous waste (solid and industrial and special waste) disposal listed in Table 4-143 represent the degree to which potentially affected landfills could be affected by increased waste receipt rates as a result of railroad construction and operation along the Caliente rail alignment. Construction of the proposed railroad along the Caliente rail alignment would raise the disposal rate of nonhazardous waste to landfills in the region of influence by about 0.21 percent. Overall, impacts during the construction phase would be small, for the relatively large Apex Landfill, to moderate for smaller landfills. During the operations phase, impacts to landfills would be small.

Impacts from the use of hazardous materials listed in Table 4-143 represent the likelihood that railroad construction and operation along the Caliente rail alignment would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous material. Overall, impacts during the construction and operations phases would be small, considering that DOE would implement proper planning measures in relation to the storage and handling of hazardous materials and would adhere to all applicable regulations.

Impacts from hazardous-waste disposal listed in Table 4-143 represent the degree to which potentially affected hazardous-waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operation along the Caliente rail alignment. Overall, impacts during the construction and operation phases would be small because adequate disposal capacity would be available.

Impacts from low-level radioactive waste disposal listed in Table 4-143 represent the degree to which potentially affected low-level radioactive waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operation along the Caliente rail alignment. No low-level radioactive waste would be generated during the construction phase. During the operations phase, low-level radioactive wastes would be generated during cask maintenance activities at the Cask Maintenance Facility. Impacts to low-level radioactive waste disposal facilities during the operations phase would be small because adequate disposal capacity would be available.

Table 4-143. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Caliente rail alignment (page 1 of 2).[a]

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Common to all common segments and alternative segments (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.

Table 4-143. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Caliente rail alignment (page 2 of 2).[a]

Rail line segment/facilities (county)	Construction impacts	Operations impacts
Facilities at the Interface with the Union Pacific Railroad Mainline (includes the Interchange Yard and Staging Yard) (Lincoln County)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.
Maintenance-of-Way Facilities (includes Maintenance-of-Way Headquarters Facility; Maintenance-of-Way Trackside Facility; Satellite Maintenance-of-Way Facilities); Rail Equipment Maintenance Yard; Cask Maintenance Facility; and Nevada Railroad Control Center and National Transportation Operations Center at the Rail Equipment Maintenance Yard (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal. Small impacts from low-level radioactive waste disposal for wastes that would be generated at the Cask Maintenance Facility.
Construction camps (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. There would be no construction camps during railroad operations.
Access roads (including alignment access roads) (Lincoln, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. Use of access roads during railroad operations would not involve the use of hazardous materials or the generation of wastes.
Quarries (common to all potential quarry locations)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. DOE would not operate quarries after the end of the construction phase.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

4.2.13 CULTURAL RESOURCES

This section describes potential impacts to cultural resources from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.13.1 describes the methods DOE used to assess potential impacts; Section 4.2.13.2 describes potential construction and operations impacts; Section 4.2.13.3 describes potential impacts under the Shared-Use Option; and Section 4.2.13.4 summarizes potential impacts to cultural resources. This section also incorporates American Indian perspectives to assess the potential direct and indirect impacts to assess the potential direct and indirect impacts to important American Indian prehistoric and historic resources.

Section 3.2.13.1 describes the region of influence for cultural resources. Unless specified otherwise, this section describes impacts within the 3.2-kilometer (2-mile)-wide area centered on the rail alignment (the Level II region of influence).

4.2.13.1 Impact Assessment Methodology

Because of the length of the proposed rail line along the Caliente rail alignment, DOE is using a phased cultural resource identification and evaluation approach, as described in 36 CFR 800.4(b) 2, to identify specific cultural resources along the alignment. Under this approach, DOE would defer final field surveys (an intensive BLM ***Class III inventory***) of the actual construction right-of-way, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, p. 15) (see Appendix M).

> A **Class II inventory** is a sample-oriented field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area to make possible an objective estimate of the nature and distribution of cultural resources in the entire defined area.
>
> A **Class III inventory** is an intensive field survey designed to locate and record all cultural resource sites within a specified area. Upon completion of such an inventory, no further cultural resource inventory work is normally needed in the area.

The programmatic agreement states that an appropriate level of field investigation – including on-the-ground intensive surveys; evaluations of all recorded resources listed on the *National Register of Historic Places*; assessments of adverse effects; and applicable mitigation of identified impacts – be completed before any ground-disturbing construction activities could begin. This programmatic agreement also stipulates that there be proper tribal consultation activities, and treatment (mitigation) guidelines and measures designed to cover unanticipated discoveries and impacts during the construction and operations phases. The BLM administers most of the potentially affected land along the Caliente rail alignment. Relevant provisions of another programmatic agreement between the BLM, the State of Nevada, and the Nevada State Historic Preservation Office (DIRS 174690-Abbey & Baldrica 2005, all) would apply, along with cultural resources procedures outlined in the BLM *Cultural Resource Inventory Guidelines* (DIRS 174691-BLM 1990, all).

The region of influence for the Class III inventory would include all potential direct and indirect effects to cultural resources and all properties of traditional religious and cultural importance from any construction activities associated with the proposed railroad. Before beginning any ground-disturbing activities, DOE would conduct a Class III inventory for the following specific region of influence for project activities (DIRS 176912-Wenker et al. 2006, p. 2):

> The APE [Area of Potential Effect, referred to in this Rail Alignment EIS as the region of influence] for the rail line will be 200 feet [61 meters] from the centerline of the alignment or the actual ROW [right-of-way]

> application submitted to BLM, whichever is greater. The APE for access roads outside of the alignment will be a minimum of 100 feet [30.5 meters] wide with at least 50 feet [15 meters] on either side of centerline. The minimum APE for any construction areas or other temporary use areas, outside of the alignment, will be the footprint of the area plus 100 feet outward in all directions from the perimeter of each area. The APE for assessing indirect effects on historic properties outside of the rail line alignment will extend at least one mile in all directions from the perimeter of the direct effects APE.

Cultural resource requirements for the portion of common segment 6 (see Figure 2-9) and the Rail Equipment Maintenance Yard within the Yucca Mountain Site boundary would be covered by a separate programmatic agreement addressing development of a geologic repository at Yucca Mountain, Nevada, underway between the DOE Office of Civilian Radioactive Waste Management, the Advisory Council on Historic Preservation, and the Nevada State Historic Preservation Office.

The present evaluation of impacts depends on a comprehensive review of existing literature and site-file databases, sample archaeological inventory, and discussions with responsible federal agencies, State of Nevada agencies, and American Indian groups, which have identified many known and potential archaeological, historical, and American Indian sites and features along the Caliente rail alignment. Section 3.2.13.3 provides pertinent baseline information. American Indian viewpoints for potential impacts to sites and resources important to regional tribes and organizations are expressed in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document; DIRS 174205-Kane et al. 2005, all).

4.2.13.2 Railroad Construction and Operations Impacts

Nearly all potential direct impacts to cultural resources, including those that would physically damage, alter, or disturb a historic property, would occur during the construction phase, specifically within the designated rail line construction right-of-way. There could be additional construction-related ground disturbances at quarry sites, road crossings, temporary access roads, borrow sites, ***spoils areas*** or piles, and 12 temporary construction camps. Each camp would have a construction footprint of about 0.1 square kilometer (25 acres). There would be other ground disturbances at the locations of the railroad operations support facilities, including the Facilities at the Interchange with the Union Pacific Railroad Mainline in the vicinity of either Caliente (0.06 square kilometer [15 acres]) or Eccles (0.12 square kilometer [30 acres]); the Maintenance-of-Way Trackside Facility (0.06 square kilometer [15 acres]), which would be near Goldfield; the Maintenance-of-Way Headquarters Facility (0.01 square kilometer [3 acres]), which would be near Tonopah; the Rail Equipment Maintenance Yard (about 0.41 square kilometer [101 acres]), which would be within the Yucca Mountain Site boundary; and the Cask Maintenance Facility, which would be collocated with the Rail Equipment Maintenance Yard.

There could be various forms of indirect impacts during both the construction and operations phases, such as visual intrusions or increased access and visitation. During construction, large numbers of workers in the vicinity of the construction camps could increase the potential for both intentional and unintentional impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that, based on previous archaeological surveys, were either thought to occur only at the surface or were previously undetected because they were completely buried. Improved access to remote areas could also increase the likelihood of looting or other damage to archaeological properties during the construction and operations phases.

Another indirect impact that would be unavoidable from construction in remote areas would be visual intrusion effects to a variety of resources designated as potential cultural resource landscapes. These resources include potential ***ethnographic landscapes***, rural historic landscapes, and historic mining landscapes, and incorporate geographic areas, including both cultural and natural resources associated with historic events or activities. In some instances, the literature reviews, known-site file searches, and the Class II inventory conducted for this Rail Alignment EIS have identified potential areas of specific impacts for some of the alternative segments and common segments. In addition, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) provides other relevant information.

4.2.13.2.1 Construction Impacts along Caliente Rail Alignment Alternative Segments and Common Segments

The following sections outline both the direct and indirect construction-related impacts within each of the Caliente rail alignment alternative segments and common segments. Each section begins with a discussion of the direct impacts to cultural resources, which is followed by a discussion of the indirect impacts. These sites include those listed on the *National Register of Historic Places*, those eligible for listing on the National Register, and those known to have cultural significance but are not listed on the National Register.

4.2.13.2.1.1 Alternative Segments at the Interface with Union Pacific Mainline.

Caliente Alternative Segment The Class I site-file search identified 11 previously recorded cultural resources along the Caliente alternative segment, including two within the Level I region of influence and nine within the Level II region of influence. These resources include three prehistoric sites (two rockshelters and a campsite), three isolated artifacts, and five historic sites (two railroad features, two trash scatters, and a cemetery). The search revealed that one site, the Caliente Union Pacific Railroad Depot, is listed on the *National Register of Historic Places* and two sites, the Caliente-Panaca Railroad berm, and a prehistoric rockshelter site, are evaluated as eligible for listing on the *National Register of Historic Places*. DOE did not perform a Class II sample inventory due to private property issues. Most of the lands along the Caliente alternative segment are privately owned. If DOE selected this alternative segment, the Department would complete an inventory before beginning construction.

There could be direct impacts to one *National Register of Historic Places*-eligible site. Construction of the rail roadbed could directly impact the abandoned Caliente-Panaca Railroad berm. The rails have been removed from the berm, but several undocumented wooden and metal bridges remain along the stretch that would be covered by the proposed rail line.

There could be indirect impacts to two National Register-eligible sites, including the Caliente Union Pacific Railroad Depot and a prehistoric rockshelter. The Caliente Union Pacific Railroad Depot is in downtown Caliente, south of the proposed interchange with the Union Pacific Railroad Mainline. Historic maps and photographs indicate that several early buildings, including a depot and a roundhouse, existed in that area and it is probable that subsurface historical archaeological remains exist even though the structures have been removed. The area known as Indian Cove, just north of the City of Caliente, through which the rail line would pass and the possible location of the Staging Yard, has evidence of prehistoric use in the form of a previously recorded rockshelter, an unevaluated rock-art panel, and ***lithic scatters*** and isolates. The rail line would extend through Meadow Valley, and would constitute a possible visual intrusion on the potential early Mormon settlement cultural landscape.

A rail line along the Caliente alternative segment could also directly and indirectly impact unrecorded sites. For example, the unrecorded Caliente Hot Springs Motel and Baths is where the proposed rail line would depart from the Union Pacific Railroad Mainline.

Potential quarry CA-8B would be along the Caliente alternative segment, on the eastern exposure of a rocky ridge overlooking Meadow Valley Wash. Preliminary archaeological reconnaissance of this location indicates that development of a quarry there would not result in direct impacts to known sites.

Eccles Alternative Segment The Class I site-file search identified three cultural resources along the Eccles alternative segment, including one within the Level I region of influence and two within the Level II region of influence. These resources include two prehistoric sites and one isolated artifact. The search revealed no sites have been evaluated as eligible for listing on the *National Register of Historic Places*; however, there could be direct impacts to two previously recorded but unevaluated prehistoric rockshelters in the vicinity of the Eccles-North Staging Yard location. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also indicates that Clover Valley is a culturally important place with associated songs, plants and animals, and water resources.

DOE inventoried three Class II survey sample units along this alternative segment, a total of 2.4 kilometers (1.5 miles) or 13 percent of the segment. No sites were recorded, but five isolated artifacts were found. In the area of Meadow Wash at the northern end of the alternative segment, there is a potential early Mormon settlement cultural landscape.

The sample inventory indicates that approximately eight sites could be present within the Level I region of influence.

4.2.13.2.1.2 Caliente Common Segment 1 (Dry Lake Valley Area). The Class I site-file search identified 39 previously recorded cultural resources along Caliente common segment 1, including nine within the Level I region of influence and 30 within the Level II region of influence. These resources include 11 prehistoric sites (a toolstone quarry locale and 10 lithic scatters), 20 isolated artifacts, and eight historic sites (three ranching campsites, three trash scatters, and Old State Route 38 along the White River).

The Class II field survey inspected a total of 23 sample units along this segment, a total of 19 kilometers (12 miles) or 16 percent of the segment. The survey recorded two sites, a prehistoric lithic scatter and a historic campsite; neither site was recommended as eligible for listing on the *National Register of Historic Places*. Seventeen isolated artifact occurrences were also recorded during the field survey along this segment.

The search revealed no previously recorded National Register-eligible sites within the area that would be directly affected by rail line construction. However, there could be indirect impacts to a National Register-eligible prehistoric/historic campsite in the vicinity of Black Rock Spring. The campsite includes abundant lithics, ceramics, and early historic-period artifacts.

Construction activities along the eastern part of Caliente common segment 1 could result in direct and indirect impacts to the Meadow Valley Wash early Mormon settlement cultural landscape, and a historically important Pioche-Hiko silver mining community route and campsites of the 1849 Bennett-Arcane Party. The 1849 party camped at Bennett Springs, about 1.6 kilometers (1 mile) from the Caliente rail alignment. The party also camped in the vicinity of Black Rock Spring before crossing the North Pahroc Range. The route the party followed, commonly referred to as the Lost ‘49er Trail, has not been physically identified but is known to have crossed Bennett Pass and Pahroc Summit. To date, no archaeological sites associated with the Bennett-Arcane Party have been identified in the present region of influence.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any potentially significant American Indian resources in the region of influence along Caliente common segment 1, though the American Indian Writers Subgroup notes that systematic ethnographic studies have not been conducted. The Subgroup does note the significance of cultural resources in the White River Valley, such as the well-known White River Narrows rock-art sites, charcoal ovens, and the area of Pahranagat Valley. These resources would be several kilometers from the Caliente rail alignment region of influence and would not be affected by rail line construction.

Sample inventory indicates that approximately 56 resources may be present within the Level I region of influence.

4.2.13.2.1.3 Garden Valley Alternative Segments.

Garden Valley Alternative Segment 1 The Class I site-file search identified 10 previously recorded cultural resources along Garden Valley alternative segment 1, including one within the Level I region of influence and nine within the Level II region of influence. These resources include five prehistoric sites (two rockshelters and three lithic scatters), four isolated artifacts, and one historic trash scatter. No sites have been evaluated as eligible for listing on the *National Register of Historic Places*. The Class II survey examined five sample units along this alternative segment, a total of 4 kilometers (2.5 miles) or 11 percent of the segment. Only six isolated artifact occurrences were recorded.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that Garden Valley contained extensive American Indian trail systems used for trade, commerce, pilgrimage, and for access to mountain ranges. Because systematic ethnographic studies have not been conducted for this alternative segment, the Resource Document gives no specific locations for trails. Therefore, Garden Valley alternative segment 1 could result in direct and indirect impacts to American Indian trail systems that pass through this part of Garden Valley.

Sample inventory indicates that approximately nine resources could be present within the Level I region of influence.

Garden Valley Alternative Segment 2 The Class I site-file search identified 12 cultural resources along Garden Valley alternative segment 2 (see Figure 3-119), including four prehistoric sites within the Level I region of influence and eight isolates within the Level II region of influence. The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles) or 9 percent of the segment; two isolates were recorded. Three cultural resources are evaluated as eligible for listing on the *National Register of Historic Places*, including the two campsites and a lithic scatter associated with a cluster of rock features.

Construction activities could directly impact two archaeological sites evaluated as eligible for listing on the *National Register of Historic Places*, a campsite and a lithic scatter, which would be in the Level I region of influence.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that Garden Valley had extensive American Indian trail systems used for trade, commerce, pilgrimage, and for access to mountain ranges. There could be direct and indirect impacts to early American Indian trails, and construction of Garden Valley alternative segment 2 could result in potential visual intrusions to the Freiberg Mining District cultural landscape in the northern part of the Worthington Mountains.

Sample inventory indicates that approximately 44 resources could be present within the Level I region of influence.

Garden Valley Alternative Segment 3 The Class I site-file search identified 17 previously recorded cultural resources along Garden Valley alternative segment 3, including one within the Level I region of influence and 16 within the Level II region of influence. These resources include two prehistoric sites (a rock feature and lithic scatter), 13 isolated artifacts, and two historic trash scatters. The Class II sample survey examined four sample units along this segment, a total of 3.2 kilometers (2 miles) or 9 percent of the segment. Only two isolates were recorded. No sites are evaluated as National Register-eligible.

Similar to the other Garden Valley alternative segments, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that this area had extensive American Indian trail systems used for trade, commerce, pilgrimage, and access to mountain ranges. Construction of Garden Valley alternative segment 3 could result in direct and indirect impacts to these trail systems. The BLM Ely office has suggested that a potential sheep ranching cultural landscape might exist in the northern part of Garden Valley due to the proximity of the Uhalde and Paris Ranches and grazing areas, which included not only northern Garden Valley and the nearby Quinn Canyon Range, but the northern part of Coal Valley and the Seaman Range to the east. Rail line construction could result in indirect visual impacts to these landscapes.

Sample inventory indicates that approximately 12 resources could be present within the Level I region of influence.

Garden Valley Alternative Segment 8 The Class I site-file search identified five previously recorded cultural resources along Garden Valley alternative segment 8, all within the Level II region of influence. These resources include three prehistoric lithic scatters and two isolated artifacts. The Class II sample survey inspected three units along this alternative segment, a total of 2.4 kilometers (1.5 miles) or 7 percent of the segment; eight isolated artifacts were recorded. No cultural resources along Garden Valley alternative segment 8 are evaluated as National Register-eligible.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) notes that Garden Valley had extensive American Indian trail systems used for trade, commerce, pilgrimage, and for access to mountain ranges. Construction of Garden Valley alternative segment 8 could result in direct and indirect visual impacts to these trail systems, and could result in potential visual intrusions to the Freiberg Mining District cultural landscape in the northern part of the Worthington Mountains.

4.2.13.2.1.4 Caliente Common Segment 2 (Quinn Canyon Range Area). The Class I site-file search identified eight cultural resources along Caliente common segment 2, including three within the Level I region of influence and six within the Level II region of influence. These resources include seven prehistoric sites (two campsites, a rockshelter, and four lithic scatters) and one isolated artifact. The Class II sample survey inspected seven sample units, a total of 5.6 kilometers (3.5 miles) or 11 percent of the segment; three sites and 16 isolated artifacts were recorded. Three cultural resources along Caliente common segment 2 are evaluated as eligible for listing on the *National Register of Historic Places*, including two lithic scatters and one locale with rockshelters and an associated scatter of artifacts.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) notes the rockshelter site as a culturally significant place, and refers to it as the "Black Top Archaeological Locality" (see Figures 3-119 and 3-120), and the Class II sample survey resulted in the identification of three sites and 16 isolated artifacts.

Indirect impacts along this common segment could include visual impacts to the significant Black Top archaeological locality, which would be within the rail alignment construction right-of-way. This site includes a stratified rockshelter, artifact scatter, and rock alignments, and is noted in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 22) as a culturally significant place. The American Indian Writers Subgroup noted the proximity of Caliente common segment 2 to the Quinn Canyon Range and, specifically, to Quinn Canyon itself, where there were historical events important to American Indians. At the west end of Caliente common segment 2, construction and operation of the proposed railroad could constitute a visual intrusion for the unrecorded historic Cedar Pipeline Ranch, which is part of the larger Reveille Valley historic ranching cultural landscape. It is also in this area that the rail alignment would intersect the 1854 John C. Fremont exploration trail. However, no physical manifestations of this trail or associated features have been identified on the ground surface.

Direct and indirect impacts to American Indian trail systems and a potential historic sheep ranching cultural landscape would be possible. The BLM Ely office has suggested that because of the proximity of ranches and grazing areas in Garden Valley, there could be a potential sheep ranching cultural landscape in the northern part of the valley.

Sample inventory indicates that approximately 27 resources could be present within the Level I region of influence.

4.2.13.2.1.5 South Reveille Alternative Segments. Because the Level II region of influence for the South Reveille alternative segments (Figure 3-120) overlap, they are discussed jointly for the Class I site-file search and the Class II survey. The Class I site-file search revealed the presence of three cultural resources along these segments. These resources include two recorded prehistoric lithic scatter sites and one historic mine prospect. Also in this vicinity are the Reveille Valley rock-art panels. This location was identified in the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) as a culturally important site for American Indian people.

DOE examined two sample units for each of these alternative segments during the Class II field survey, a total of 1.6 kilometers (1 mile) or 8.5 percent of the segments. Only a single isolate was encountered along South Reveille 2. The Class II survey also recorded the rock-art site noted above.

Both South Reveille alternative segments 2 and 3 would pass within 0.8 kilometer (0.5 mile) of a National Register of Historic Places-eligible rock-art site. Based on limited observations, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, p. 20) also associated a high level of American Indian cultural significance with this property. Construction and operation of the proposed railroad could represent a long-term indirect impact on this important place.

There are two potential quarry locations (NN-9A and NN-9B) along South Reveille alternative segments 2 and 3. The northernmost location (NN-9A) would be within 366 meters (1,200 feet) of a significant rock-art site. Development of the quarry could result in indirect aesthetic, visual, and noise impacts to that site. Potential quarry NN-9B would occupy a long, narrow sandy ridge with frequent rocky outcrops. Preliminary archaeological reconnaissance of this location indicates that development of this quarry would not result in direct impacts to known sites.

Sample archaeological inventory did not indicate the presence of any archaeological sites within the Level I region of influence for these segments.

4.2.13.2.1.6 Caliente Common Segment 3 (Stone Cabin Valley Area). The Class I site-file search identified 35 cultural resources along Caliente common segment 3 (see Figure 3-120), including seven within the Level I region of influence. These resources include 29 prehistoric sites and six historic sites. The Class II survey examined 22 sample units, a total of 18 kilometers (11 miles) or 16 percent of the segment. Three prehistoric sites are evaluated as eligible for listing on the National Register of Historic Places, including two lithic scatters within the Level I region of influence and a rock-art site within the Level II region of influence. Several potentially important cultural resources are found along Caliente common segment 3, although most are just outside the Level II region of influence.

Caliente common segment 3 would cross nearly all of Reveille Valley, Stone Cabin Valley, and the southern part of Ralston Valley, and it would pass close to many archaeological and historical places, and several potential cultural landscapes that could be eligible for listing on the *National Register of Historic Places* (see Section 3.2.13.3.4 for a list of individual sites and cultural landscapes). There could be direct and indirect impacts at one National Register-eligible archaeological site recorded during the Class II inventory. Based on the prevalence of known but largely unrecorded cultural resources in these valleys, it can be anticipated that a Class III inventory of the construction right-of-way would encounter additional cultural resources that could be subject to direct impacts from construction activities.

Based on available information, the greatest potential for impacts would be of the indirect visual-intrusion type, with the rail line intersecting possible ethnographic and historic ranching and mining cultural landscapes, and passing in full view of other possible historic properties.

Sample inventory indicates that approximately 45 resources could be present within the Level I region of influence.

4.2.13.2.1.7 Goldfield Alternative Segments.

Goldfield Alternative Segment 1 The Class I site-file search identified four cultural resources along Goldfield alternative segment 1, all within the Level II region of influence. These resources include two prehistoric lithic scatters and two historic sites (a trash scatter and a campsite). The Class II survey examined six sample units along this segment, a total of 4.8 kilometers (3 miles) or 10 percent of the segment; 52 isolated artifacts were recorded. No sites within the Goldfield alternative segment 1 are considered as eligible for listing on the *National Register of Historic Places*.

Construction of Goldfield alternative segment 1 could result in direct impacts to several important cultural resources close to the construction right-of-way, including a rockshelter and rock art in the vicinity of Mud Lake and early Western Shoshone camps east of Goldfield. None of these sites would be within the construction right-of-way, but they could be subject to indirect impacts during construction, and in the longer term, by a potential visual intrusion to the cultural landscape.

Construction of Goldfield alternative segment 1 could result in additional direct and indirect impacts to the five prehistoric sites within the region of influence, including three campsites, a lithic scatter, and an historic habitation, none of which is eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies the campsites, which occur at springs east of Goldfield, as possible Western Shoshone camps, with one of them (Willow Springs), having been identified as such in the literature. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) also notes the Lowe rockshelter site as having a high level of cultural significance. There are also rock-art panels at this location. The Lowe site would be east of Goldfield alternative segment 1.

Sample archaeological inventory did not indicate the presence of any archaeological sites within the Level I region of influence for this segment.

Goldfield Alternative Segment 3 The Class I site-file search identified three previously recorded cultural resources along Goldfield alternative segment 3, including one within the Level I region of influence and two within the Level II region of influence. These resources include two rockshelters and a prehistoric campsite. The Class II survey covered 2.4 kilometers (1.5 miles) or 5 percent of the segment, and 13 isolated artifacts were recorded. The campsite is the same possible group of Western Shoshone winter camps discussed in the preceding section. The American Indian Resource Document discussion from Goldfield alternative segment 1 also applies to this segment.

A potential quarry site NS-3A would be along the northern portion of this alternative segment. Limited archaeological reconnaissance of this location indicates that development of this quarry would not result in direct impacts to known sites; DOE has not evaluated potential indirect effects.

Sample inventory indicates that approximately 21 resources could be present within the Level I region of influence.

Goldfield Alternative Segment 4 The Class I site-file search revealed 154 previously recorded cultural resources along Goldfield alternative segment 4 (see Figure 3-121), including 35 within the Level I region of influence and 119 within the Level II region of influence. The Class II field effort examined eight sample units along this segment, totaling 6.4 kilometers (4 miles) or 12 percent of the segment, resulting in the identification of 69 isolates.

Sites that are evaluated as being *National Register of Historic Places*-eligible include the downtown section of Goldfield itself, which is National Register listed. Goldfield 4 would pass through the National Register-eligible historic Goldfield town dump area and two mining sites. Rail line construction could result in direct or indirect impacts to these resources.

Other eligible sites outside the Level I region of influence include two town-related features, three mining sites, and three lithic scatters. In addition, several unrecorded prehistoric and historic sites are known to exist in the region of influence (see Section 3.2.13.1), based on literature reviews and field reconnaissance, along with an unmarked historic cemetery.

The American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) commented on the known presence of numerous American Indian resources in the vicinity of Goldfield alternative segment 4. American Indian Writers Subgroup field reconnaissance noted the presence of several rockshelters, a boulder with rock art, and several unrecorded lithic scatters. Additionally, a grave marker in the paupers section of the historic Goldfield Cemetery indicates that an American Indian woman was buried there in 1908.

A potential quarry ES-7 would be near Goldfield alternative segment 4, west of Goldfield. No cultural materials or other evidence of prehistoric or historic activities were noted during preliminary archaeological reconnaissance of the quarry area. Access to this quarry from Goldfield would pass through recent and historic mining areas, but neither the quarry location nor the access road would directly overlay the historic mining areas.

Sample inventory indicates that approximately 289 resources may be present within the Level I region of influence.

4.2.13.2.1.8 Caliente Common Segment 4 (Stonewall Flat Area). In Stonewall Flat, Caliente common segment 4 would generally follow an abandoned historic rail line for much of its length to a place in Lida Valley. The Class I site-file search identified one previously recorded but unevaluated rockshelter site along this segment. The Class II survey examined four sample units, a total of 3.2 kilometers (2 miles) or 29 percent of the segment. Eight isolates were recorded.

The American Indian Resource Document does not note any specific areas of importance to American Indians. In the Stonewall Flat area, the rail line construction right-of-way would create a direct impact for the unrecorded and unevaluated trail stop of Ralston, where there could be buried historical archaeological features and remains.

Sample inventory indicates that approximately 4 resources could be present within Level I region of influence.

4.2.13.2.1.9 Bonnie Claire Alternative Segments.

Bonnie Claire Alternative Segment 2 The Class I site-file search identified one cultural resource in the Level I region of influence. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II sample survey examined five sample units, a total of 4 kilometers (2.5 miles) or 19 percent of the segment. Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and ground stone scatter, evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review.

Potential direct and indirect impacts along this alternative segment include the National Register-eligible prehistoric lithic and ground stone scatter identified during the Class II survey. This area also reveals the potential for the existence of prehistoric lithic scatters, obsidian nodule source areas, and rockshelters that, if present, would be directly affected by the construction of this alternative segment. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

The sample inventory indicates that approximately 10 resources could be present within the Level I region of influence.

Bonnie Claire Alternative Segment 3 The Class I site-file search identified four cultural resources within the Level I region of influence. These resources include four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences.

The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles) or 17 percent of the segment. One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

Construction along this alternative segment could result in direct and indirect impacts to the historic railroad camp along the abandoned Bullfrog and Goldfield/Las Vegas and Tonopah Railroad.

Sample inventory indicates that approximately 12 resources could be present within the Level I region of influence.

4.2.13.2.1.10 Common Segment 5 (Sarcobatus Flat Area). The Class I site-file search identified 33 cultural resources along common segment 5, including seven within the Level I region of influence and 26 within the Level II region of influence. These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for listing on the *National Register of Historic Places*, 11 are not eligible, and 14 remain unevaluated.

DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles) or 20 percent of the segment. Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places*, and the tree lithic scatters are not eligible. Common segment 5 would pass about 2.4 kilometers (1.5 miles) east of the Timbisha Shoshone Trust Lands at Scottys Junction. However, no specific cultural resource properties are identified on those lands that would be indirectly affected by construction of the proposed railroad. There is a high probability for direct and indirect impacts along common segment 5. Previous cultural resources inventories in the Sarcobatus Flat area indicate a relatively high potential for lithic scatters and extractive quarries (obsidian nodules). The sample inventory indicates that approximately 15 resources could be present within the Level I region of influence.

4.2.13.2.1.11 Oasis Valley Alternative Segments. The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3, within the Level II region of influence. These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places*) and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

Oasis Valley Alternative Segment 1 The Class II survey looked at three sample units along Oasis Valley 1, a total of 2.4 kilometers (1.5 miles) or 25 percent of the segment. Two prehistoric sites (lithic scatters) and one historic mine site were recorded, all recommended not eligible for nomination to the *National Register of Historic Places*.

This alternative segment would cross the culturally sensitive Oasis Valley, where potential ethnographic and historic ranching cultural landscapes are present. There could be direct and indirect impacts to sites in the Oasis Valley, particularly the unrecorded historic Beatty Cattle Company Ranch and an unevaluated Western Shoshone winter camp.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated and supplied labor for the ranches.

Rail line construction could directly and indirectly affect sites in the Oasis Valley, particularly the historic Beatty Cattle Company Ranch and a known Western Shoshone winter camp.

The sample inventory indicates that approximately 20 resources could be present within the Level I region of influence.

Oasis Valley Alternative Segment 3 The Class II sample survey inspected four sample units, a total of 3.2 kilometers (2 miles) or 22 percent of the segment; five sites and 28 isolated artifacts were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 also would cross the culturally sensitive Oasis Valley. It would pass just east of another historic ranch, the Colson or Indian Camp Ranch, which also has an early Western Shoshone winter camp adjacent to the ranch buildings. While both the ranch and Western Shoshone camp are unevaluated, rock lines (geoglyphs) were observed at the Indian camp area during field reconnaissance. These resources would be additional components of the potential Oasis Valley ethnographic and historic ranching cultural landscapes. Construction of the alternative segment could result in a visual intrusion to these cultural landscapes.

The sample inventory indicates that approximately 23 resources could be present within the Level I region of influence.

4.2.13.2.1.12 Common Segment 6 (Yucca Mountain Approach). The Yucca Mountain area has been heavily analyzed in conjunction with repository ***site characterization*** studies. Intensive cultural resource studies related to the development of the repository site have been completed. Consequently, a large number of archaeological sites have been found along common segment 6. This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, 3 historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected 13 sample units, a total of 11 kilometers (7 miles) or 22 percent of the segment. Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6 within the Yucca Mountain Site boundary, Desert Research Institute conducted a Class III supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary. This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that was previously surveyed during repository site characterization activities. Desert Research Institute identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Given the large number of resources in the area, construction of common segment 6 could result in direct and indirect impacts to prehistoric and historic sites. Three National Register-eligible prehistoric quarry sites are in this area within the Level I region of influence. The Beatty Wash Petroglyphs Site, listed on the National Register, is in the vicinity of a proposed bridge over Beatty Wash. Direct and indirect impacts from construction activities would include vibration of the rock matrix exhibiting the rock-art panels, and a potential for inadvertent or deliberate adverse impacts due to increased access and worker presence. The site holds important cultural value for American Indians. Over the long term, American Indians would likely view the bridge and operating trains as a visual and noise impact to the rock-art cultural landscape site.

After common segment 6 crossed onto the Yucca Mountain Site, it would cross an area that has undergone earlier intensive archaeological inventory and has been the subject of previous American Indian studies during repository characterization. As discussed in Section 4.2.13.1, DOE would consider identification, evaluation, and mitigation of potential impacts to these resources under a separate programmatic agreement with those along the proposed rail alignment.

Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this common segment. Several of these fall inside the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty area rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

The sample inventory of the segment outside the Yucca Mountain Site boundary indicates that approximately 32 sites could be present within Level I region of influence.

4.2.13.2.2 Railroad Operations Impacts

After the construction phase, there would be no additional direct or indirect impacts at cultural resource sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes. American Indians would continue to view operation of the rail line as an intrusion on their holy lands.

4.2.13.3 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use. Although under the Shared-Use Option there would be a slight increase in train traffic from the addition of commercial users, construction and operation of the proposed railroad would not differ and the slight increase in train traffic under the Shared-Use Option would not result in additional impacts. Construction of any additional commercial-use sidings would have the potential to impact cultural resources.

4.2.13.4 Summary

DOE would be obligated to complete intensive cultural resource inventories of the Caliente rail alignment alternative segments and common segments. Because of the length of the rail alignment and the complexity associated with engineering a feasible alignment, the Department is using a phased cultural resource identification and evaluation approach, described in 36 CFR 800.4(b)2, to identify specific cultural resources. Under this approach, the Department would complete an inventory of the construction right-of-way, evaluate all recorded resources in accordance with criteria established for listing on the *National Register of Historic Places*, assess adverse impacts, and apply mitigation measures for identified impacts before it started any ground-disturbing construction activities.

Table 4-144 summarizes the potential for impacts to cultural resources within the region of influence for each Caliente rail alignment alternative segment and common segment. At present, DOE cannot fully characterize potential effects on cultural resources and the magnitude of those impacts. The potential for impacts is based primarily on the relationship between the frequency of cultural resource sites associated with each alternative segment and common segment (that is, the greater the likely frequency of sites along a particular alternative segment or common segment, the higher the potential of affecting one or more of these sites). Sample inventory indicates that approximately 545 archaeological sites could be present within the Caliente rail alignment Level I region of influence. Based on this sample, DOE expects that most of these sites will be characterized as prehistoric sites (65 percent), primarily lithic scatters, followed by historic sites (20 percent) and sites with both prehistoric and historic components (15 percent). Data currently available indicate that many of these sites (78 percent or more) will not meet eligibility criteria for listing in the *National Register of Historic Places*.

Based on preliminary information and sample surveys conducted to date, the magnitude of these impacts would likely range from small to moderate because there would be an extensive effort to avoid or mitigate impacts in accordance with the regulatory framework and with the terms of the cultural resources programmatic agreement (see Appendix M). To the extent feasible, cultural resources identified within the construction areas will be avoided. Where appropriate, temporary barriers will be used to isolate resources during construction. Monitoring and data recovery through excavation will also be used where necessary to mitigate impacts to archaeological sites. If the additional future inventory work described above indicated the presence of National Register-eligible sites, the magnitude of impacts could be greater.

Table 4-144. Summary of potential impacts to cultural resources – Caliente rail alignment (page 1 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Rail line segment		
Caliente alternative segment (Lincoln County)	Potential direct and indirect impacts at two known National Register-eligible sites, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Eccles alternative segment (Lincoln County)	Potential direct and indirect impacts at two known prehistoric rockshelters, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Caliente common segment 1 (Lincoln County and Nye County)	Construction activities could result in impacts to the early Mormon colonization cultural landscape, the Pioche-Hiko silver mining community route, 1849 emigrant campsites, National Register-eligible prehistoric sites in the vicinity of Black Rock Springs, and to other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Garden Valley alternative segments 1, 2, 3, and 8 (Lincoln County and Nye County)	Construction of Garden Valley alternative segments could result in direct and indirect impacts to American Indian trail systems and to other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Caliente common segment 2 (Lincoln County and Nye County)	Potential indirect impacts include visual impacts to the Black Top archaeological locality; potential direct and indirect impacts to American Indian trail systems and a potential historic ranching cultural landscape, and to other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
South Reveille alternative segments 2 and 3 (Nye County)	Rail line construction could represent a long-term indirect impact on a National Register-eligible rock-art site, and potential direct and indirect impacts at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Caliente common segment 3 (Nye County)	Potential direct and indirect impacts at one known National Register-eligible archaeological site, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Goldfield alternative segments 1 and 4 (Nye County and Esmeralda County) Goldfield alternative segment 3 (Nye County)	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.

Table 4-144. Summary of potential impacts to cultural resources – Caliente rail alignment (page 2 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Rail line segment (continued)		
Caliente common segment 4 (Nye County and Esmeralda County)	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Potential direct and indirect impacts at two National Register-eligible archaeological sites, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 5 (Nye County)	Potential direct and indirect impacts at two National Register-eligible archaeological sites, 20 additional resources that have been recorded within the region of influence, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 6 (Nye County)	Potential direct and indirect impacts at archaeological sites recorded in region of influence, including three National Register-eligible resources, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Proposed facilities		
Access roads (including alignment access roads) (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Facilities at the Interface with the Union Pacific Railroad Mainline (including the Interchange Yard and the Staging Yard) (Lincoln County)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.

Table 4-144. Summary of potential impacts to cultural resources – Caliente rail alignment (page 3 of 3).

Location	Construction impacts[a]	Operations impacts[b]
Proposed facilities (continued)		
Maintenance-of-Way Facilities (includes Maintenance-of-Way Headquarters Facility, Maintenance-of-Way Trackside Facility, Satellite Maintenance-of-Way Facility); Rail Equipment Maintenance Yard; Cask Maintenance Facility; and Nevada Railroad Control Center and National Transportation Operations Center (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Construction camps (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Wells (Lincoln, Nye, and Esmeralda Counties)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Quarries		
Potential quarry CA-8B (Lincoln County)	No impacts.	No additional direct or indirect impacts.
Potential quarries NA-9A and NA-9B (Nye County)	No direct impacts; indirect impacts to a National Register-eligible rock-art site would be likely.	Utilization of quarries in this area could represent a long-term indirect impact on a National Register-eligible rock-art site.
Potential quarry ES-7 (Nye County)	No impacts.	No additional direct or indirect impacts.
Potential quarry NS-3A (Esmeralda County)	No impacts.	No additional direct or indirect impacts.

a. Impact assessment based on sample inventory only; actual impacts would not be identified until completion of field studies.
b. After the construction phase, no additional direct or indirect impacts would be anticipated at archaeological, historical, and cultural sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes.

4.2.14 PALEONTOLOGICAL RESOURCES

This section describes potential impacts to paleontological resources (fossils) from constructing and operating the proposed railroad along the Caliente rail alignment. Section 4.2.14.1 describes the methodology DOE used to assess impacts to such resources; Section 4.2.14.2 describes potential impacts during the construction phase; Section 4.2.14.3 describes potential impacts during the operations phase; Section 4.2.14.4 describes impacts under the Shared-Use Option; and Section 4.2.14.5 summarizes potential impacts.

Section 3.2.14.1 describes the region of influence for paleontological resources along the Caliente rail alignment.

4.2.14.1 Impact Assessment Methodology

Any project activity involving land disturbance could have an adverse impact on the physical environment that could contain paleontological resources. Paleontological resources could be disturbed or destroyed by ground excavation, cuts and fills, surface-disturbing activities such as road building and blasting, or vandalism or theft of the resources.

DOE used the BLM system (DIRS 176084-BLM 1998, all; DIRS 176085-BLM 1998, all) to identify and classify paleontological resource areas along the Caliente rail alignment according to their potential for containing vertebrate (animals with backbones) fossils or noteworthy occurrences of invertebrate or plant fossils. The BLM uses these paleontological resource classifications (***Condition 1***, ***Condition 2***, and ***Condition 3***; see the text box in Section 3.2.14) to identify areas that might warrant special management or special designation for paleontological resources.

The BLM steps to evaluate the potential for impacts to fossil resources are outlined in *General Procedural Guidance for Paleontological Resource Management* (DIRS 176084-BLM 1998, Chapter III), and include identification by a qualified paleontologist and protection of any paleontological area uncovered during field surveys. Educating the public about the value of paleontological resources is also an important part of BLM resource management.

To assess potential impacts to paleontological resources along the Caliente rail alignment, DOE considered whether unique or scientifically important vertebrate, invertebrate, or plant fossils could be damaged, destroyed, or removed during construction and operation of the proposed railroad, quarries, water wells, and access roads.

4.2.14.2 Construction Impacts

There is a Condition 1 paleontological resource site in an area known as Ruin Wash approximately 4.8 to 8 kilometers (3 to 5 miles) south of where Caliente common segment 1 would cross Bennett Pass (DIRS 174204-Palmer 1998, all; DIRS 173841-Shannon & Wilson 2005, pp. 108 and 109; DIRS 174509-Russ 2005, all). Because of its distance from the rail alignment, DOE would expect no impacts to the site as a result of rail line construction.

While other areas within the Caliente rail alignment region of influence could contain paleontological resources, none of the remaining areas of alternative segments or common segments are known to contain or have a strong potential to contain important paleontological resources. Therefore, DOE would expect no impacts to paleontological resources in any of those areas.

None of the proposed railroad construction and operations support facilities would be at or near known or likely fossil beds. Therefore, DOE would expect no impacts to paleontological resources from these facilities.

In addition to known locations of paleontological resources near Caliente common segment 1, DOE could encounter unknown paleontological resources during the construction phase. The BLM would continue to manage all identified paleontological resources in accordance with its management plans, and if DOE discovered new paleontological resources during the construction phase, the BLM would take appropriate action.

4.2.14.3 Operations Impacts

The most likely source of potential impacts to paleontological resources would be from land disturbance during the construction phase, as discussed in Section 4.2.14.2. DOE expects there would be no impacts to paleontological resources resulting from railroad operations.

4.2.14.4 Construction and Operations Impacts under the Shared-Use Option

As for the Proposed Action without shared use (see Sections 4.2.14.2 and 4.2.14.3), DOE expects there would be no impacts to paleontological resources along the Caliente rail alignment under the Shared-Use Option.

4.2.14.5 Summary

DOE expects there would be no impacts to known paleontological resources along Caliente rail alignment common segment 1. There are no known paleontological resources along any of the other Caliente rail alignment alternative segments and common segments or at the proposed locations of railroad construction and operations support facilities. While there could be a potential to uncover previously unknown fossils during the construction phase, DOE would consult with the BLM to develop appropriate measures to minimize damage to any paleontological resources discovered during the construction phase.

Chapter 7, Best Management Practices and Mitigation, describes the best management practices DOE would implement as part of the Proposed Action and the mitigation measures the Department would consider to reduce or eliminate the potential for impacts to paleontological resources.

4.2.15 ENVIRONMENTAL JUSTICE

This section describes the DOE analysis of ***environmental justice*** (the potential for impacts to be ***disproportionately high and adverse*** to ***minority*** or ***low-income populations***) under the Proposed Action along the Caliente rail alignment. Section 4.2.15.1 describes the DOE methodology for analyzing environmental justice; Section 4.2.15.2 describes the assessment of impacts to environmental resources; Section 4.2.15.3 describes the potential for disproportionately high and adverse impacts; and Section 4.2.15.4 summarizes any environmental justice impacts.

Section 3.2.15.1 describes the region of influence for environmental justice.

4.2.15.1 Impact Assessment Methodology

For this analysis, DOE uses the terms minority and low-income in the context of environmental justice (DIRS 155970-DOE 2002, Section 3.1.13.1; DIRS 174625-Bureau of Census 2005, all).

DOE performed the analysis of potential environmental justice impacts in accordance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and Council on Environmental Quality guidance (DIRS 103162-CEQ 1997, all). Using information from Sections 4.2.1 through 4.2.14, this section assesses whether any high and adverse impacts could fall disproportionately on minority or low-income populations.

As a starting point, DOE determined whether there would be minority or low-income populations in the Caliente rail alignment region of influence for environmental justice. Next, DOE determined whether there would be any potential for high and adverse impacts to environmental resources as evaluated in Sections 4.2.1 through 4.2.14. Finally, DOE determined whether any potential high and adverse impacts would fall disproportionately on minority or low-income populations.

According to the Council on Environmental Quality, a minority population exists where either (a) the minority population of the affected area exceeds 50 percent; this calculation includes federally recognized American Indian lands, because American Indians are included in the definition of minority populations; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis.
In addition to the 50-percent threshold, DOE used both the United States and the State of Nevada minority populations as bases for comparison.

The Council on Environmental Quality defines low-income by using the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is meaningfully greater than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE used both the United States and the State of Nevada low-income populations as the bases for comparison. DOE assumed a 20-percent threshold above state low-income percentages in accordance with U.S. Nuclear Regulatory Commission guidance.

DOE also considered whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique ***exposure pathways*** or rates of exposure, special sensitivities, or different uses of natural resources.

If there would be no high and adverse impacts to environmental resource areas, or if any identified high and adverse impacts would not fall disproportionately on minority or low-income populations, then there would be no environmental justice impacts.

4.2.15.2 Assessment of Impacts to Environmental Resources

Results of the impacts analyses described in Sections 4.2.1 through 4.2.14 indicate that there would be moderate to large impacts in the following environmental resource areas:

- Land use. Construction and operation of the proposed railroad along the Caliente rail alignment would result in general impacts to land use and ownership along the entire alignment. Specifically there would be changes in land uses on private land within the rail line construction and operations rights-of-way and impacts to unpatented mining claims.

- Aesthetic resources. There would be small to large impacts as a result of construction along all portions of the Caliente rail alignment. There would be small to large, but temporary, impacts as a result of construction along Garden Valley alternative segments 1, 2, 3, and 8. There would be moderate, but temporary, impacts from construction of the Staging Yard at Caliente-Indian Cove and moderate impacts from construction at potential quarry CA-8B. There would be small to moderate impacts from railroad operations along all segments of the Caliente rail alignment. There would be small to large impacts from railroad operations along Garden Valley alternative segments 1, 2, 3, and 8. There would be moderate impacts from Staging Yard operations at Caliente-Indian Cove.

- Air quality. Air pollutant concentrations would not exceed the National Ambient Air Quality Standards for construction or operation of the railroad or any associated facilities, with the exception of the 24-hour standards for PM_{10} that could be exceeded during quarry operations at South Reveille Valley during the construction phase.

- Surface water. The Staging Yard at Caliente-Indian Cove would be in a meadow that is a floodplain of Meadow Valley Wash on the east side of U.S. Highway 93, roughly midway between the City of Caliente and Indian Cove. Construction of the Staging Yard at Indian Cove would require the wetland meadow area to be drained and built up above the level of the floodplain. It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. The Staging Yard at Indian Cove would require filling an area of wetlands and the associated plant and animal habitat (see Section 4.2.7 for a discussion of impacts to biological resources). Construction of the Staging Yard in this area would result in the loss of approximately 0.12 square kilometer (30 acres) of wetlands.

- Biological resources. There would be impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove or Uplands), the Eccles alternative segment, and the Interchange Yard. There could be impacts to wetlands in the vicinity of Caliente common segment 1 and Oasis Valley alternative segment 1 from rail line construction. Potential adverse impacts related to noxious and ***invasive species*** would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. There would be the potential for impacts to threatened or endangered species during the construction phase. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from construction and operation of the proposed railroad. Direct impacts to wildlife and wild horses and burros from railroad operations would consist of potential collisions of wildlife with trains and temporary disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and the presence of humans at railroad facilities and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

Although there are many historic and archaeological sites along the Caliente rail alignment (see Section 3.2.13), and construction and operation of the proposed railroad could directly and indirectly affect those resources (see Section 4.2.13), that analysis did not determine that potential impacts to cultural resources would be high and adverse.

4.2.15.3 Potential for Disproportionately High and Adverse Impacts

To determine whether potential environmental impacts identified in Sections 4.2.1 through 4.2.14 could be disproportionately high and adverse to minority or low-income populations, DOE considered the following factors:

- Whether there would be an impact on the natural or physical environment that would adversely affect a minority population, low-income population, or American Indian tribe (such effects could include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or American Indian tribes when those impacts are interrelated with impacts on the natural or physical environment)
- Whether environmental effects could have an adverse impact on minority populations, low-income populations, or American Indian tribes that would be meaningfully greater than or be likely to be meaningfully greater than the impact on the general population or other appropriate comparison group
- Whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources
- Whether the environmental effects could occur in a minority population, low-income population, or American Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards

Based on these factors, DOE identified the following potential impacts to land use, aesthetic resources, air quality, surface-water resources, and biological resources.

- Land use. DOE would need to gain access to some private land, the amount of which would be very small (about 1 percent) compared to the total amount of land that would be required for the project. Additionally, there would be unpatented mining claims along some rail line segments where they would fall within the construction right-of-way, some of which could be extinguished. There is also the possibility that the rail line could be affected by or affect underground mining tunnels or shafts. During the final design phase, DOE would need to perform a survey for these underground features to avoid adverse impacts.

  These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and, because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to land use would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31 percent threshold (20 percent above the state average of 11 percent) established by the Nuclear Regulatory Commission and the Council on Environmental Quality and used for analysis of potential impacts to low-income populations in this Rail Alignment EIS. Thus, land-use impacts would not fall disproportionately on low-income populations located mostly in Caliente.
- Aesthetic resources. There would be small to large impacts from construction as a result of weak to strong contrast in the short term from visible construction equipment either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads; and weak to strong

contrast in the long term from scars on rock from cuts, and from access roads along the entire Caliente rail alignment. There would be small to large, but temporary, impacts from construction as a result of weak to strong contrast in the short term, along Garden Valley alternative segments 1, 2, and 8, which would not meet BLM management objectives for Class II visual resources. There would be moderate, but temporary, impacts from construction as a result of moderate contrast during construction of the Staging Yard Caliente-Indian Cove consistent with surrounding non-BLM lands treated as Class III, but inconsistent with BLM management objectives for Class II visual resources on the BLM lands at the north end of the yard. There would be moderate impacts from construction as a result of moderate contrast in the short term from installation and use of the conveyor from the quarry across U.S. Highway 93, consistent with surrounding non-BLM lands treated as Class III.

There would be small to moderate impacts from railroad operations as a result of no to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads along the entire Caliente rail alignment. There would be small to large impacts from railroad operations as a result of track on some parts of Garden Valley alternative segments 1, 2, 3, and 8 that would create a new linear feature that would not meet BLM Class II management objectives. There would be moderate impacts from railroad operations as a result of moderate contrast in the Class III non-BLM lands, and weak contrast from the track on BLM Class II lands at the north end.

These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to aesthetic resources would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31 percent threshold (20 percent above the state average of 11 percent) established by the Nuclear Regulatory Commission and the Council on Environmental Quality and used for analysis of potential impacts to low-income populations in this Rail Alignment EIS. Thus, the potentially moderate and large impacts to aesthetic resources would not fall disproportionately on low-income populations located mostly in Caliente.

- Air quality. Emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the National Ambient Air Quality Standards, except for quarry operations in South Reveille Valley. Therefore, the projected impacts throughout the region of influence, during both construction and operations, would be small, except in the vicinity of the South Reveille quarries. Under the Shared-Use Option, there would be an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small.

  These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and, because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to air quality would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31 percent threshold (20 percent above the state average of 11 percent) established by the Nuclear Regulatory Commission and the Council on Environmental Quality and used for analysis of potential impacts to low-income populations in this Rail Alignment EIS. Thus, the potentially moderate and large impacts to air quality resources would not fall disproportionately on low-income populations located mostly in Caliente.

- Surface-water resources. There are two options for siting the Staging Yard along the Caliente alternative segment: one approximately 1.6 kilometers (1 mile) northeast of Caliente (the Indian Cove option); the other 6.4 kilometers (4 miles) northeast of Caliente (the Upland option). The Indian Cove option would be in a meadow that is a floodplain of Meadow Valley Wash on the east side of U.S. Highway 93, roughly midway between the City of Caliente and Indian Cove.

Construction of the Staging Yard at Indian Cove would require the wetland meadow area to be drained and built up above the level of the floodplain. It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. Meadow Valley Wash drainage through the site is from north to south toward the City of Caliente. Drainage of the site would be accomplished by constructing a channel along the eastern edge of the facility. The channel around the site would be approximately 1,700 meters (5,500 feet) long. The Department would determine final channel dimensions during final design of the Staging Yard. It is very likely that a system of drains would have to be constructed under the Staging Yard tracks. Fill could be needed to elevate portions of the site out of the floodplain. These actions would require permits from the U.S. Army Corps of Engineers, and compliance with Section 404 of the Clean Water Act for stormwater runoff control measures.

The Staging Yard at Indian Cove would require filling an area of wetlands and the associated plant and animal habitat (see Section 4.2.7 for a discussion of impacts to biological resources). Construction of the Staging Yard in this area would result in the loss of approximately 0.12 square kilometer (30 acres) of wetlands. DOE prepared this estimate by intersecting the wetland areas identified during the field survey in support of this Rail Alignment EIS with the perimeter of the Staging Yard fenceline. This facility would also impact the ability of the valley to handle floodwaters. Although the Federal Emergency Management Agency has not mapped floodplains this far north, development in Meadow Valley would make it reasonable to follow Agency criteria for construction in floodplains. The flow path for floodwaters would be constricted through this area, potentially causing the elevation of the floodwaters to increase upstream of the Staging Yard. DOE would incorporate hydraulic modeling into the engineering design process to ensure that adverse impacts to floodplains from elevated floodwaters were kept to an acceptable level (as determined through modeling).

These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to aesthetic resources would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31 percent threshold (20 percent above the state average of 11 percent) established by the Nuclear Regulatory Commission and the Council on Environmental Quality and used for analysis of potential impacts to low-income populations in the Rail Alignment EIS. Thus, impacts to surface-water resources would not fall disproportionately on low-income populations located mostly in Caliente.

Lincoln, Esmeralda, and Nye Counties and the county subdivisions within them have been identified as having a higher percentage of low-income residents than the State of Nevada overall. However, these census block groups do not meet the 20-percent threshold over the state threshold (11 percent) established by the Nuclear Regulatory Commission and the Council on Environmental Quality and used for analysis of potential impacts to low-income populations in this Rail Alignment EIS. There are no minority populations along the Caliente rail alignment that meet the 50 percent threshold. Thus, the potentially large impacts to surface-water resources would not fall disproportionately on low-income or minority populations located mostly in Caliente.

- Biological resources. There would be impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove or Upland), the Eccles alternative segment, and the Interchange Yard. There could be impacts to wetlands in the vicinity of common segment 1 and Oasis Valley alternative segment 1 from rail line construction. However, during final design, DOE would make slight adjustments to minimize such impacts. Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and approved methods to prevent the establishment of noxious weeds or invasive plant species. There would be the potential for impacts to threatened or endangered species during rail line construction. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from construction and operation of the proposed railroad and associated facilities. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act. Direct impacts to wildlife and wild horses and burros during the operations phase would consist of potential collisions of wildlife with trains; temporary disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and presence of humans at railroad facilities; and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

These impacts would be in census blocks that do not meet the 50-percent threshold for impacts to minority populations, and because of the low population density, the census units are generally too large in land area to efficiently illustrate distributions of minority populations. Therefore, impacts to biological resources would not fall disproportionately on minority populations. These impacts would also be in census block groups that do not exceed the 31 percent threshold (20 percent above the state average of 11 percent) established by the Nuclear Regulatory Commission and the Council on Environmental Quality and used for analysis of potential impacts to low-income populations in this Rail Alignment EIS. Thus, the potentially moderate and large impacts to biological resources would not fall disproportionately on low-income populations located mostly in Caliente.

Seventeen tribes and organizations have formed the Consolidated Group of Tribes and Organizations, which is a forum consisting of tribally approved representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. The Consolidated Group of Tribes and Organizations has provided DOE with valuable insights into American Indian cultural and religious values and beliefs.

Section 3.4 summarizes the interests and concerns expressed by various American Indian tribes and organizations within or near the Caliente and Mina rail alignment regions of influence. Sections 3.2.13 and 3.3.13, Cultural Resources, provide additional information on American Indian cultural resources. Perceptions about the types and magnitudes of potential impacts to American Indian interests along the Caliente and Mina rail alignments vary among the various stakeholders with interests in the proposed railroad because of different beliefs, goals, responsibilities, and values. American Indians are concerned that the proposed railroad could cause substantial and high adverse effects to a number of American Indian interests within and adjacent to the Caliente rail alignment region of influence. DOE acknowledges the concerns of the American Indians and has consulted with the tribes. The Department would continue to consult with the Consolidated Group of Tribes and Organizations throughout the life of the project. If DOE implemented Proposed Action, the Department would work closely with American Indians to ensure that a mitigation action plan was developed and to ensure compliance with Section 106 of the National Historic Preservation Act.

The environmental justice analysis for the Shared-Use Option is the same as that described for the Proposed Action without shared use.

4.2.15.4 Conclusion

Constructing and operating the proposed railroad along the Caliente rail alignment would not result in any high and adverse impacts. No special pathways were identified; therefore, DOE concluded that there would be no disproportionately high and adverse impacts to minority or low-income populations.

4.3 Mina Rail Alignment

4.3.1 PHYSICAL SETTING

This section describes potential impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.1.1 describes the method DOE used to assess potential impacts to physical setting; Section 4.3.1.2 describes potential impacts of constructing the railroad; Section 4.3.1.3 describes potential impacts of operating the proposed railroad; Section 4.3.1.4 describes potential impacts under the Shared-Use Option; and Section 4.3.1.5 summarizes potential impacts to physical setting.

As described in Section 3.3.1, physical setting includes physiography, geology, and soils. Section 3.3.1.1 describes the ***region of influence*** for physical setting along the Mina rail alignment.

4.3.1.1 Impact Assessment Methodology

To assess potential impacts to physical setting along the Mina rail alignment, DOE considered whether railroad construction and operations would:

- Result in soil erosion or loss of topsoil
- Result in the direct conversion of ***prime farmland*** to nonagricultural uses
- Result in the loss of availability of a known mineral resource that would be of value to the region or residents of Nevada
- Generate unstable slope conditions that could result in an on-site or off-site landslide or collapse
- Expose construction workers, DOE personnel, and structures to amplified or unique adverse effects from ***seismic*** activity

If possible, DOE quantified impacts using data from Nevada soils surveys, geological maps, ***earthquake fault*** maps and records, and the total area of disturbance that would result from construction and operation of the proposed railroad.

The total area of disturbance would be the sum of disturbed areas within the nominal width of the rail line construction right-of-way and areas outside the nominal width of the construction right-of-way (railroad operations support facilities, quarry sites, some water-well sites, and access roads). The nominal width of the construction right-of-way would encompass the rail line, alignment access roads, some wells, ***construction camps***, and ***cuts*** and ***fills*** required to attain an appropriate ***grade***. While the nominal width of the construction right-of-way would be 300 meters (1,000 feet) across BLM lands, the width could vary in certain locations along the rail alignment. For example, it could be wider to accommodate additional earthwork, or narrower to avoid a sensitive environmental resource. Section 4.3.1.2.3 describes potential impacts from constructing the railroad operations support facilities; the number and size of those facilities would not vary among alternative segments.

Some potential impacts to physical setting along the Mina rail alignment are more specifically addressed under other ***environmental resource areas***. Section 4.3.2, Land Use and Ownership, describes potential impacts to ***mining districts*** and mineral and energy resources; Section 4.3.4, Air Quality and Climate, describes soil loss from ***fugitive dust*** emissions; Section 4.3.5, Surface-Water Resources, describes potential erosion due to surface-water flow; and Section 4.3.10, Occupational and Public Health and Safety, describes impacts to worker safety from geologic hazards.

4.3.1.2 Construction Impacts

Direct impacts to physical setting along the Mina rail alignment would occur primarily during the construction phase. Section 4.3.1.2.1 describes potential construction impacts common to the entire rail alignment. Section 4.3.1.2.2 describes impacts specific to alternative segments and common segments. Tables in Section 4.3.1.2.2 list the key information DOE used to analyze potential impacts to physical setting for the common and alternative segments.

4.3.1.2.1 Construction Impacts Common to the Entire Mina Rail Alignment

4.3.1.2.1.1 Physiography. To the extent practicable, the Mina rail alignment would avoid uneven topography and rugged terrain by following valleys and skirting mountain ranges, as described in Section 3.3.1.2.1 and illustrated in Figure 3-124. Where it is necessary to cross mountain ranges, the rail line would be located in gaps and passes. The rugged natural terrain surrounding the mountain ranges would, however, contribute to the potential for impacts to topography and soils. The ruggedness of an area is represented by the "rise and fall" calculation, which is the absolute elevation change measured at a fixed distance along the alignment. The rise and fall calculation provides a context for determining the amount of disturbance that would be required to establish appropriate grades.

Depending on the combination of alternative segments and common segments along the Mina rail alignment, the total area that would be disturbed during the construction phase would range from 40 to 48 square kilometers (9,900 to 12,000 acres) (DIRS 180874-Nevada Rail Partners 2007, p. B-3). Construction impacts to physical setting would be centered along the rail alignment and would decrease with distance from the alignment.

Cuts and fills would be required to level steep slopes and provide a suitable grade for the rail ***roadbed***. The estimated volume of cuts along the Mina rail alignment is 10.9 million to 18.8 million cubic meters (14.3 million to 24.6 million cubic yards), and the estimated volume of fill is 15.9 million to 25.7 million cubic meters (20.8 million to 33.6 million cubic yards) (DIRS 180872-Nevada Rail Partners 2007, Appendix D). Cut and fill activities would occur within the construction right-of-way. DOE would use the material excavated from the cuts to supply a portion of the required fill. The Montezuma alternative segments, especially Montezuma alternative segment 1, would require the most earthwork (see Section 4.3.1.2.2.7). There also would be major cut, fill, and other earthwork processes around the Calico Hills and Terrill Mountains, the Goldfield Hills, Beatty, and Yucca Mountain.

DOE would build up to 10 construction camps along the rail alignment. Each camp would include housing, support facilities, office space, utilities, contractor work areas, roadways, and parking, and would disturb approximately 0.10 square kilometer (25 acres) inside the nominal width of the construction right-of-way (DIRS 176172-Nevada Rail Partners 2006, p. 4-1).

There are five potential quarry sites along the Mina rail alignment, of which DOE would develop up to two. Each site would be expected to disturb an area from 0.97 to 2.7 square kilometers (240 to 660 acres) outside the nominal width of the construction right-of-way (DIRS 176172-Nevada Rail Partners 2006, pp. 3-1 and 3-2).

Construction of the ***Staging Yard*** at Hawthorne could disturb a total of 0.20 square kilometer (50 acres). Construction of the Maintenance-of-Way Facility would disturb 0.061 square kilometer (15 acres), and the ***Rail Equipment Maintenance Yard*** would disturb the largest area (0.41 square kilometer [100 acres]) (DIRS 180874-Nevada Rail Partners 2007, p. A-5).

Construction activities that would disturb topsoil include, but are not limited to, cut excavation; quarry-pit excavation and borrow-pit stockpiles; placement of compacted fill, ***ballast***, and ***subballast***; road development and grading; and building facility foundations. During the construction phase, the soil column would be disturbed and topsoil would be removed. The areas with disturbed soils would have an increased potential for erosion by wind and water. DOE would implement best management practices (see Chapter 7) to control erosion, minimize soil loss, and conserve topsoil for grading after construction was completed. After construction was completed, disturbed areas away from the rail line would be leveled to a grade that would blend with the terrain, covered with reserved topsoil, and to the extent practicable, revegetated.

4.3.1.2.1.2 Geology.

Faulting and Seismic Activity Seismic-related hazards in the project area include ground shaking, rock falls and landslides, soil liquefaction, and fault displacement. The northern portion of the Mina rail alignment would cross through an area with more earthquakes; however, seismic activity in this area is consistent with the rest of southern Nevada, as shown on Figure 3-127. Construction activities would not induce earthquakes or reactivate any faults. The Mina rail alignment would generally cross Quaternary fault traces at a perpendicular angle, which would minimize the contact between the rail alignment and the linear range-bounding faults. At a minimum, DOE would design and operate the proposed railroad to be consistent with American Railway Engineering and Maintenance-of-Way Association seismic guidelines (DIRS 162040-AREMA 2001, Chapter 9) and could decide to implement additional, more stringent standards.

During the construction and operations phases, DOE would monitor earthquake activity using U.S. Department of the Interior, Geological Survey, and Yucca Mountain seismic networks. The response level of the maintenance-of-way authority would depend on the earthquake magnitude and distance to the rail line (see Table 4-145). DOE would develop an inspection protocol that would outline the procedures that would be used to inspect the track, rail roadbed, bridges, and other structures along the rail line. If required after a seismic event, construction would halt, trains would run at reduced speeds, and qualified inspectors would verify the safety of the track.

The rail line and transportation casks would be constructed to be consistent with the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. The inspection protocol and acceptance of the seismic guidelines would ensure that the risks associated with operating in a seismically active area would be minimized. Section 4.3.10, Occupational and Public Health and Safety, describes potential impacts to transportation safety and worker and public health and safety from seismic hazards.

Rock-Slope Hazards Several sections of the Mina rail alignment would pass through steep and rugged terrain where unstable rock slopes would be a hazard (DIRS 180878-Shannon & Wilson 2007, pp. 41 and 42, and Table 6). Rock-slope failures typically occur where rock discontinuities (such as joints, bedding, foliation, and faults) are adversely oriented in relation to natural or constructed slope faces. Slope stability could be further reduced by natural weathering processes, which contribute to the mechanical breakdown of the rock mass within the rock ***matrix*** and along the discontinuities (DIRS 180878-Shannon & Wilson 2007, p. 41).

Rail line construction activities such as blasting and other cut procedures would have the potential to induce rock falls and landslides. Blasting could be required to excavate bedrock and would occur in strict compliance with existing regulations. Impacts resulting from construction and construction-related blasting are expected to be small, due to safety measures DOE would employ during blasting activities.

Table 4-145. American Railways Engineering and Maintenance-of-Way Association seismic guidelines.[a]

Earthquake magnitude (Richter scale)	Response radii (kilometers)[b]	Response level[c]	Response protocol
0.0 to 4.9	d	I	Resume maximum operating speed. The need for the continuation of inspections will be determined by the proper maintenance-of-way authority.
5.0 to 5.9	160	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
6.0 to 6.9	320	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority.
	480	II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority.
7.0 or greater	As directed, but not less than for 6.0 to 6.9	III	All trains and engines within the specified radius of the epicenter must stop and may not proceed until inspections have been performed and appropriate speed restrictions established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.
		II	All trains and engines will run at restricted speed within a specified radius of the epicenter until inspections have been made and appropriate speeds established by proper authority. The radius shall not be less than that specified for earthquakes between magnitudes 6.0 and 6.9.

a. Source: DIRS 162040-AREMA 2001, Table 9-1.1 and p. 9-1.5.
b. To convert kilometers to miles, multiply by 0.62137.
c. Response level as defined by America Railway Engineering and Maintenance-of-Way Association.
d. Radii not applicable.

Debris Flows Debris flows are rapidly moving mixtures of water, soil, rock, and organic material. A debris flow can begin during or after heavy precipitation, and is especially dangerous if the debris dams a stream channel. If the dam fails, the saturated debris can travel downslope for several miles in a confined channel. Debris flows lose their energy and begin to deposit material when the stream gradient flattens or when the channel widens (DIRS 180878-Shannon & Wilson 2007, pp. 45 and 46).

There would be a potential for debris flows along portions of the rail alignment during the construction and operations phases. Such flows would be most common where there is evidence of prior activity, specifically in steep areas and channels of ***alluvial fans*** (DIRS 180878-Shannon & Wilson 2007, pp. 45 and 46). Debris flows could bury the rail line in sediment, destroy portions of the line, or weaken bridge pylons as a result of excessive erosion. It would not be possible to completely avoid debris flows in the area around the rail alignment.

Mineral and Energy Resources The rail line could cross surface or subsurface mineral or energy resources not part of identified mining districts or mineral leases. During construction, previously unknown resources could be identified in areas with large cuts. The area surrounding the Mina rail alignment has an extensive history of ***mining claims*** and commercial operations. For this analysis, DOE used the existence of historical commercial mining as an indicator of mineral potential.

During the construction phase, some minerals could be rendered inaccessible because they would be within the construction right-of-way. However, the ***operations right-of-way*** would be smaller than the construction right-of-way, so these restricted areas would become available during the operations phase. The Mina rail alignment would not cross any known mineral deposits unique to the region. Any impacts related to restricted access of mineral resources would be temporary and limited to the construction phase. Sections 4.3.1.2.2.1 through 4.3.1.2.2.12 provide more information on potential impacts to individual mineral and energy resources along Mina rail alignment alternative segments and common segments. Section 4.3.2, Land Use and Ownership, describes potential impacts to local mining districts.

Local Sources of Construction Materials Construction of the rail line along the Mina rail alignment would require from 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of crushed-rock ballast and from 2.18 to 2.39 million metric tons (2.40 to 2.64 million tons) of subballast for rail roadbed construction (DIRS 180874-Nevada Rail Partners 2007, p. A-5). Soil and rock excavated from construction cuts would not be suitable for ballast; DOE would use this material for subballast and embankment fill (DIRS 176034-Shannon & Wilson 2006, pp. 15, 19 and 20). The amount of cut material excavated during construction would not be sufficient to supply the necessary fill. Additional borrow sites would be opened to supplement the cut material. These sites would be excavated from alluvial gravels and sands approximately every 16 kilometers (10 miles) within the construction right-of-way. Where possible, these sites would be within or adjacent to existing Nevada Department of Transportation gravel pits. Additional subballast requirements would also be supplemented with bedrock extracted from the ballast quarries.

DOE has identified five potential ballast quarry sites along the Mina rail alignment in the Garfield Hills, Gabbs Range, and Goldfield areas (DIRS 180875-Nevada Rail Partners 2007, Figure 3-C). Of these potential locations, DOE would develop two to supply rock for ballast and subballast during the construction phase. Each quarry would be approximately 24 meters (80 feet) deep, with an anticipated ***footprint*** of approximately 0.04 square kilometer (10 acres). However, depending on the number of open quarries, and the quality of the mineral materials, a quarry pit footprint could be as large as 1 square kilometer (260 acres). A waste-rock pile at each quarry site would disturb approximately 0.06 square kilometer (14 acres). ***Overburden*** material and rock not suitable for ballast or subballast gravel would be stored at this location until the end of quarry operations. A railroad ***siding*** to accommodate the ballast cars would be included in the total quarry disturbance area (DIRS 176172-Nevada Rail Partners 2006, pp. 3-1 and 3-2). When adding all of the maximum areas of the quarry site that could be disturbed during construction (quarry pit, production plant, ballast storage, and waste pile), and including a temporary construction buffer area, a quarry site could disturb between 0.97 and 2.7 square kilometers (240 to 660 acres). These quarry-site values are considered to be maximum calculations, in the event of irregular topography and poor-quality excavated mineral materials. Section 4.3.1.2.4 describes potential impacts from the quarry facilities in more detail. The quarries would remain open through the construction phase. Afterward, DOE would reclaim disturbed areas in accordance with the post-construction and maintenance best management practices described in Chapter 7. Such practices would include grading the disturbed area, reshaping quarry-pit walls to stabilized slopes, replacing reserved topsoil, and revegetating.

DOE could use other local materials for rail line construction. Subballast would be generated from borrow sites on certain ***alluvial fans*** and crushed quarry rock. Blasted bedrock from slope cuts and excess ballast rock would be suitable for use to protect rail roadbed embankments from erosion. Some natural sand and gravel excavated from cuts and crushed rock from the quarries could be used to make concrete aggregate (DIRS 176034-Shannon & Wilson 2006, pp. 24 to 26). DOE would determine the prime sand and gravel deposits to be used before beginning construction.

Using local materials for ballast, subballast, and concrete aggregate would result in the consumption of construction resources (such as rock, sand, and gravel) often used for other construction projects in the area. However, alluvial deposits are plentiful in the region, and their use to construct the rail line would not substantially reduce the area supply of these resources. Because the potential impact to sand and gravel resources would be small along the entire alignment, this resource is not discussed further in Sections 4.3.1.2.2.1 through 4.3.1.2.2.12. Section 4.3.11, Utilities, Energy, and Materials, describes impacts to regional supply chains for other construction materials.

4.3.1.2.1.3 Soils. This section describes potential impacts to soils, including the removal of prime farmland from productive use. Rock excavation and land clearing would cause soil loss, surface erosion, and disruption of soil structure on previously undisturbed land.

During the construction phase, most soils would be excavated using conventional earthmoving equipment such as bulldozers, scrapers, rubber-tired backhoes, and track-mounted excavators. Solid rock encountered along the rail alignment would require drilling and blasting (DIRS 180878-Shannon & Wilson 2007, pp. 48 and 49).

Soil Loss and Erosion There would be soil loss and erosion at all places where construction activities disturbed the ground surface. The severity of soil loss would depend on the extent of the disturbance, the erodibility of the soil, and the steepness of the terrain.

Land disturbed along the rail alignment would be most susceptible to soil loss and erosion during heavy rains and high winds. Areas where fine-textured soil and sand (such as on alluvial fans, lake-bed terraces, valleys, and flats) and where soils exhibit the ***erodes easily*** or ***blowing soil*** characteristic would be most susceptible to erosion. The Mina rail alignment would be in an area with an ***arid*** climate that has variable rainfall events across the region. The northern portion of the Mina rail alignment occasionally experiences low-intensity, long period events (DIRS 180885-Parsons Brinckerhoff 2007, pp. 13 and 14). Once the ground is saturated, a brief increase in rainfall intensity can initiate surface flooding. South of the Goldfield Hills, rainfall is typically brief, but can be very intense and form washouts in low-lying areas. Elevated water velocities during rain events would increase erosion and scouring in areas where there is no vegetation, in areas dominated by sandy soils on steep slopes, along channel banks, and at bridge crossings (DIRS 176184-Shannon & Wilson 2006, p. 51). Construction of the proposed railroad would result in the loss of some topsoil and soil erosion. During and after construction, DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. In areas of temporary surface disturbance, the topsoil would be reserved and replaced, where practicable.

Disturbed soils would also be susceptible to wind erosion, because wind speeds greater than 19 kilometers (12 miles) per hour are sufficient to move sand grains (DIRS 176184-Shannon & Wilson 2006, p. 53). Disturbed soils with the blowing soil characteristic tend to generate sand dunes, increase fugitive dust in the air, and contribute to the loss of topsoil. Wind and water erosion could also impact ***air quality***, surface-water quality, and biological resources, as discussed in Sections 4.3.4, 4.3.5, and 4.3.7, respectively.

Prime Farmland The Farmland Protection Policy Act (7 U.S.C. 4201 *et seq*.) seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion of farmlands to nonagricultural uses. As discussed in Section 3.3.1.2.3, less than 0.1 percent of soils along the Mina rail alignment are classified as prime farmlands. The Schurz alternative segments would cross prime farmland soils around the Walker River on the Walker River Paiute Reservation (see Figure 3-129). DOE calculated the amount of potentially disturbed prime farmland soils by multiplying the total area of disturbance by the calculated percentage of prime farmland that would be within the rail line construction right-of-way. On the Reservation, there is 0.011 square kilometer (2.7 acres) of prime farmland along

Schurz alternative segment 1, 0.012 square kilometer (3 acres) along Schurz alternative segment 4, and 0.014 square kilometer (3.5 acres) along each of Schurz alternative segments 5 and 6.

Along these alternative segments, DOE would limit the disturbance within the construction right-of-way to minimize potential impacts to private lands and thus minimize impacts to farmland. All of the Schurz alternative segments would cross the prime farmland soils around the Walker River on the eastern side of Sunshine Flat. At present, these soils are not farmed. The Walker River Paiute Reservation contains approximately 5.5 square kilometers (1,400 acres) of prime farmland soils; thus, the proposed railroad would temporarily disturb 2.6 percent of the prime farmland soils on the Reservation.

In addition to using the Nevada soil survey database classification, DOE also requested assistance from the Nevada Natural Resources Conservation Service office to identify prime, unique statewide, or locally important farmland along the Mina rail alignment (DIRS 181388-Arcaya 2007, all). The Conservation Service analysis determined that the Mina rail alignment would not cross prime, unique statewide, or locally important farmland.

Soil Stability Excavation and grading activities would disturb the natural structure of the soil by breaking plant roots and natural mineral cements that bind soils. Soils disturbed along cut slopes would have a higher risk of becoming unstable and creating mudflows or landslides in steep topography because water-bearing properties would have changed, and the soil structure would have been altered. However, DOE would revegetate or otherwise stabilize these areas and would reclaim them to the extent practicable, which would reduce the potential for increased erosion (see Chapter 7).

DOE would erect up to 10 construction camps along the rail alignment to house workers. Although the camps would be temporary and used only during the construction phase, soil could become compacted at these sites. After construction was complete, DOE would grade the terrain and revegetate these areas with ***native plant*** species (see Chapter 7), which would minimize the effects of soil compaction.

Studies have shown that, if left to natural ***soil recovery***, the return of soil to pre-disturbed conditions and natural succession of vegetation in the Yucca Mountain area could take decades or more, creating an increased potential for erosion, landslides, and mudslides (DIRS 104837-DOE 1989, p. 17). Impacts due to soil disruption would be large within the construction right-of-way and immediate region of influence until new vegetation was established and the natural succession was reestablished. DOE would reduce the impacts related to the increased potential for erosion, landslides, and mudslides through the implementation of best management practices, such as revegetating disturbed sites, establishing proper roadbed grades, and using stormwater erosion control measures (see Chapter 7).

4.3.1.2.2 Construction Impacts along Alternative Segments and Common Segments

4.3.1.2.2.1 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation). DOE would construct a rail siding along the existing rail line within the existing operations right-of-way. This siding would be constructed on previously disturbed land. Otherwise, DOE would not perform any ground-disturbing activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to physical setting along this existing branchline.

4.3.1.2.2.2 Department of Defense Branchline through Schurz. This branchline would not be part of the Mina rail alignment. Rather, as part of the Proposed Action, DOE would remove the track and ballast from this branchline, leaving only the rail roadbed, subballast, and structures such as bridges and culverts. The use of rail removal equipment (such as hydraulic spike pullers, fork-lifts, and front-end loaders) to help dismantle the rail line would cause temporary soil disruption and increased soil erosion. However, this would be confined to the previously disturbed area and would not affect undisturbed resources.

4.3.1.2.2.3 Department of Defense Branchline South. DOE would construct a rail siding along the existing rail line within the existing operations right-of-way. This siding would be constructed on previously disturbed land. Otherwise, DOE would not perform any ground-disturbing activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to physical setting along this existing branchline.

4.3.1.2.2.4 Schurz Alternative Segments. The Schurz alternative segments would travel around or through several mountain ranges and valleys in the Walker River Basin. To maintain a rail grade of less than 2 percent, DOE would excavate and level high points along the alignment and, to the extent practicable, use this material to raise the low points. Table 4-146 lists the anticipated cut and fill requirements and other important information used in the impact analysis for the Schurz alternative segments. The cut and fill requirements would be greatest where an alternative segment would cross mountain passes, specifically between the Calico Hills and Terrill Mountains (Schurz alternative segments 4 and 5), and through an unnamed pass in the Terrill Mountains (Schurz alternative segment 6). Schurz alternative segments 5 and 6 would require the greatest ground disturbance (6.9 and 6.5 square kilometers [1,700 and 1,600 acres], respectively). Schurz alternative segment 1 would primarily travel along alluvial fans along Sunshine Flat and in Campbell Valley, and would therefore involve the least amount of ground disturbance (4.6 square kilometers [1,100 acres]). Construction activities required to achieve the appropriate grade could contribute to the loss of topsoil and local erosion; however, DOE would reduce impacts by regrading and revegetating the disturbed areas (see Chapter 7).

The Schurz alternative segments would cross faults associated with the Wassuk Range fault sequence. Schurz alternative segment 6 would also cross a fault near the Terrill Mountains. Since the U.S. Geological Survey began keeping seismic records, there have been a few earthquakes larger than 4.0 around the town of Schurz. The largest was a magnitude 6.3 earthquake in 1959 (DIRS 180878-Shannon & Wilson 2007, p. 17). The seismic activity in this area is suggested to be part of the extension of the Walker Lane structural belt. DOE would monitor the seismic activity along the Mina rail alignment, and follow procedures outlined in Table 4-145 in the event of an earthquake.

There is a high ***probability*** for metallic minerals in the mountains the Schurz alternative segments would bypass. Gold, silver, and copper historically have been mined in the Calico Hills and Terrill Mountains (DIRS 180882-Shannon & Wilson 2007, pp. 19, 20, 28 and 29). Nonmetallic minerals, such as soda and halite, are identified in the lowland area of Double Springs Marsh (DIRS 180882-Shannon & Wilson 2007, pp. 33 and 34). Each of the Schurz alternative segments is expected to have little or no impact on metallic and nonmetallic minerals in the area because they would be in the lowlands and would not disturb known commercial-grade deposits.

Less than 1 percent of the Schurz alternative segments would traverse prime farmland soils. Depending on alternative segment, 0.011 to 0.014 square kilometer (2.7 to 3.5 acres) of prime farmland soils would be disturbed (see Table 4-146). Prime farmland soils along the Schurz alternative segments only occur in the immediate vicinity of the Walker River.

All of the Schurz alternative segments would contain a high percentage of soils with blowing soil characteristics. Schurz alternative segment 1 would cross a higher percentage of blowing soils than the other Schurz alternative segments. In addition, southwest of Red Ridge, the southern portion of all the Schurz alternative segments would cross an area with a high percentage of blowing soils (see Figure 3-128). Soils with the blowing soils characteristic easily form sand dunes. Schurz alternative segments 1 and 4 would cross a higher percentage of erodes easily soils, but the alternative segments would disturb only about 0.19 to 0.29 square kilometer (47 to 72 acres) of this soil type. As a ***mitigation*** measure (see Chapter 7), DOE might need to install fencing around the rail alignment in this area to stabilize existing sand dunes that would be disturbed during rail line construction. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Table 4-146. Summary of key information for assessing impacts from constructing Schurz alternative segment 1, 4, 5, or 6.

Attribute	Schurz 1	Schurz 4	Schurz 5	Schurz 6
Length (kilometers)[a,b]	52	64	71	72
Rise and fall (meters)[a,c]	200	440	620	780
Earthwork cut quantities (cubic meters)[a,d]	1.25 million	3.49 million	6.38 million	4.82 million
Earthwork fill quantities (cubic meters)[a,d]	1.54 million	4.33 million	4.86 million	6.85 million
Construction[e]	Cuts up to 14 meters high; fills up to 9 meters deep	Cuts up to 18 meters high; fills up to 21 meters deep	Cuts up to 32 meters high; fills up to 24 meters deep	Cuts up to 20 meters high; fills up to 24 meters deep
Number of construction camps[f]	1 (no. 18A)	1 (no. 18B)	1 (no. 18C)	1 (no. 18D)
Number of well sites outside nominal width of construction right-of-way[f]	0	1 (no. 22)	1 (no. 22)	2 (nos. 23 and 24)
Disturbed area (square kilometers)[g]				
• Rail alignment[h]	4.6	6.1	6.9	6.5
• Quarries[f]	Not applicable	Not applicable	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	0.0058	0.0058	0.012
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable	Not applicable	0.012 (to construction camp 18D)
	Not applicable	0.01 (to well site 22)	0.01 (to well site 22)	0.019 (to well sites 23 and 24)
Total disturbed area (square kilometers)[f,i]	4.6	6.1	6.9	6.5
Percent soil characteristics[j]	4.7 erodes easily 83 blowing soils 0.24 prime farmland	4.8 erodes easily 69 blowing soils 0.19 prime farmland	2.9 erodes easily 63 blowing soils 0.21 prime farmland	2.9 erodes easily 51 blowing soils 0.21 prime farmland
Soil characteristic area (square kilometers)[g,k]	0.22 erodes easily 3.8 blowing soils 0.011 prime farmland	0.29 erodes easily 4.2 blowing soils 0.012 prime farmland	0.2 erodes easily 4.3 blowing soils 0.014 prime farmland	0.19 erodes easily 3.3 blowing soils 0.014 prime farmland

a. Source: DIRS 180872-Nevada Rail Partners 2007, Appendix D.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 180880-Shannon & Wilson 2007, Table 6.
f. Source: DIRS 180875-Nevada Rail Partners 2007, Table 4-6, and Appendix H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 180874-Nevada Rail Partners 2007, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

4.3.1.2.2.5 Department of Defense Branchline South (end of Schurz Alternative Segments to beginning of Mina Common Segment 1). DOE would develop construction camp number 17 on the southern portion of Department of Defense Branchline South near its junction with Mina common segment 1 (see Figure 2-14). The construction camp would disturb approximately 0.10 square kilometer (25 acres), which would result in topsoil loss and increased erosion. In addition, approximately 39 percent of the area that would be disturbed contains soils with the blowing soil characteristic. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Other than construction of this camp, the Department does not anticipate any other surface-disturbing activities in this area; therefore, there would be no other impacts associated with this portion of the Mina rail alignment. DOE would build the Staging Yard directly north of the junction between Department of Defense Branchline South and Mina common segment 1. Section 4.3.1.2.3.1 describes potential impacts associated with the Staging Yard.

4.3.1.2.2.6 Mina Common Segment 1. Mina common segment 1 would generally travel within valleys flanked by expansive mountain ranges. Most of the required earthwork would be used to fill topographic variations on alluvial fans. Table 4-147 summarizes the key information DOE considered to assess impacts to physical setting from construction of Mina common segment 1. The rail line would disturb a total of 12 square kilometers (3,000 acres). Surface disturbance from construction activities would remove topsoil and increase the potential for erosion around the rail alignment. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Mina common segment 1 would cross some Quaternary faults. The Soda Spring Valley has experienced several earthquakes in the last 150 years (see Figure 3-126). However, most of these earthquakes had magnitudes below human detection. DOE would adopt the American Railway Engineering and Maintenance-of-Way Association guidelines to reduce the hazards to people and structures from earthquakes greater than magnitude 4.0 (see Chapter 7).

Mina common segment 1 would cross multiple mining districts, which are centered around the bounding mountains. Metallic minerals such as copper, gold, and silver have been identified and occasionally mined within these districts. Impacts to commercial minerals along Mina common segment 1 would be small because, although Mina common segment 1 would approach mining districts with claims, the segment would be restricted to valley locations and would not disturb subsurface mineral deposits.

4.3.1.2.2.7 Montezuma Alternative Segments. The Montezuma alternative segments would travel in valleys and passes as much as possible; however, all of these alternative segments would need to cross some mountain ranges, including the Montezuma Range and Goldfield Hills. Montezuma alternative segment 1 would require the greatest amount of fill material, while Montezuma alternative segment 3 would require the greatest amount of cuts. Table 4-148 summarizes the key information DOE considered to assess impacts to physical setting from construction of any of the Montezuma alternative segments.

Surface disturbance related to construction of the rail line, quarries, water wells, and access roads would range from 11 square kilometers (2,700 acres) along Montezuma alternative segment 2 to 17 square kilometers (4,200 acres) along Montezuma alternative segment 3. Cuts and fills associated with construction of any of the Montezuma alternative segments would result in the loss of topsoil and an increased potential for erosion.

Table 4-147. Summary of key information for assessing potential impacts from constructing the proposed railroad along Mina rail alignment common segments (page 1 of 2).

Key information	Union Pacific Railroad Hazen Branchline	Department of Defense Branchline North	Department of Defense Branchline through Schurz	Department of Defense Branchline South	Mina common segment 1	Mina common segment 2	Mina common segment 5	Mina common segment 6
Length (kilometers)[a,b]	69	8.1	NA	35	120	3.4	40	51
Rise and fall (meters)[a,d]	NA[c]	NA	NA	NA	200	10	170	410
Earthwork cut quantities (cubic meters)[a,e]	NA	0	NA	0	0.70 million	0	0.45 million	5.88 million
Earthwork fill quantities (cubic meters)[a,e]	NA	43,000	NA	43,000	5.15 million	99,000	1.01 million	2.94 million
Construction[f]	NA	New siding along existing rail alignment	NA	New siding along existing rail alignment	Cuts up to 20 meters high; fills up to 14 meters deep	Cuts and fills up to 6 meters high	Cuts up to 15 meters high; fills generally up to 6 meters deep	Cuts and fills up to 15 meters high; side hill cuts and fills to 42 meters high
Number of construction camps[g]	NA	NA	NA	1 (no. 17)	3 (nos. 14, 15, and 16)	0	1 (no. 10)	1 (no. 12)
Number of well sites outside nominal width of construction right-of-way[g]	NA	NA	NA	NA	1 (no. 21)		0	2 (nos. 14 and 15)
Disturbed area (square kilometers)[g,h]								
• Rail alignment[i]	NA	0.16	NA	0.16	10	0.28	3.1	5.3
• Quarries[g,j]	NA	NA	NA	NA	2.4 (Garfield Hills and Gabbs Range)	NA	NA	NA
• Well sites outside nominal width of construction right-of-way[g]	NA	NA	NA	NA	0.0058	NA	NA	0.012
• Access roads to construction camps/well sites/quarries[g]	NA	NA	NA	NA	0.013 (to construction camp 15) 0.024 (to well site 21)	NA	0.021 (to construction camp 10)	0.19 (to construction camp 12) 0.047 (to well sites 14 and 15)

Table 4-147. Summary of key information for assessing potential impacts from constructing the proposed railroad along Mina rail alignment common segments (page 2 of 2).

Key information	Union Pacific Railroad Hazen Branchline	Department of Defense Branchline North	Department of Defense Branchline through Schurz	Department of Defense Branchline South	Mina common segment 1	Mina common segment 2	Mina common segment 5	Mina common segment 6
Total disturbed area (square kilometers)[g,k]	NA	0.16	NA	0.26	12	0.28	3.1	5.5
Percent soil characteristics[l]	NA	NA	NA	0 erodes easily 39 blowing soils 0 prime farmland	7.9 erodes easily 39 blowing soils 0 prime farmland	100 erodes easily 0 blowing soils 0 prime farmland	0 erodes easily 2.6 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[h,m]	NA	NA	NA	0 erodes easily 0.1 blowing soils 0 prime farmland	0.95 erodes easily 4.7 blowing soils 0 prime farmland	0.28 erodes easily 0 blowing soils 0 prime farmland	0 erodes easily 0.081 blowing soils 0 prime farmland	0 erodes easily 0 blowing soils 0 prime farmland

a. Sources: DIRS 176165-Nevada Rail Partners 2006, Appendix E; DIRS 180872-Nevada Rail Partners 2007, Appendix D.
b. To convert kilometers to miles, multiply by 0.62137.
c. NA = not applicable.
d. To convert meters to feet, multiply by 3.2808.
e. To convert cubic meters to cubic yards, multiply by 1.308.
f. Source: DIRS 180880-Shannon & Wilson 2007, Table 6.
g. Sources: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H; DIRS 180875-Nevada Rail Partners 2007, Table 4-6, and Appendix H.
h. To convert square kilometers to acres, multiply by 247.10.
i. Sources: DIRS 176170-Nevada Rail Partners 2006, p. B-3; DIRS 180874-Nevada Rail Partners 2007, p. B-3.
j. Assuming that two quarries would be developed along Mina common segment 1.
k. Totals might not equal sums of values due to rounding.
l. Source: DIRS 176781-MO0603GSCSSGEO.000, all.
m. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Table 4-148. Summary of key information for assessing impacts from constructing Montezuma alternative segment 1, 2, or 3.

Key information	Montezuma alternative segment 1	Montezuma alternative segment 2	Montezuma alternative segment 3
Length (kilometers)[a,b]	120	120	140
Rise and fall (meters)[a,c]	1,500	1,000	1,400
Earthwork cut quantities (cubic meters)[a,d]	4.80 million	2.30 million	3.65 million
Earthwork fill quantities (cubic meters)[a,d]	7.61 million	4.51 million	3.85 million
Construction[e]	Cuts up to 29 meters high; fills up to 30 meters deep	Cuts up to 3 meters high; fills up to 15 meters deep	Cuts up to 20 meters high; fills up to 15 meters deep
Number of construction camps[f]	2 (nos. 9A and 13A)	1 (nos. 9 and 13B)	2 (nos. 9A and 13B)
Number of well sites outside nominal width of construction right-of-way[f]	4 (nos. 16, 18, 19, and 20)	2 (nos. 10 and 13)	3 (nos. 10, 16, and 18)
Disturbed area (square kilometers)[g]			
• Rail alignment[h]	11	9.7	12
• Quarries[f,i]	4.5 (North Clayton and Malpais Mesa)	1.5 (ES-7)	4.5 (North Clayton and Malpais Mesa)
• Well sites outside nominal width of construction right-of-way[f]	0.023	0.012	0.017
• Access roads to construction camps/well sites/quarries[f]	0.012 (to construction camp 13A)	0.15 (to construction camps 9 and 13B)	0.061 (to construction camps 9A and 13B)
	0.074 (to well sites 16, 18, 19, and 20)	0.052 (to well sites 10 and 13)	0.041 (to well sites 10, 16, and 18)
	0.049 (special access road from U.S. Highway 95)		0.049 (special access road from U.S. Highway 95)
Total disturbed area (square kilometers)[f,j]	16	11	17
Percent soil characteristics[k]	15 erodes easily 5.2 blowing soils 0 prime farmland	13 erodes easily 33 blowing soils 0 prime farmland	10 erodes easily 26 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[l]	2.3 erodes easily 0.81 blowing soils 0 prime farmland	1.4 erodes easily 3.6 blowing soils 0 prime farmland	1.7 erodes easily 4.4 blowing soils 0 prime farmland

a. Source: DIRS 180872-Nevada Rail Partners 2007, Appendix D.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 180880-Shannon & Wilson 2007, Table 6.
f. Source: DIRS 180875-Nevada Rail Partners 2007, Table 4-6, and Appendix H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 180874-Nevada Rail Partners 2007, p. B-3.
i. Assuming that two quarries would be developed along Montezuma alternative segment 1 or 3.
j. Totals might not equal sums of values due to rounding.
k. Source: DIRS 176781-MO0603GSCSSGEO.000, all.
l. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

Construction of the Montezuma alternative segments would disturb between 1.4 square kilometers (350 acres) and 2.3 square kilometers (570 acres) of erodes easily soils. More soils along Montezuma alternative segments 2 and 3, in the Big Smoky Valley and Montezuma Valley, have the blowing soils characteristic. These soils would have additional potential to be easily displaced by wind. Section 4.3.4, Air Quality and Climate, includes more discussion of impacts related to blowing soils and fugitive dust emissions. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Montezuma alternative segments 1, 2, and 3 would cross some Quaternary faults, specifically as they approach mountain foothills. There has been one magnitude 5.3 earthquake recorded to the west of Lone Mountain. However, there have been very few earthquakes above magnitude 3.0 in the area (see Figure 3-126). The potential exposure of people or structures to seismic hazards would be small.

There are multiple mining districts in the area surrounding the Montezuma alternative segments. There is an operating lithium evaporate mine immediately east of Silver Peak, and the Goldfield Hills contain multiple mining claims for metallic minerals (DIRS 180882-Shannon & Wilson 2007, pp. 104 to 106). There are also multiple metallic and nonmetallic minerals found within the Monte Cristo and Montezuma Ranges, and at Lone Mountain. However, there would be a small potential for impacts to mineral resources in this area, because ground disturbances would be limited to the rail line construction right-of-way. Construction would not require drilling into the deep saline aquifers Chemetall Foote Corporation uses for its lithium operations.

There is also a high potential for the mineral zeolite around the southern end of Montezuma alternative segment 2. Zeolite can be used as an antimicrobial agent and forms when saline ***groundwater*** reacts with certain volcanic deposits (DIRS 173841-Shannon & Wilson 2005, pp. 31 and 32). The potential impacts to local mineral resources would be small because rail line construction activities would be limited to the nominal width of the construction right-of-way. Section 4.3.2, Land Use and Ownership, also addresses impacts to the mining district from constructing and operating the proposed railroad along the Mina rail segment.

4.3.1.2.2.8 Mina Common Segment 2 (Stonewall Flat Area). Crossing the Stonewall Flat area, Mina common segment 2 would have relatively low rise and fall amounts and low cut and fill requirements (see Table 4-147).

Mina common segment 2 would cross the southern portion of the Stonewall Flat faults. However, within the past 150 years, there have been few earthquakes in the area (see Figure 3-126). There is a high potential for metallic minerals within the central portion of Mina common segment 2. Gold and silver deposits historically have been mined from the Stonewall and Cuprite Mining Districts (DIRS 173841-Shannon & Wilson 2005, pp. 56 to 59). However, impacts to these areas resulting from construction of the proposed rail line would be expected to be small and temporary because the minerals have not been found within the nominal width of the construction right-of-way. There are also geothermal wells near Mina common segment 2. DOE would avoid these wells during rail line construction, thereby reducing potential impacts. Section 4.3.2, Land Use and Ownership, describes land-use impacts regarding access to and use of mineral and energy resources.

Mina common segment 2 would disturb approximately 0.28 square kilometer (69 acres), which would include construction of the rail line, water wells, and access roads. The surface-area disruption would result in a loss of topsoil and the potential for increased erosion. Approximately 0.28 square kilometer (69 acres) of soils along Mina common segment 2 have the blowing soil characteristic and would be especially susceptible to wind erosion during construction.

There are also soils characterized as ***soft soils*** in ***playa*** deposits present along Mina common segment 2. The saline conditions of these soils limit the chemical and physical potentials of the soil and could have negative effects on the vegetation-bearing capacity of the soil. Reclamation of these soils following construction would be more difficult than on non-saline soils, and would require more maintenance and care than on more productive soils. These soils would have a higher potential for erosion until revegetation was complete. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

4.3.1.2.2.9 Bonnie Claire Alternative Segments. The two Bonnie Claire alternative segments would pass through Lida Valley and Sarcobatus Flat. The alternative segments would require similar amounts of fill, but Bonnie Claire alternative segment 2 would require excavation of twice as much cut material as Bonnie Claire alternative segment 3. Table 4-149 summarizes the key information DOE considered to assess impacts to physical setting from construction of either of the Bonnie Claire alternative segments.

Each alternative segment would result in a total land disturbance of 1.9 square kilometers (470 acres) (see Table 4-149). Areas disturbed during construction would result in a loss of topsoil and increase the potential for erosion. However, these impacts would be temporary and would be reduced through the implementation of best management practices (see Chapter 7).

Although the alternative segments would pass through areas that have experienced recent low-level ***seismicity*** (magnitude 3.0 to 3.9) events, neither Bonnie Claire 2 nor Bonnie Claire 3 would cross known Quaternary fault traces. The primary seismic activity within the past 150 years occurred in 1999, when a magnitude 5.3 earthquake triggered many aftershocks over a series of days. Since then, earthquakes in the immediate vicinity of the Bonnie Claire alternative segments have been below magnitude 3.0 (DIRS 176184-Shannon & Wilson 2006, Plate 4). Seismic hazards in this area are considered consistent with the rest of southern Nevada.

There is a potential for metallic mineral deposits along both Bonnie Claire alternative segments. Each segment would travel around the Wagner Mining District, which has produced low-tonnage mixed oxide and sulfide copper ore (DIRS 173841-Shannon & Wilson 2005, p. 54). DOE would position the rail alignment to avoid the mining district and to reduce the potential for impacts to mineral deposits. Section 4.3.2, Land Use and Ownership, addresses potential impacts to the Wagner Mining District. The rail alignment would travel along the low sections of Stonewall Flat; therefore, impacts to metallic mineral deposits would be small.

About 0.48 to 0.51 square kilometer (120 to 130 acres) of the soils along Bonnie Claire 3 and Bonnie Claire 2, respectively, have the erodes easily characteristic (see Table 4-149). Thus, there would be a high potential for erosion along these alternative segments. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion. Overall, the potential impacts from constructing a rail line along either Bonnie Claire alternative segment 2 or Bonnie Claire alternative segment 3 would be similar.

4.3.1.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Passing through Sarcobatus Flat, common segment 5 would have a low rise and fall. Table 4-147 summarizes the key information DOE considered to assess impacts to physical setting from construction of common segment 5.

The potential to expose people or structures to seismic hazards would be small because common segment 5 would not cross any known Quaternary fault traces, and would travel over relatively level terrain.

Table 4-149. Summary of key information for assessing impacts from constructing Bonnie Claire alternative segments 2 or 3.

Key information	Bonnie Claire 2	Bonnie Claire 3
Length (kilometers)[a,b]	21	19
Rise and fall (meters)[a,c]	160	170
Earthwork cut quantities (cubic meters)[a,d]	0.46 million	0.24 million
Earthwork fill quantities (cubic meters)[a,d]	0.95 million	0.70 million
Construction[e]	Cuts to 30 meters high in ***tuff***; cuts and fills to 15 meters deep in ***alluvium***	Cuts to 15 meters high in tuff; cuts and fills to 6 meters deep in alluvium; low strength rock; broken rock expected because of faults visible in outcrop
Number of construction camps[f]	0	0
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	1.9	1.9
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	Not applicable	Not applicable
Total disturbed area (square kilometers)[f,i]	1.9	1.9
Percent soil characteristics[j]	27 erodes easily 0 blowing soils 0 prime farmland	25 erodes easily 0 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[g,k]	0.51 erodes easily 0 blowing soils 0 prime farmland	0.48 erodes easily 0 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

There is a high potential for metallic mineral resources where common segment 5 would pass near the Clarkdale Mining District. Small gold and silver deposits have been mined in Clarkdale, and are hypothesized to extend below portions of common segment 5 (DIRS 173841-Shannon & Wilson 2005, Table 1). However, construction activities would not uncover the bedrock and disturb the mineral resources. The area of common segment 5 also has a generally high potential for geothermal resources; there are several thermal springs near U.S. Highway 95 that would be parallel to the rail line (DIRS 173841-Shannon & Wilson 2005, p. 23). However, because DOE would avoid these resources during rail line construction, the potential for impacts would be small.

Construction of this common segment would disturb a total of 3.1 square kilometers (770 acres) of land. Surface disturbance related to construction activities would remove topsoil and increase the potential for erosion along the rail alignment. These impacts would be temporary and would be reduced through the use of best management practices (see Chapter 7).

Approximately 0.081 square kilometer (20 acres) of common segment 5 has the blowing soils characteristic, which would increase the potential for soil loss from wind. DOE would implement best management practices to minimize any additional soil loss from erosion. Section 4.3.4, Air Quality and Climate, addresses impacts related to construction-generated fugitive dust emissions.

4.3.1.2.2.11 Oasis Valley Alternative Segments. Oasis Valley alternative segments 1 and 3 would have a similar profile throughout the valley. Table 4-150 summarizes the key information DOE considered to assess impacts to physical setting from construction of either Oasis Valley alternative segment.

The Oasis Valley alternative segments would not cross known fault traces. Within the past 150 years of seismic records, there has been generally low earthquake activity in the area, so the potential seismic-related impacts to humans and structures would be small.

There is a low potential for commercial metallic, nonmetallic, and oil resources in the area of the Oasis Valley alternative segments (DIRS 182762-Shannon & Wilson 2005, Appendix E). The minerals present in the area around the alternative segments are found in small veins in the surrounding hills. There would be small impacts to such resources because the rail alignment would remain in the valley, away from mineral-bearing ***outcrops***. There is a high potential for geothermal deposits in the area; however, neither Oasis Valley alternative segment would approach any known hot springs or wells.

Oasis Valley alternative segment 3 would require more earthwork than Oasis Valley alternative segment 1 to obtain the appropriate grade (see Table 4-150) and would disturb 0.3 square kilometer (74 acres) more land area than Oasis Valley alternative segment 1. Construction activities would remove topsoil in the area and increase the potential for erosion along the rail alignment. Oasis Valley 1 also contains about twice as much blowing soils as Oasis Valley 3. DOE would implement best management practices (see Chapter 7) to reduce the potential for additional soil loss due to erosion.

Overall, potential impacts along either Oasis Valley alternative segment would be small. Oasis Valley 3 would be longer and would require more land disturbance than Oasis Valley 1, and Oasis Valley 1 would contain more soils with a high potential for erosion.

4.3.1.2.2.12 Common Segment 6 (Yucca Mountain Approach). Approaching Yucca Mountain, common segment 6 would pass through rugged terrain and along fault blocks. To achieve an appropriate grade, 15-meter (49-foot) cuts and fills would be required with up to 42-meter (140-foot) cuts and fills in some areas (see Table 4-147). Some of the fill would be required to build the bridge over Beatty Wash.

Table 4-150. Summary of key information for assessing impacts from constructing Oasis Valley alternative segment 1 or 3.

Key information	Oasis Valley 1	Oasis Valley 3
Length (kilometers)[a,b]	10	14
Rise and fall (meters)[a,c]	70	66
Earthwork cut quantities (cubic meters)[a,d]	0.051 million	0.12 million
Earthwork fill quantities (cubic meters)[a,d]	0.55 million	1.03 million
Construction[e]	Cuts and fills to 6 meters high	Cuts and fills to 12 meters high
Number of construction camps[f]	1 (no. 11)	1 (no. 11)
Number of well sites outside nominal width of construction right-of-way[f]	0	0
Disturbed area (square kilometers)[g]		
• Rail alignment[h]	0.97	1.3
• Quarries[f]	Not applicable	Not applicable
• Well sites outside nominal width of construction right-of-way[f]	Not applicable	Not applicable
• Access roads to construction camps/well sites/quarries[f]	0.04 (to construction camp 11)	0.04 (to construction camp 11)
Total disturbed area (square kilometers)[f,i]	1.0	1.3
Percent soil characteristics[j]	0 erodes easily 13 blowing soils 0 prime farmland	0 erodes easily 4.8 blowing soils 0 prime farmland
Soil characteristic area (square kilometers)[g,k]	0 erodes easily 0.13 blowing soils 0 prime farmland	0 erodes easily 0.062 blowing soils 0 prime farmland

a. Source: DIRS 176165-Nevada Rail Partners 2006, Appendix E.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.
d. To convert cubic meters to cubic yards, multiply by 1.308.
e. Source: DIRS 176184-Shannon & Wilson 2006, Table 5.
f. Source: DIRS 176172-Nevada Rail Partners 2006, pp. 3-2 to 3-4 and 4-11, Table 4-7, and Appendixes G and H.
g. To convert square kilometers to acres, multiply by 247.10.
h. Source: DIRS 176170-Nevada Rail Partners 2006, p. B-3.
i. Totals might not equal sums of values due to rounding.
j. Source: DIRS 176781-MO0603GSCSSGEO.000, all.
k. Soil area calculated by multiplying total disturbed area by the percent soil characteristic.

There is a low potential for ground rupture associated with the eastern and western Yucca Fault systems (DIRS 176184-Shannon & Wilson 2006, Table 6). In areas with high topographic relief, construction of this common segment would also result in an increased potential for rock-slope failure and landslides (DIRS 176184-Shannon & Wilson 2006, Table 6). DOE would incorporate appropriate engineering features (see Chapter 2) during construction to stabilize these areas and prevent rock-slope failure and landslides. Construction activities would not be expected to result in off-site rock falls and landslides.

There is a high potential for the occurrence of some metallic and nonmetallic minerals along common segment 6. The rail alignment would cross the northeastern portion of the Bare Mountain Mining District, which has produced a variety of commodities over its period of operation, including fluorspar, silica, limestone, and trace amounts of gold and mercury (DIRS 173841-Shannon & Wilson 2006, p. 39). Construction impacts to mineral resources in this area would be small because the width of the construction right-of-way would allow for the extraction of the mining district's resources. Section 4.2.2, Land Use and Ownership, further describes impacts to the Bare Mountain Mining District.

There is a potential for geothermal resources in the northern portions of common segment 6. There are several warm and hot springs around Beatty, some of which are used as warm bathing pools. The rail alignment would bypass the springs; therefore, there would be no impact to local geothermal resources (DIRS 182762-Shannon & Wilson 2005, p. 31).

Construction activities along common segment 6 would disturb an estimated 5.5 square kilometers (1,400 acres). These activities could cause topsoil loss and an increase erosion potential. DOE would implement best management practices (see Chapter 7) to minimize these impacts. There are no special soil characteristics along this common segment.

4.3.1.2.3 Facilities

4.3.1.2.3.1 Staging Yard. DOE would build the Staging Yard northeast of Hawthorne near the end of Department of Defense Branchline South. The Staging Yard would disturb approximately 0.20 square kilometer (50 acres) and consist of a 610-square-meter (6,600-square-foot) office, a 560-square-meter (6,600-square-foot) Satellite Maintenance-of-Way Facility, and a paved access road (DIRS 180919-Nevada Rail Partners 2007, p. 3-1; DIRS 176168-Nevada Rail Partners 2006, p. 5-2). Construction of this facility would result in removal of topsoil and an increased potential for erosion within the disturbed areas. There would be a permanent loss of topsoil in the areas under buildings and paved roads.

4.3.1.2.3.2 Maintenance-of-Way Facility. There are two potential locations for the Maintenance-of-Way Facility along the Mina rail alignment, depending on the alternative segment. The Montezuma alternative segment 1 site would be approximately 1.6 kilometers (1 mile) south of Silver Peak. The site along Montezuma alternative segment 2 or 3 would be 2.9 kilometers (1.8 miles) west of U.S. Highway 95 between Tonopah and Goldfield (DIRS 180919-Nevada Rail Partners 2007, p. 4-4). Construction of this facility would disturb 0.061 square kilometer (15 acres) (DIRS 176170-Nevada Rail Partners 2006, Appendix B). The disturbed area would have the potential for topsoil loss and increased erosion.

4.3.1.2.3.3 Rail Equipment Maintenance Yard. Construction of the Rail Equipment Maintenance Yard would disturb approximately 0.41 square kilometer (100 acres) (DIRS 176170-Nevada Rail Partners 2006, p. A-5). This area would include the ***Cask Maintenance Facility***, and ***escort-car*** and locomotive-light-repair garages. It could also house the ***Nevada Railroad Control Center*** and National Transportation Operations Center. Construction of these facilities would result in topsoil loss and increased erosion potential. DOE would implement best management practices (see Chapter 7) to minimize potential erosion impacts. During construction, the topsoil would be sequestered and stabilized to prevent its permanent loss.

4.3.1.2.3.4 Cask Maintenance Facility. The Cask Maintenance Facility would be used to house the transportation casks, and would process them during routine inspections, cleaning, and repair.
The facility would disturb 0.081 square kilometer (20 acres), which would include buildings, a rail yard, and track siding (DIRS 176168-Nevada Rail Partners 2006, p. 1-3). The facility could be in one of three locations: collocated with the Rail Equipment Maintenance Yard inside the ***Yucca Mountain Site*** boundary, along one of the rail alignment segments outside the ***Yucca Mountain Site boundary***, or at a currently undetermined location outside Nevada.

4.3.1.2.4 Quarries

DOE would develop two of five potential quarry sites along the Mina rail alignment. Each quarry site would contain an operations plant, quarry and production area, access roads, and a railroad siding with loading facility, and could contain a conveyor belt (see Figure 2-33). The operations plant would include administrative offices, a parking area, sanitary facilities, and an equipment fueling and service area. The quarry and production area would include the pit, which would vary in size depending on quarry location, a waste-rock pile with a rectangular footprint of 0.057 square kilometer (14 acres), a ballast stockpile, settling ponds, a water well, and emergency generators.

The maximum disturbance area for each quarry was calculated from the areas that would be disturbed from excavating the quarry pit and building the associated plant facilities, roads, railroad siding, and conveyor belts. The area for a temporary construction buffer was also included, which would be reclaimed once construction was completed. The quarry pit would create the largest disturbance area, so depending on the quality of the bedrock and the quantity of required ballast and subballast, the total disturbance area for the quarry site would most likely be much smaller. Depending on the topography, the relative positions of the facilities, the quality and amount of the extracted rock, the total area of disturbance from a quarry site would be 0.97 to 2.7 square kilometers (240 to 660 acres).

Construction and operation of quarries would modify the physical setting in multiple ways. Construction of the buildings, access roads, and conveyer belts would disturb topsoil. During quarry operation, rock extraction would require the removal of the thin soil overburden. The result would be some topsoil loss during quarry construction and operation. Construction and operation of the quarries would also increase the potential for erosion. These impacts would be temporary, limited to the area around the quarry facilities, and DOE would implement best management practices (see Chapter 7) to reduce the impacts. Where practicable, the topsoil would be reserved for reclamation and revegetation. Excavation of bedrock from the pit would result in permanent loss of the mineral resources and change the local topography. However, the quarries would be in areas with abundant mineral resources, so impacts to overall availability of minerals suitable for quarrying would be small.

After construction, DOE would implement reclamation activities to reduce permanent impacts (see Chapter 7). The Department would demolish quarry access roads by removing the roadway materials and regrading the area. Terrain restoration around the quarry facility and pit would include restoring quarry-pit walls to more stable slopes, grading and replacing topsoil, and revegetating the area (DIRS 176172-Nevada Rail Partners 2006, p. 3-4). Reclamation activities would reduce the direct and indirect topsoil loss and increased erosion impacts caused by quarry construction and operation.

Sections 4.3.1.2.4.1 through 4.3.1.2.4.5 describe potential impacts related to each potential quarry site along the Mina rail alignment.

4.3.1.2.4.1 Garfield Hills Quarry. The potential Garfield Hills quarry would be in low hills south of Mina common segment 1. The quarry pit (see Figure 2-28) would be mined from the southwest side of a mesa, extracting basalt from two 30-meter (100-foot) hills. At most, this quarry pit could occupy an area of 0.30 square kilometer (74 acres) with an average depth of 22 meters (71 feet), which would produce 38.1 million metric tons (42 million tons) of ballast (DIRS 180875-Nevada Rail Partners 2007, p. A-4). Actual quarry dimensions would likely be much smaller – approximately 0.04 square kilometer (10 acres) (DIRS 176172-Nevada Rail Partners 2006, p. 3-2). The ballast produced from this quarry could supply a portion of the 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) required for railroad construction and maintenance (DIRS 180875-Nevada Rail Partners 2007, p. 3-1).

Access to the Garfield Hills quarry site would be by existing and new roads (DIRS 180875-Nevada Rail Partners 2007, Appendix H). To connect the quarry pit to the facilities, the Mina common segment 1 siding, and U.S. Highway 95, DOE would construct 3.1 kilometers (1.9 miles) of new roadway and would improve 3.2 kilometers (2 miles) of existing roadway (DIRS 180875-Nevada Rail Partners 2007, Table4-6). The Department would update existing roads with grading and a gravel roadbed. Excavated ballast would be trucked to the quarry plant site, which would be on an alluvial fan to the north of the quarry site. Once the ballast was separated, it would be transported to the rail alignment via conveyer belt. This conveyer belt would need to cross U.S. Highway 95 to reach the siding. The conveyer belt and service road would travel approximately 1.6 kilometers (1 mile) and disturb a 15-meter (50-foot)-wide path from the processing plant to the rail loading facility. The entire quarry footprint, including pit, facilities, and associated transportation routes would disturb a maximum of 1.4 square kilometers (350 acres).

4.3.1.2.4.2 Gabbs Range Quarry. The potential Gabbs Range quarry and its facilities would be northeast of Mina common segment 1, shown on Figure 2-29. When operational, this quarry could supply a portion of the 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of ballast required for railroad construction and maintenance (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). The southern edge of a 120-meter (400-foot)-high ridge would be mined for granite. The quarry pit would be able to produce a maximum of 13 million metric tons (14.3 million tons) of ballast excavated out of a 0.21-square-kilometer (52-acre) pit on average 23 meters (77 feet) deep. The potential plant facility would be to the southwest of the quarry pit and adjacent to the rail alignment. Ballast would be trucked along a modified off-road vehicle trail to the loading facility along Mina common segment 1. For the Gabbs Range quarry, DOE would upgrade 8.9 kilometers (5.5 miles) of existing roads, and create 0.81 kilometer (0.50 mile) of new roads (DIRS 180875-Nevada Rail Partners 2007, Table 4-6). The Gabbs Range quarry footprint would disturb about 0.97 kilometer (240 acres).

4.3.1.2.4.3 North Clayton Quarry. The potential North Clayton quarry would be north of Montezuma alternative segment 3 and east of Montezuma alternative segment 1 north of the Montezuma Mountains. The quarry pit would be on granite hills north of the Montezuma Range and Clayton Ridge. The plant site and waste-rock pile would be on alluvial fans to the west and east of the rail alignment, respectively (see Figure 2-30). The quarry would be able to produce a maximum of 12.3 million metric tons (13.6 million tons) of granite rock from a pit totaling 0.35 square kilometer (86 acres) with a bench height of 15 meters (50 feet). Construction requirements for ballast for the rail alignment would be 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). The ballast would be trucked from the quarry pit to the quarry plant facility, and then trucked to the rail alignment along new and existing roads. DOE would construct 3.1 kilometers (1.9 miles) of new road and use 5.8 kilometers (3.6 miles) of existing roads to connect the quarry pit to the plant facilities and the rail alignment. The entire quarry footprint would disturb a maximum of 1.8 square kilometers (440 acres).

4.3.1.2.4.4 Malpais Mesa Quarry. The potential Malpais Mesa quarry would be in the area between Montezuma alternative segments 1, 2, and 3, shown on Figure 2-32. ***Basalt*** rock would be excavated from the side of a 61-meter (200-foot)-high bowl-shaped cliff. The waste-rock pile and plant facilities would be to the southwest at the base of the cliff. A maximum of 11.9 million metric tons (13.1 million tons) of ballast could be extracted from the 1-square-kilometer (260-acre) pit with a depth of 21 meters (70 feet). Depending on the percentage of the required 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of ballast the quarry would supply, the final quarry footprint would likely be smaller (DIRS 180875-Nevada Rail Partners 2007, p. 3-1).

Access to the quarry pit and production plant would be via 5.3 kilometers (3.3 miles) of updated off-road vehicle trails off U.S. Highway 95, with 6.8 kilometers (4.2 miles) of new roadway construction to connect the quarry site to the rail alignment, waste-rock pile, and plant facility (DIRS 180875-Nevada Rail Partners 2007, Table 4-6). A conveyer belt would carry the ballast from the production facility to the rail siding. The width of the conveyer belt and correlating service road would be 15 meters (50 feet). The Malpais Mesa quarry footprint would disturb about 2.7 square kilometers (660 acres).

4.3.1.2.4.5 Quarry ES-7. Potential quarry ES-7 would be west of Montezuma alternative segment 2 or 3 shown on Figure 2-31. The quarry pit and plant facilities would be on a 49-meter (160-foot)-high mesa with access to two basalt deposits. DOE could extract a maximum of 8.49 million metric tons (9.36 million tons) of basalt ballast from the 0.11-square-kilometer (27-acre) pit with a depth of 30 meters (100 feet). Depending on the amount of ballast required, the footprint of this quarry would likely be smaller. There could also be a secondary quarry of variable-quality rock in the area. It would be able to produce a maximum of 2.9 million metric tons (3.2 million tons) of ballast from a 37,000-square-meter (9.2-acre) pit 30 meters deep. However, the final dimensions of this secondary quarry would likely be smaller. This quarry could supply a portion of the required 2.49 to 2.73 million metric tons (2.74 to 3.01 million tons) of ballast (DIRS 180875-Nevada Rail Partners 2007, p. 3-1).

Access to the quarry pit and production plant would be via an existing road off U.S. Highway 95, with new roadway construction to extend into the quarry site (DIRS 176172-Nevada Rail Partners 2006, Appendix I). DOE would construct approximately 6.6 kilometers (4.1 miles) of new roadway and would improve 8.4 kilometers (5.2 miles) of existing roadway to access the quarry pit and facilities (DIRS 176172-Nevada Rail Partners 2006, Table 4-7). A conveyer belt would carry the ballast from the production facility to the rail siding. The conveyer belt and correlating service road would be 15 meters (50 feet) wide. The total disturbance area of the quarry footprint would be 1.5 square kilometers (370 acres).

4.3.1.3 Operations Impacts

The proposed railroad would operate for up to 50 years (DIRS 176173-Nevada Rail Partners 2006, p. 4-1). The operations right-of-way would be nominally 61 meters (200 feet) on either side of the centerline of the rail line. By definition, the operations right-of-way would be within the construction right-of-way; therefore, use of the completed rail line to Yucca Mountain would have no additional impact to physical setting beyond the permanent alterations resulting from construction.

Rail line maintenance would require periodic inspections to verify the condition of the track, drainage structures, and rock-wall surfaces. When necessary, rock faces on cuts would be repaired to minimize the potential for rockfall or landslide. Areas along the rail line would also be monitored for evidence of erosion, particularly where there is a high percentage of soils classified as erodes easily (Schurz alternative segment 1 [31 percent], Schurz alternative segment 5 [36 percent], Schurz alternative segment 6 [49 percent], and Mina common segment 2 [100 percent]).

Eroded areas encroaching on the track bed would be repaired, which could include replacement of ballast and subballast to reduce erosion of exposed soils. Although there would be a potential for erosion and landslides along the rail line, the potential would be substantially similar to baseline conditions, and would be attributed to natural occurrences after construction was completed, not due to train operations. In addition, DOE would use appropriate slope-stabilizing engineering practices (see Chapter 2) during the construction phase that would reduce hazards from rockfalls and landslides during the operations phase. Section 4.2.8, Noise and Vibration, discusses potential impacts from vibration in more detail.

During the operations phase, DOE would continue to monitor seismic activity in the region. DOE would also continue to follow the procedures based on the American Railways Engineering and Maintenance-of-Way Association seismic guidelines adopted during the construction phase (see Section 4.3.1.2.1.2 and Table 4-145). These measures, also outlined in Chapter 7, would reduce the potential for structural damage and human exposure to seismic hazards.

4.3.1.4 Impacts under the Shared-Use Option

The Shared-Use Option would include the construction and operations activities described in Sections 4.3.1.2 and 4.3.1.3, and private companies would use the rail line for shipment of general freight. Under the Shared-Use Option, potential construction and operations impacts would be very similar to those identified in Sections 4.3.1.2 and 4.3.1.3 for the Proposed Action without shared use.

The Shared-Use Option would require the construction of more rail sidings within the rail line construction right-of-way in areas of relatively flat terrain. A commercial-use interchange facility at the beginning of the line and a facility at the commercial-use termination point to support the Shared-Use Option would also be constructed within the construction right-of-way. Implementation of the Shared-Use Option would increase the area of surface disturbance by less than 0.1 percent (see Chapter 2). There would be a potential for topsoil loss and increased erosion in this area.

Under the Shared-Use Option, the rail line would likely be in use for more than 50 years, compared to the railroad operations life under the Proposed Action without shared use. Shared use of the proposed rail line would add no impacts to physical setting beyond the permanent alterations already described.

4.3.1.5 Summary

Table 4-151 summarizes potential impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment. With the exception of topsoil loss, overall impacts would be small because of the best management practices or mitigation procedures DOE would implement (see Chapter 7). There would be a potential for increased erosion because relatively undisturbed land would be extensively graded. Impacts related to soil erosion or loss of topsoil would be small because implementation of best management practices would effectively reduce the potential for increased erosion and sedimentation that could occur during construction activities. In addition, soil disturbance would be distributed through several counties, reducing the concentration of increased soil erosion.

The Mina rail alignment would cross faults in Nevada, a seismically active area. However, DOE would adopt the American Railway Engineering and Maintenance-of-Way Association seismic guidelines. Additional seismic monitoring procedures would also be implemented during the construction and operations phases. Construction of the rail line would avoid known commercial mineral deposits, and would not remove them from permanent use. The quarries and borrow sites that would be developed and used for supplying the ballast and subballast would remove mineral resources from the area. However, construction would consume only a small percentage of the total available supply over several counties. There would be no additional impacts to the physical setting from railroad operations under the Proposed Action or the Shared-Use Option.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 1 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment		
Department of Defense Branchline North (Lyon County)	Total surface disturbance: 0.16 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 2 of 4).

Rail line segment (continued)		
Schurz alternative segments 1, 4, 5, and 6 (Lyon, Churchill, and Mineral Counties including Walker River Paiute Reservation)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Schurz 1 = 4.6 square kilometers Schurz 4 = 6.1 square kilometers Schurz 5 = 6.9 square kilometers Schurz 6 = 6.5 square kilometers Loss of prime farmland soils: Schurz 1 = 0.011 square kilometer Schurz 4 = 0.012 square kilometer Schurz 5 = 0.014 square kilometer Schurz 6 = 0.014 square kilometer Each segment would cross 2.6 percent of the prime farmland soils of the Walker River Paiute Reservation. Small impact to local mineral resources due to metallic minerals historically mined in local mountains.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Department of Defense Branchline South (Mineral County)	Total surface disturbance: 0.26 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Mina common segment 1 (Mineral and Esmeralda Counties)	Total surface disturbance: 12 square kilometers, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Montezuma alternative segments 1, 2, and 3 (Esmeralda and Nye Counties)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Montezuma 1 = 16 square kilometers Montezuma 2 = 11 square kilometers Montezuma 3 = 17 square kilometers Potential impacts to metallic and nonmetallic resources would be small.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Mina common segment 2 (Esmeralda and Nye Counties)	Total surface disturbance: 0.28 square kilometer, would result in topsoil loss and increased potential for erosion. Small impacts to metallic and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 3 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Rail line segment (continued)		
Bonnie Claire alternative segments 2 and 3 (Nye County)	Total surface disturbance, would result in topsoil loss and increased potential for erosion: Bonnie Claire 2 = 1.9 square kilometers Bonnie Claire 3 = 1.9 square kilometers Small impacts to metallic mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 5 (Nye County)	Total surface disturbance: 3.1 square kilometers, would result in topsoil loss and increased potential for erosion. Small impact to metallic mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Total surface disturbance would result in topsoil loss and increased potential for erosion: Oasis Valley 1 = 1 square kilometer; Oasis Valley 3 = 1.3 square kilometers Small impacts to mineral resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Common segment 6 (Nye County)	Total surface disturbance: 5.5 square kilometers, would result in topsoil loss and increased potential for erosion. Small impacts to mineral and geothermal resources.	Potential for soil erosion in localized areas along the rail roadbed; implementation of erosion prevention methods would reduce impacts.
Facilities		
Access roads (included in total surface disturbance in individual segments) (Mineral, Esmeralda, and Nye Counties)	Total surface disturbance: 1.5 square kilometers, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Staging Yard at Hawthorne (includes the Satellite Maintenance-of-Way Facility) (Mineral County)	Total surface disturbance: 0.2 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Maintenance-of-Way Facility (includes Maintenance-of-Way Headquarters Facility and Maintenance-of-Way Trackside Facility) (Esmeralda County)	Total surface disturbance: 0.061 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.
Rail Equipment Maintenance Yard (includes Cask Maintenance Facility)(Nye County)	Total surface disturbance: 0.41 square kilometer, would result in topsoil loss and increased potential for erosion.	Potential for soil erosion in localized areas around the facility; implementation of erosion prevention methods would reduce impacts.

Table 4-151. Summary of impacts to physical setting from constructing and operating the proposed railroad along the Mina rail alignment[a] (page 4 of 4).

Rail line segment/ facilities (county)	Construction impacts	Operations impacts
Facilities (continued)		
Construction camps (Esmeralda, Nye, and Mineral Counties including the Walker River Paiute Reservation)	Total surface disturbance: 1 square kilometer would result in topsoil loss and increased potential for erosion. Construction camps would be within the nominal width of the construction right-of-way.	Potential for soil erosion in localized areas around the construction camps; implementation of erosion prevention methods would reduce impacts.
Water wells (Lyon, Mineral, Churchill including Walker River Paiute Reservation, Nye, and Esmeralda Counties)	Total surface disturbance: 0.17 square kilometer, would result in topsoil loss and increased potential for erosion. (105 potential well sites with 130 potential wells; 76 well sites would be within the nominal width of the construction right-of-way; 29 well sites would be outside the nominal width of the construction right-of-way, at 0.0057 square kilometer surface disturbance at each well site)	Potential for soil erosion in localized areas around the well sites; implementation of erosion prevention methods would reduce impacts.
Quarries		
Potential Garfield Hills quarry (Mineral County)	Total surface disturbance: 1.4 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 38.1 million metric tons of rock would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential North Clayton quarry (Esmeralda County)	Surface disturbance: 1.8 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 12.3 million metric tons would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential Malpais Mesa quarry (Esmeralda County)	Surface disturbance: 2.7 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 11.9 million metric tons would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.
Potential quarry ES-7 (Nye County)	Total surface disturbance: 1.5 square kilometers, would result in topsoil loss and increased potential for erosion. Extraction of all 11.4 million metric tons from two pits would reduce the availability of local construction mineral materials.	Potential for soil erosion in localized areas around the quarry; implementation of erosion prevention methods would reduce impacts.

a. To convert square kilometers to acres, multiply by 247.10; to convert metric tons to tons, multiply by 1.1023.

4.3.2 LAND USE AND OWNERSHIP

This section describes potential impacts to land use and ownership from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.2.1 describes the methods DOE used to assess potential impacts; Section 4.3.2.2 describes potential impacts to land use during the construction phase; Section 4.3.2.3 describes potential railroad operations impacts; Section 4.3.2.4 describes potential impacts under the Shared-Use Option; and Section 4.3.2.5 summarizes potential impacts to land use and ownership.

Section 3.3.2.1 describes the region of influence for land use and ownership.

4.3.2.1 Impact Assessment Methodology

Table 4-152 lists factors DOE considered to determine potential impacts to land use and ownership from project-related construction and operations activities.

Table 4-152. Impact assessment considerations for land use and ownership.

Land use	Potential for impact
General	Nonconformance with applicable general and regional plans and approved or adopted policies, goals, or operations of communities or governmental agencies
Private land	Change in current land use
	Displacement of existing, developing, or approved urban/industrial buildings or activities (residential, commercial, industrial, governmental, or institutional)
	Loss of ownership or title to private land
American Indian land	Conflict with existing land-use plans or cause incompatible land uses
Department of Defense land	Conflict with existing land-use plans or cause incompatible land uses
Livestock grazing lands	Loss of grazing land and associated ***animal unit months***
	Alteration of livestock operations or disruption of livestock movement
	Change to the amount or distribution of existing stockwater sources
	Potential human disturbance to livestock (such as loss of livestock due to collisions with trains)
Mineral and energy resources	Potential to preclude mining operations or the extraction of oil, gas, and geothermal resources within the rail line construction right-of-way
	Disturbance to existing or proposed mining operations with an approved mining plan
	Potential to cause the collapse of active underground mines, tunnels, or shafts
Recreational areas and access to public or private lands	Potential disturbance to federal, state, local, or private land designated as recreational sites
	Potential alteration of routes for large, recurring organized off-highway vehicle events and races
	Restricted or altered access to federal, state, local, or private recreational sites or public land
	Restricted or altered access to private land
Utility and transportation corridors and rights-of-way	Interference with an existing or planned utility or transportation right-of-way
	Need for a new right-of-way within a BLM-designated right-of-way avoidance area, such as an Area of Critical Environmental Concern

DOE assessed potential impacts to land use and ownership along the rail line based on the nominal width of the construction right-of-way. The Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines North and South are existing rail lines where there would be no new construction outside of the existing railroad right-of-way under the DOE Proposed Action. Therefore, there would be no changes to land use, ownership, or access associated with those segments.

For railroad construction and operations support facilities, this section describes potential impacts to land use and ownership in conjunction with each facility's nearest segment, based on the current land use at the site. Table 4-153 describes the required support facilities and the current land uses at their proposed locations. Chapter 2 describes the facilities and their locations in more detail.

Table 4-153. Land use associated with proposed construction and operations support facilities.

Facilities	Number of facilities under the Proposed Action[a,b]	Within the nominal width of the construction right-of-way	Land ownership
Construction camps	Up to 10	Yes	BLM-administered public land and the Hawthorne Army Depot
Construction wells	Maximum: 74 well sites needed Area of disturbance for each well outside the construction right-of-way would be 0.0057 square kilometer	All but 9	Construction wells outside the nominal width of the construction right-of-way would be on BLM-administered public land and Walker River Paiute Reservation land
Quarries	Up to two needed out of five potential sites	No	All would be on BLM-administered public land except for the potential Garfield Hills quarry, which would be partially on the Hawthorne Army Depot
Staging Yard	One required Area of disturbance would be approximately 0.2 square kilometer	No	BLM-administered public land and the Hawthorne Army Depot
Maintenance-of-Way Facility	One required	Yes	BLM-administered public land
Rail Equipment Maintenance Yard	Includes the Satellite Maintenance-of-Way Facility, possibly the Nevada Railroad Control Center and National Transportation Operations Center	No	DOE-managed land –Yucca Mountain Site[c]
Cask Maintenance Facility	One This facility has three location options: (1) collocated with the Rail Equipment Maintenance Yard, (2) anywhere along the rail line outside the Yucca Mountain Site boundary, or (3) anywhere outside Nevada	No	For purposes of analysis, collocated with the Rail Equipment Maintenance Yard

a. To convert square meters to square feet, multiply by 10.76.
b. To convert square kilometers to acres, multiply by 247.10.
c. DOE would implement the Proposed Action only after the proposed public land withdrawal for the Yucca Mountain Site was completed, when land ownership would be transferred to DOE.

Because the basis for rail line impacts is the construction right-of-way, impacts from construction camps, some construction wells, and some facilities that fall within the construction right-of-way are already accounted for, and those impacts are not addressed separately. Although not all the well locations identified would be used for the project, for purposes of analysis and to conservatively estimate impacts to land use and ownership, DOE assumes that it would develop all the well locations outside the rail line construction right-of-way and ***footprints*** of the quarry sites.

4.3.2.2 Construction Impacts to Land Use and Ownership

Sections 4.3.2.2.1 through 4.3.2.2.8 discuss potential land-use impacts during the construction phase. Because potential impacts to land use would occur primarily from the presence of the rail line, the construction timeframe (which could range from 4 to 10 years) would have little effect on the resulting land-use impacts, other than to provide greater lead time to implement mitigation measures, establish land-use agreements, and revise ***grazing allotment*** permits where applicable. Therefore, DOE did not assess potential land-use impacts for different construction timeframes.

Table 4-154 provides an overview of the land ownership within the proposed construction right-of-way and locations of support facilities.

Table 4-154. Land ownership by common or alternative segment within the proposed construction right-of-way and facilities outside the construction right-of-way[a] (page 1 of 2).

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)[b]
Staging Yard at Hawthorne	Public (BLM-administered)	0.25	63
	Hawthorne Army Depot	1.1	270
Construction camp 17	Hawthorne Army Depot	0.08	20
Schurz alternative segment 1	Walker River Paiute Reservation	3.5	850
	Public (BLM-administered)	0.53	130
Schurz alternative segment 4	Walker River Paiute Reservation	4.7	1,170
	Public (BLM-administered)	0.53	130
Schurz alternative segment 5	Walker River Paiute Reservation	5.0	1,240
	Public (BLM-administered)	2.0	490
Schurz alternative segment 6	Walker River Paiute Reservation	5.3	1,320
	Public (BLM-administered)	2.0	490
Mina common segment 1	Private	0.21	53
	Hawthorne Army Depot	3.45	860
	Public (BLM-administered)	30	7,403
Montezuma alternative segment 1	Public (BLM-administered)	36	8,760
Montezuma alternative segment 2	Private	0.24	59
	Public (BLM-administered)	24	5,870

Table 4-154. Land ownership by common or alternative segment within the proposed construction right-of-way and facilities outside the construction right-of-way[a] (page 2 of 2).

Rail line segment or facility	Land ownership	Area (square kilometers)[b]	Area (acres)[b]
Montezuma alternative segment 3	Private	0.1	25
	Public (BLM-administered)	42	10,460
Mina common segment 2	Public (BLM-administered)	1.1	260
Bonnie Claire alternative segment 2	Public (BLM-administered)	6.14	1,520
Bonnie Claire alternative segment 2	Public (BLM-administered)	6.1	1,500
Common segment 5	Public (BLM-administered)	12	2,950
Oasis Valley alternative segment 1	Private	0.04	9.9
	Public (BLM-administered)	3.8	940
Oasis Valley alternative segment 3	Public (BLM-administered)	5.3	1,300
Common segment 6	Public (BLM-administered)	12	2,880
	Public (DOE)	4.1	1,020

a. Source: DIRS 181617-Hopkins 2007, all.
b. Land area values are rounded to two significant figures, except for values over 1,000, which are rounded to the nearest 10.

4.3.2.2.1 Private Land

4.3.2.2.1.1 County and Local Land-Use Plans. In general, DOE developed the Mina rail alignment to avoid private land. There would be no land-use conflicts in terms of county land use, projects, or planning.

- *Nye County Comprehensive Plan* (DIRS 147994-McRae 1994, all)

  This plan addresses the proposed Yucca Mountain ***Repository*** and states that the repository could affect the county's future economy and the quality of life of its residents. The plan does not address the proposed railroad. However, DOE has determined that a rail line along the Mina rail alignment would not substantially alter current land uses or impact future land-use plans in Nye County.

- *Esmeralda County Master Plan* (DIRS 176770-Duval et. al. 1976, all)

  This plan predates plans for a repository at Yucca Mountain; therefore, it does not address the project. The plan states that the county must be consulted on all proposed federal projects. DOE continues to consult with Esmeralda County on the Proposed Action. DOE has determined that a rail line along the Mina rail alignment would not substantially alter current land uses or impact future land-use plans in Esmeralda County. The only private land that would be impacted within an established town in Esmeralda County would be along Montezuma alternative segment 2 near Goldfield.

Although there is no zoning designation in the community of Goldfield, the designation of its historic district is a consideration for determining potential adverse impacts to land use. The historic district would be approximately 0.6 kilometer (0.4 mile) from Montezuma alternative segment 2 construction right-of-way. Goldfield has been historically linked with both mining and railroad activity. Therefore, a new rail line adjacent to the town would not be a wholly incompatible feature with its historic characteristics. The BLM, DOE, and the Surface Transportation Board (STB) signed a Programmatic Agreement regarding the Yucca Mountain rail alignment project with the Nevada State Historic Preservation Office on April 17, 2006, to formalize the consultation process (DIRS 176912-Wenker et. al. 2006, all). As for any other potential cultural resources along the rail alignment, DOE would consult with the State Historic Preservation Office to determine potential impacts and possible mitigation measures (see discussion in Section 4.3.13, Cultural Resources).

4.3.2.2.1.2 Private Parcels. DOE would need to gain access to private land that falls within the Mina rail alignment construction right-of-way and the locations of support facilities. Segments that would cross private lands include Mina common segment 1, Montezuma alternative segments 2 and 3, and Oasis Valley alternative segment 1. None of the other segments would cross private land. Table 4-155 lists private lands the Mina rail alignment could affect. No residences or other privately owned structures would lie within the Mina rail alignment construction right-of-way.

Table 4-155. Uses of private land along the Mina rail alignment.

Segment and land use	Number of parcels within the construction right-of-way	Area of parcels within the construction right-of-way (square meters)[a]
Mina common segment 1		
Vacant	1	213,000
Montezuma alternative segment 2		
Vacant	28	177,000
Residential	1	470
Commercial	1	65
Utilities	4	9,500
Patented mining claims	4	137,000
Montezuma alternative segment 3		
Vacant	1	99,000
Oasis Valley alternative segment 1		
Commercial	1	40,000

a. To convert square meters to acres, multiply by 0.000247.

Mina common segment 1 would cross approximately 0.21 square kilometer (52.6 acres) of private land (Figure 3-138) just east of the Hawthorne Army Depot. DOE would need to gain access to this land.

Montezuma alternative segments 2 and 3 would cross 0.1 square kilometer (24.4 acres) of private vacant land at Millers (Figure 3-140). DOE would need to gain access to this land, which would cause a change of land use.

Montezuma alternative segment 2 would pass to the immediate west and south of the community of Goldfield, which is clustered along U.S. Highway 95. The Montezuma alternative segment 2 construction right-of-way would intersect 37 privately owned parcels with at least 20 individual landowners (0.24 square kilometer [58 acres]) (see Table 4-154 and Figure 3-140). Esmeralda County owns 12 of the 37 parcels (including 4 patented ***mining claims***), and the Nevada Department of Highways owns one parcel (while state and county entities own 13 parcels, they are non-federal lands and still considered private land in this Rail Alignment EIS). If DOE selected Montezuma alternative segment 2, DOE would gain access to portions of privately owned land, resulting in changes of land use.

The Oasis Valley alternative segment 1 construction right-of-way would cross one parcel owned by a cattle company (see Figure 3-143), impacting 0.04 square kilometer (9.9 acres) of land. DOE would need to gain access to this land, causing a change to land use.

4.3.2.2.2 American Indian Land

4.3.2.2.2.1 Walker River Paiute Reservation. There are no land-use plans for the Walker River Paiute Reservation. However, DOE developed the Schurz alternative segments in consultation with the Tribe to avoid Schurz and other populated areas on the Reservation.

While the nominal width of the construction right-of-way for most of the Mina rail alignment is 300 meters (1,000 feet), DOE has reduced the proposed width along the Schurz alternative segments to 61 meters (200 feet) to minimize disturbance to the Reservation. The construction right-of-way of the Schurz alternative segments would occupy between 3.5 and 5.3 square kilometers (850 and 1,300 acres) of land on the Reservation. This represents a very small area in relation to the entire Reservation, ranging from 0.3 and 0.5 percent of the land area. Because most of the Reservation is rangeland, the rail line could cause a small reduction of land available for grazing and farming. There would also be construction well sites located outside the construction right-of-way on Reservation land: one along Schurz alternative segments 4 and 5, or two along Schurz alternative segment 6. Each well would disturb an additional 5,800 square meters (1.4 acres) of land.

DOE developed the Schurz alternative segments to comply with the Walker River Paiute Tribe’s wish to ultimately remove the Department of Defense Branchline through Schurz, which runs directly through Schurz, where most of the Tribe resides. The Tribe based this request on safety concerns related to the current rail shipments of Army munitions through their town. Therefore, as part of the Mina rail alignment, DOE would remove the Department of Defense Branchline through Schurz once the selected Schurz alternative segment was constructed. Removal of the existing rail line would provide a perceived benefit to the town’s existing residential land uses and the remaining rail roadbed could become a recreational trail for the Walker River Paiute Tribe.

In April 2007, the Walker River Paiute Tribe Tribal Council passed a resolution removing the Tribe from the DOE EIS process and will not allow ***nuclear waste*** to be transported by rail through the Reservation.

If the Mina rail alignment was selected, DOE would seek to obtain a right-of-way across the Reservation in accordance with 25 CFR 169 (Bureau of Indian Affairs, Department of Interior, Part 169, Right of Way Over Indian Lands), the provisions of which restrict the width of new rights-of-way to 30 meters (9100 feet). Under this regulation (169.3(a)), “No right-of-way shall be granted over and across any tribal land, nor shall any permission to survey be issued with respect to any such lands, without the prior written consent of the tribe.”

4.3.2.2.2.2 Timbisha Shoshone Trust Land. During the scoping period for this Rail Alignment EIS in 2004, DOE received comments from the Western Shoshone Nation indicating that a rail line crossing Timbisha Shoshone Trust Land would be incompatible with current and planned land uses. The opposition was based, in part, on treaty issues involving land in the vicinity of the Caliente rail alignment (see Section 3.4). The Department subsequently eliminated Bonnie Claire alternative segment 1, which would have crossed onto Timbisha Shoshone Trust Land, from analysis in this Rail Alignment EIS.

4.3.2.2.3 BLM-Administered Public Land

4.3.2.2.3.1 Consistency with BLM Resource Management Plans. Some portions of the Mina rail alignment would cross federal land the BLM has identified for potential disposal (sale). The ***withdrawal*** of these lands along the rail alignment for other federal use would take precedence over potential land disposals. While this federal use would not pose a conflict with BLM ***resource management plans***, the community or public would lose the ability to use affected land for future economic or private development.

- *Carson City Field Office, Consolidated Resource Management Plan* (Carson City Consolidated Resource Management Plan; DIRS 179560-BLM 2001, all)

  The northernmost segments of the Mina rail alignment (the Union Pacific Railroad Hazen Branchline, Department of Defense Branchline North, the Schurz alternative segments, Department of Defense Branchline South, and most of Mina common segment 1) would pass through ***public lands*** covered by the Carson City Consolidated Resource Management Plan. Under that plan, future right-of-way corridors will be evaluated on a case-by-case basis, but should be as consistent as possible with the Western Regional Corridor Study and existing roads and trails should be used whenever possible during construction. The Mina rail alignment would be collocated with existing powerline rights-of-way near U.S. Highway 95 and would also generally follow the former Tonopah and Tidewater railroad route. The Mina rail alignment would not cross any right-of-way avoidance areas. Therefore, the Mina rail alignment would not conflict with Carson City Consolidated Resource Management Plan right-of-way provisions. Mina common segment 1 would intersect the western edge of land disposal areas near Mina and Sodaville. Because DOE has withdrawn the land for study and there are no active disposal actions underway, this rail segment would not conflict with the land disposal provisions of the Carson City Consolidated Resource Management Plan. New segments would cross several grazing allotments in the Carson District. Therefore, if DOE selects the Mina rail alignment, the BLM would need to adjust applicable livestock permits to reflect decreases in public land forage available in accordance with the resource management plan.

- *Tonopah Resource Management Plan and* ***Record of Decision*** (Tonopah Resource Management Plan; DIRS 173224-BLM 1997, all)

  The Tonopah Resource Management Plan designates 1,075 kilometers (668 miles) for transportation and utility corridors (DIRS 173224-BLM 1997, p. 2). It also allows rights-of-way on more than 600 square kilometers (149,000 acres) if the land use is compatible with existing land values.
  The Tonopah Resource Management Plan identifies areas for potential disposal at Coaldale Junction, Blair Junction, Silver Peak, Millers, Goldfield, Scottys Junction, and Beatty. The plan does not specifically address the portions of land released from withdrawal in 1999 adjacent to (on the western border of) the Nevada Test and Training Range. Because withdrawal for other federal use has precedence over potential land disposals, there would be no conflict with the Tonopah Resource Management Plan.

- *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (Las Vegas Resource Management Plan; DIRS 176043-BLM 1998, all)

  The Las Vegas Resource Management Plan designates corridors within its planning area to avoid ***Areas of Critical Environmental Concern***. The proposed rail alignment would not pass through or near any right-of-way avoidance areas, such as Areas of Critical Environmental Concern. The portion of the rail alignment (common segment 6) that would pass through this district would be on land for which DOE already has a temporary right-of-way and is slated for future land withdrawal for the Yucca Mountain Project. Therefore, there would be no conflict with the Las Vegas Resource Management Plan.

BLM-administered lands encompassing the Mina rail alignment have been withdrawn from surface and mineral entry to avoid land-use conflicts in the near term (70 *FR* 76854, December 28, 2005). Furthermore, this withdrawal takes precedence over potential land disposals that might be planned in and around the rail alignment. Under the terms of the BLM land-disposal policy, identification of the lands for another federal purpose, such as the proposed railroad, would disqualify the land for disposal for other uses. Therefore, there would be no conflict with BLM land-use plans or policies.

4.3.2.2.3.2 Construction Impacts to BLM Grazing Allotments. Construction of the rail line and support facilities would result in surface disturbances across a number of grazing allotments. Wherever the rail line would cross a grazing allotment, DOE quantified the amount of forage loss in animal unit months.

DOE calculated potential loss of animal unit months as the proportion of land within each grazing allotment that would be crossed by the footprints of the rail line construction right-of-way and support facilities. The Department did not consider site-specific allotment characteristics. The BLM would determine actual loss of animal unit months for each affected allotment in association with the issuance of a ***right-of-way grant***. For this analysis, DOE conservatively assumed that all the area within the rail line construction right-of-way would be unavailable for forage. Section 4.3.9, Socioeconomics, describes the economic consequences of reductions in permitted animal unit months.

The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. The rail line could pose additional risk to ranching operations in that livestock may be struck by passing trains. DOE or the commercial operator (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. The rail line could intersect existing fences on active grazing allotments. The BLM and DOE would review with the affected allotment permittees the need to restore fences.

The Mina rail alignment would cross one stockwater pipeline on an active grazing allotment (Mina common segment 1 crossing of the Pilot-Table Mountain Allotment) and one or more on the inactive Montezuma Allotment. During the construction phase, the Department would sleeve these pipelines within a casing pipe under the rail roadbed to protect them and keep them operational. The casing pipe would be capable of withstanding the load of the roadbed, track, and rail traffic.

There would also be a number of new construction wells on grazing allotments outside the construction right-of-way. The well footprints would be small (approximately 0.0057 square kilometer [1.4 acres] each) and would not affect grazing patterns except for the presence of human activity during the construction phase.

<u>Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North</u>
DOE would use the existing rail line along the Union Pacific Railroad Hazen Branchline and the Department of Defense Branchline North. Because there would be no new construction outside of the existing right-of-way, there would be no impacts to the use of the land for grazing along these segments, although increased train traffic along these lines could increase the possibility of livestock being struck by trains.

<u>Schurz Alternative Segments</u> The Schurz alternative segments would begin within the Parker Butte Allotment (see Figure 3-146). However, most of the length of these segments would be on the Walker River Paiute Reservation. Although information on current grazing operations on the Reservation is not available, years of drought have put farming and ranching on hold (DIRS 180701-National American Indian Housing Council 2004, p. 30). Therefore, impacts to grazing land from the Schurz alternative segments would be small.

Department of Defense Branchline South DOE would use existing rail line along Department of Defense Branchline South. Because there would be no new construction outside of the existing right-of-way, there would be no impacts to the use of the land for grazing along these segments, although increased train traffic along these lines could increase the possibility of livestock being struck by trains.

Mina Common Segment 1 Mina common segment 1 would pass through three active grazing allotments (Pilot-Table Mountain, Bellville, and Monte Cristo) and one closed grazing allotment (Columbus Salt Marsh) (see Figures 3-147 and 3-148). DOE estimates that this segment could reduce animal unit months across all the active allotments by 104. Table 4-156 lists reductions in animal unit months per grazing allotment. There could be one construction well outside the Mina common segment 1 construction right-of-way that would disturb an additional 0.0057 square kilometer (1.4 acres) of land on the Columbus Salt Marsh Allotment. The land disturbance for this well would not impact grazing operations because the Columbus Salt Marsh Allotment is inactive. However, if DOE decided to leave some wells in place after the construction phase, the Department could make those wells available to ranchers in the future, which would provide additional sources of stockwater.

There are two potential quarry sites along Mina common segment 1. The potential Garfield Hills quarry would impact both the Garfield Flat and Pilot-Table Mountain Allotments, reducing their animal unit months by 4 and 1, respectively. The potential Gabbs Range quarry would impact the Pilot-Table Mountain Allotment, reducing its animal unit months by 4 (see Table 4-156).

Table 4-156. Potential loss of animal unit months associated with Mina common segment 1.

Allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Pilot-Table Mountain	19	7,900 on 2,020 square kilometers	74	0.9
Bellville	0.90	303 on 630 square kilometers	1	0.3
Monte Cristo	6.34	9,352 on 2,010 square kilometers	29	0.3
Columbus Salt Marsh		None		
Totals	26	17,555 animal unit months	1,044	0.6
Garfield Flat (potential Garfield Hills quarry)	0.99	3,516 on 890 square kilometers	4	0.1
Pilot-Table Mountain (potential Garfield Hills quarry)	0.09	7,900 on 2,020 square kilometers	1	0.01
Pilot-Table Mountain (potential Gabbs Range quarry)	0.97	7,900 on 2,020 square kilometers	4	0.2

a. Source: Refer to Table 3-85 for source information.
b. To convert square kilometers to acres, multiply by 247.10.

Montezuma Alternative Segment 1 Montezuma alternative segment 1 would pass through the Columbus Salt Marsh, Silver Peak, Sheep Mountain, Yellow Hills, Montezuma, and Magruder Mountain Allotments (see Figures 3-149 and 3-150). All but Columbus Salt Marsh and Montezuma are active allotments. This segment would pass through the West Pasture of the Montezuma Allotment (near the Yellow Hills Allotment). At present, there is one temporary grazing permit (1 year for 600 animal unit months) for the West Pasture, but that permit will expire in March 2008. DOE estimates that this alternative segment could reduce animal unit months across all the active allotments by 117. See Table 4-157 for reductions in animal unit months per grazing allotment.

Table 4-157. Potential loss of animal unit months associated with Montezuma alternative segment 1.

Allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Columbus Salt Marsh	23	None		
Silver Peak	8.1	436 on 1,430 square kilometers	3	0.7
Sheep Mountain	1.9	1,740 on 360 square kilometers	9	0.5
Yellow Hills	4.8	1,212 on 20 square kilometers	23	1.9
Montezuma	14	None		
Magruder Mountain	3.5	6,300 on 267.92 square kilometers	82	1.3
Totals	55	9,688 animal unit months	117	1.2
Montezuma (potential North Clayton quarry)	1.8	None		
Montezuma (potential Malpais Mesa quarry)	2.7	None		

a. Source: Refer to Table 3-85 for source information.
b. To convert square kilometers to acres, multiply by 247.10.

There are two potential quarry sites along Montezuma alternative segment 1: North Clayton and Malpais Mesa. Both would be on the inactive Montezuma Allotment and neither would have an impact on grazing operations.

Montezuma Alternative Segment 2 Montezuma alternative segment 2 would pass through the Columbus Salt Marsh, Monte Cristo, and Montezuma Allotments (see Figures 3-149 through 3-151). Only the Monte Cristo Allotment is active. DOE estimates that Montezuma alternative segment 2 could reduce animal unit months within the Monte Cristo Allotment by 47 (see Table 4-158).

There is one potential 1.5 square kilometer (360 acre) quarry site along the alternative segment, ES-7, which would be on the inactive Montezuma Allotment and would not have an affect on grazing operations.

Table 4-158. Potential loss of animal unit months associated with Montezuma alternative segment 2.

Allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Columbus Salt Marsh	2.2	None		
Monte Cristo	10	9,352 on 2010 square kilometers	47	0.5
Montezuma	14	None		
Totals	26	9,352 animal unit months	47	0.5
Montezuma (potential ES-7 quarry)	1.5	None		

a. Source: Refer to Table 3-85 for source information.
b. To convert square kilometers to acres, multiply by 247.10.

Montezuma Alternative Segment 3 Montezuma alternative segment 3 would pass through the Columbus Salt Marsh, Monte Cristo, Montezuma, and Magruder Mountain Allotments (see Figures 3-149 through 3-151). Only the Monte Cristo and Magruder Mountain Allotment are active. This segment would pass through the West Pasture of the Montezuma Allotment (near the Yellow Hills Allotment). At present, there is one temporary grazing permit (1 year for 600 animal unit months) for the West Pasture, but that permit will expire in March 2008. DOE estimates that this alternative segment could reduce animal unit months in the affected grazing allotments by 129 (see Table 4-159).

Table 4-159. Potential loss of animal unit months associated with Montezuma alternative segment 3.

Allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Columbus Salt Marsh	2.2	None		
Monte Cristo	10	9,352 on 2,010 square kilometers	47	0.5
Montezuma	26	None		
Magruder Mountain	3.5	6,300 on 270 square kilometers	82	1.3
Totals	42	15,652 animal unit months	129	0.8
Montezuma (potential North Clayton quarry)	1.8	None		
Montezuma (potential Malpais Mesa quarry)	2.7	None		

a. Source: Refer to Table 3-85 for source information.
b. To convert square kilometers to acres, multiply by 247.10.

There are two potential quarry sites along the Montezuma alternative segment 3: North Clayton and Malpais Mesa. Both would be on the inactive Montezuma Allotment and neither would have an impact on grazing operations.

Mina Common Segment 2 Mina common segment 2 would cross a narrow stretch of the inactive Montezuma Allotment west of the Nevada Test and Training Range and east of the Magruder Mountain Allotment (see Figure 3-151). Because the Montezuma Allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along this segment.

Bonnie Claire Alternative Segments The Bonnie Claire alternative segments would cross a narrow stretch of the inactive Montezuma Allotment west of the Nevada Test and Training Range and east of the Magruder Mountain Allotment (see Figure 3-151). Because the Montezuma Allotment is inactive, there would be no impacts to grazing activities or stockwater resources during rail line construction along either of the Bonnie Claire alternative segments.

Common Segment 5 (Sarcobatus Flat Area) Common segment 5 would pass through the southern portion of the inactive Montezuma Allotment near the southwestern boundary of the Nevada Test and Training Range (see Figures 3-151 and 3-152). Because the Montezuma Allotment is inactive, rail line construction along common segment 5 would not impact grazing activities or stockwater resources.

Oasis Valley Alternative Segments The Oasis Valley alternative segments would cross the inactive Montezuma Allotment and the active Razorback Allotment (see Figure 3-152). The Razorback Allotment has one permittee. Oasis Valley alternative segment 1 would pass near the northeastern corner of the small Springdale 2 Allotment, but the construction right-of-way would not fall within the allotment. There are no stockwater features within the construction right-of-way of either of the Oasis Valley alternative segments.

Oasis Valley alternative segments 1 and 3 could result in the loss of 8 or 13 animal unit months, respectively, within the Razorback Allotment (see Table 4-160).

Table 4-160. Potential loss of animal unit months associated with the Oasis Valley alternative segments.

Alternative segment/allotment	Construction right-of-way area or impact area (square kilometers)[a]	Current animal unit months (maximum) and allotment area[b]	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Oasis Valley 1 – Razorback	2.3	959 animal unit months on 290 square kilometers	8	0.8
Oasis Valley 3 – Razorback	3.8	959 animal unit months on 290 square kilometers	13	1.4

a. Source: DIRS 173224-BLM 1997, p. A-14.
b. To convert square kilometers to acres, multiply by 247.10.

Common Segment 6 (Yucca Mountain Approach) Common segment 6 would cross a corner of the inactive Montezuma Allotment near the beginning of the common segment. At present, there are no permittees on this allotment (DIRS 176942-Metscher 2006, all). Common segment 6 would also pass through the Razorback Allotment (see Figure 3-152) and encompass approximately 5.3 square kilometers (1,300 acres) of the allotment. This would correspond to a potential loss of 18 animal unit months (1.9 percent loss of the grazing allotment) (see Table 4-161).

Table 4-161. Potential loss of animal unit months associated with common segment 6.

Allotment	Construction right-of-way area or impact area (square kilometers)[a,b]	Current animal unit months (maximum) and allotment area	Potential loss of animal unit months (as a direct correlation with land area removed)	Percent loss of animal unit months
Razorback	5.3	959 animal unit months on 290 square kilometers	18	1.9

a. Source: DIRS 173224-BLM 1997, p. A-14.
b. To convert square kilometers to acres, multiply by 247.10.

4.3.2.2.4 Department of Defense-Managed Land

The Mina rail alignment would use portions of the existing Department of Defense Branchlines and DOE would construct a new rail line across the Hawthorne Army Depot (Mina common segment 1). The Staging Yard would also be on the Depot. All new construction would occur within the active military area, near existing rail lines. The Army has concurred with the proposed location of the Mina rail line and facilities. One land-use compatibility concern would be meeting the Explosive Quantity Safety Distance between the ammunition storage areas and Army rail line to the planned Staging Yard, which would be occupied by personnel. Section 4.3.10, Occupational and Public Health and Safety, addresses these safety aspects.

The Department of Defense provided comments during the first scoping period for this Rail Alignment EIS in 2004, which resulted in DOE modifying Bonnie Claire alternative segment 2 and proposing Bonnie Claire alternative segment 3 as a new alternative segment to avoid crossing the Nevada Test and Training Range. These rail segment changes were carried through for the Mina rail alignment when it was added as an alternative. Specifically, the Air Force commented that the earlier proposed rail segments were "within the weapons safety footprint for test and training munitions" and that the rail line would "impinge on Range testing and training activities."

The closest segment to the Range would be Bonnie Claire alternative segment 2, the centerline of which would be approximately 100 meters (330 feet) from the Range boundary. The construction right-of-way for this segment has been reduced to specifically avoid entering Range land. Other segments closest to the Range and the distances of the edge of the construction right-of-way from the boundary include Montezuma alternative segment 2 (200 meters [660 feet]), common segment 5 (560 meters [1,800 feet]), and Oasis Valley alternative segment 3 (280 meters [920 feet]). While the Mina rail alignment would not directly affect land use on the Nevada Test and Training Range, portions of the Bonnie Claire alternative segment 2 and common segment 5 would cross land formerly within the western border of the Range. The land released by the Range now falls under the BLM Tonopah planning area. Portions of the rail line (common segment 5 and common segment 6) would be beneath restricted air space associated with the Range. However, testing and training activities within the restricted air spaces would generally not exceed the western boundary of the range and the Department of Defense would institute controls so that activities within related air spaces would not pose harm to the rail line. The proposed railroad would not interfere with Range activities and would not conflict with the Range's Resource and Management Plan.

4.3.2.2.5 DOE-Managed Land

The Rail Equipment Maintenance Yard, Cask Maintenance Facility, and a portion of common segment 6 would be within the Yucca Mountain Site boundary. These proposed maintenance facilities would be on land that is currently part of the Nevada Test Site, and used for Yucca Mountain Project characterization. Because the proposed railroad project would proceed only after control of the proposed Yucca Mountain Site was transferred to DOE, the Rail Equipment Maintenance Yard and Cask Maintenance Facility and portions of common segment 6 proposed within the Yucca Mountain Site boundary would not conflict with future land uses on the Nevada Test Site.

4.3.2.2.6 Construction Impacts to Mineral and Energy Resources (Public and Private Land)

Because of the relatively high mineral and energy potential of lands along the Mina rail alignment, DOE evaluated the potential impacts to these resources. Rail line construction would require that DOE gain access to lands that contain patented or ***unpatented mining claims*** or have active energy leases (oil, gas, or geothermal). Rail line construction would also require substantial quantities of ballast and subballast that would be obtained from existing or new quarry and ***borrow sites*** (see Sections 2.2.2.3.2 and 2.2.2.3.3). Section 4.2.11, Utilities, Energy, and Materials, describes the impact of the removal of material from the proposed quarries and ballast sites on regional material availability.

The land encompassing the Mina rail corridor was withdrawn through a ***public land order*** (see Chapter 1) from surface and mineral entry through December 2015 so DOE could evaluate the land for the possible location of a rail line. If the BLM granted DOE a right-of-way for the rail line before the public land orders expire, then surface and mineral entry prohibitions would be removed from lands not part of the right-of-way. Therefore, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases of the project. While the presence of the line would not necessarily preclude non-surface resource extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mining shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

4.3.2.2.6.1 Union Pacific Railroad Hazen Branchline and Department of Defense Branchline North. DOE would use the existing rail line along the Union Pacific Railroad Hazen Branchline and the Department of Defense Branchline North. Because there would be no new construction outside of the existing right-of-way, there would be no land-use impacts to mineral or energy resources along these segments.

4.3.2.2.6.2 Schurz Alternative Segments. The Schurz alternative segments would cross one or more mining districts. However, none of the districts (Calico Hills, Double Springs Marsh, Buckley, Benway, or Holy Cross) have active mining operations (see Figure 3-155). There are no patented or unpatented mining claims within the construction right-of-way of these segments. There are also no active geothermal, oil, or gas leases near the Schurz alternative segments. Therefore, there would be no land-use impacts to mineral or energy resources along these segments.

4.3.2.2.6.3 Department of Defense Branchline South. DOE would use the existing rail line along the Department of Defense Branchline South. Because there would be no new construction outside of the existing right-of-way, there would be no land-use impacts to mineral or energy resources along this segment.

4.3.2.2.6.4 Mina Common Segment 1. Mina common segment 1 would cross six mining districts, although only two of these have active mining or claims that would be impacted by the rail line (see Figures 3-156 through 3-158). The segment would bisect active mining claims in the New York Canyon area east of Luning and cross the Redlich claim block in the northern part of the Rock Hill District. Overall, the Mina common segment 1 construction right-of-way would intersect 20 sections that contain up to 388 unpatented mining claims. Because data on unpatented mining claims are provided by Township and Range Section, the actual number of mining claims within the construction right-of-way would likely be much less. DOE would negotiate surface rights across affected unpatented mining claims with the claim holders.

There are no active oil and gas leases within Mina common segment 1 construction right-of-way. However, it would cross the northeastern-most section of a geothermal lease block (Figure 3-157).

4.3.2.2.6.5 Montezuma Alternative Segments.

Montezuma Alternative Segment 1 Montezuma alternative segment 1 would cross the southwestern portion of Silver Peak Marsh Mining District where production of lithium is ongoing. This alternative segment would cross the Montezuma Mining District but would not intersect historically mined areas near Montezuma, Nevada. It would also cross the northeastern portion of the Cuprite Mining District where there is evidence of recent mining claims and trenching and drilling. Although there are no patented mining claims within the construction right-of-way, there are 17 sections containing up to 202 unpatented mining claims that intersect the construction right-of-way. These include one section southwest of the Alum Mining District; four sections on the western edge of the Silver Peak Marsh Mining District; seven sections south of the Montezuma Mining District; and five sections along U.S. Highway 95 near the Cuprite Mining District. Montezuma alternative segment 1 would cross several geothermal leases near the Alum Mining District and Silver Peak Marsh Mining District (see Figure 3-158).

Montezuma Alternative Segment 2 Montezuma alternative segment 2 would cross the Goldfield and Stonewall Mining Districts. Most of the mining in the Goldfield district occurs to the east of Montezuma alternative segment 2, although the segment's construction right-of-way would intersect four patented mining claims within the district. At present, there is exploration in the Stonewall Mining District 5 kilometers (3 miles) east of the alternative segment. The construction right-of-way would intersect 24 sections containing up to 655 unpatented mining claims. Two of the sections are approximately 10 kilometers (6 miles) east-northeast of Blair Junction. Four sections are approximately 6 to 8 kilometers (4 to 5 miles) north of Goldfield, and one section is to the west of the Stonewall Mining District. There are no geothermal or energy leases along this alternative segment, although there are geothermal occurrences near the segment in the vicinity of Ralston (see Figure 3-159).

Montezuma Alternative Segment 3 Montezuma alternative segment 3 would cross the Montezuma and Cuprite Mining Districts. The segment would be well north of historically mined areas near Montezuma, Nevada. It would also cross the northeastern portion of the Cuprite Mining District where there is evidence of recent mining claims and trenching and drilling. There are 19 sections containing up to 249 unpatented mining claims that would intersect the construction right-of-way. These include two sections south of the Gilbert Mining District along U.S. Highway 6; four sections approximately 8 kilometers north of Goldfield; one section within the northern portion of the Montezuma Mining District; seven sections south of the Montezuma Mining District; and five sections along U.S. Highway 95 near the Cuprite Mining District. There are no geothermal or energy leases along this alternative segment, although there are geothermal occurrences near the segment in the vicinity of Ralston (see Figure 3-159).

DOE would negotiate surface rights across affected unpatented mining claims with the claim holders and surface rights across geothermal lease areas with lease holders.

There are three underground mines or tunnels/shafts within the Montezuma alternative segments construction rights-of-way (see Figures 3-158 and 3-159). There is one underground mine near Millers along Montezuma alternative segments 2 and 3. There is one tunnel/shaft near Goldfield along Montezuma alternative segment 2 and one tunnel/shaft on the southern end of the Montezuma Mining District along Montezuma alternative segments 1 and 3. As discussed in Chapter 2, DOE would conduct further investigations, including drilling ***boreholes***, the use of ground penetrating radar or seismic analysis, to determine the extent of nearby underground features. The Department would then develop appropriate engineered solutions to address underground features.

4.3.2.2.6.6 Bonnie Claire Alternative Segments. The Wagner Mining District would lie between the two Bonnie Claire alternative segments, just to the west of Bonnie Claire alternative segment 3 (see Figure 3-160). There are patented mining claims in this district, but they would all be outside the construction right-of-way of each segment. There are no geothermal or oil and gas leases within the construction right-of-way of either segment. Therefore, there would be no direct impacts to mining or energy resource extraction along either alternative segment. Section 4.3.2.2.7.5 describes potential impacts associated with road access to the patented mining claims in the Wagner Mining District.

4.3.2.2.6.7 Common Segment 5 (Sarcobatus Flat Area). The southwestern portion of the Clarkdale Mining District would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, outside the construction right-of-way (see Figure 3-160). Almost two-thirds of the Clarkdale Mining District is on the Nevada Test and Training Range, and the historically mined areas of the district are far enough away from common segment 5 that there would be no impacts to mining activities as a result of rail line construction (DIRS 173841-Shannon & Wilson 2005, pp. 50 to 52).

There are geothermal resources along U.S. Highway 95 in Sarcobatus Valley, but none would be within the rail line construction right-of-way. There is one warm spring that would be approximately 0.8 kilometer (0.5 mile) northeast of common segment 5, and a hot well that would be approximately 0.4 kilometer (0.25 mile) northeast (DIRS 173841-Shannon & Wilson 2005, p. 50). There are no identified uses of these geothermal resources, and they would be far enough away from common segment 5 that they would not be affected by the rail line. The common segment 5 construction right-of-way would not cross any oil or gas lease areas.

4.3.2.2.6.8 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would intersect two sections containing 14 unpatented mining claims (DIRS 173841-Shannon & Wilson 2005, pp. 48 and 49); DOE would negotiate surface rights across affected unpatented mining claims with the claim holders for either alternative segment. There are oil and gas leases north of Beatty along the southwest flank of Pahute Mesa in southern Nye County (see Figure 3-161). Oasis Valley alternative segments 1 and 3 would cross portions of this oil and gas lease block (DIRS 173837-Sweeney 2005, pp. 49 and 50). At present, the lease is not in production, and records show that there has been no exploration in these areas since the 1970s. Therefore, the Oasis Valley alternative segments would not affect ongoing operations associated with this oil and gas lease.

4.3.2.2.6.9 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross the northern section of the Bare Mountain Mining District (see Figure 3-161). Most past mining activity in the district occurred more than 3 kilometers (2 miles) south of the common segment (see Figure 3-153). There are recently active gold mining operations within the district, approximately 6 to 8 kilometers (4 to 5 miles) from common segment 6. The Silicon Mine and Thompson Quicksilver Mine would be north of common segment 6. The Silicon Mine would be approximately 800 meters (2,500 feet) and the Thompson Quicksilver Mine would be approximately 1,400 meters (4,500 feet) outside the construction right-of-way. Recent mining activity in these areas would be outside the rail line construction right-of-way, and would not be directly affected by common segment 6. The common segment 6 construction right-of-way would intersect four sections containing 34 unpatented mining claims. DOE would negotiate the surface rights across unpatented mining claims with the claim holders. There are no energy leases (oil, gas, or geothermal) within the common segment 6 construction right-of-way.

4.3.2.2.7 Construction Impacts to Recreation and Access (Public and Private Lands)

DOE developed the Mina rail alignment alternative segments and common segments to avoid crossing sensitive areas, such as Wilderness Areas, ***Wilderness Study Areas***, state and national forests and parks, and other prominent recreational and scenic areas. DOE would maintain access for all existing roads the rail line would cross at or near their current location by constructing ***at-grade crossings*** (the road and the rail line would cross paths at the same elevation) or ***grade-separated crossings*** (the road and the rail line would cross paths via an overpass or an underpass), as appropriate, resulting in no long-term adverse impacts to traffic patterns and land access. However, there could be temporary small impacts to access to these areas during rail line construction due to temporary road closures and detours.

At locations where there would be several road crossings close to one another (generally over a distance of 0.8 kilometer [0.5 mile] or less), there could be some minor rerouting and consolidation of crossings but those would not prevent crossing the rail line. The regulatory authority to make decisions regarding roads, road closures, and rail line crossings rests with the BLM and county and local governments. DOE would work in close consultation with these groups to ensure access would be maintained.

Although many undeveloped recreation opportunities exist over much of the public lands surrounding the rail alignment (such as off-highway vehicle use and dispersed hunting), descriptions of potential impacts in Sections 4.2.2.2.7.1 through 4.2.2.2.7.3 are limited to defined recreation areas. While impacts to non-designated recreation areas are not specifically addressed, individuals might have to alter their access routes to particular recreation areas near the rail line. Construction of the rail line might also cause some dispersed recreationists (such as hunters) who use non-designated areas nearby to temporarily relocate. Future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and the construction and operation of the railroad. Most organized off-highway vehicle events with previously approved race routes are on existing roads and trails, and access across the rail line for these events would not be compromised. However, some previously permitted routes that the rail line would cross might need to alter their crossing locations in areas where crossing are consolidated.

4.3.2.2.7.1 Churchill County. DOE would use existing rail line along the rail segments in Churchill County. Therefore, there would be no impacts to recreation or access along segments in this county.

4.3.2.2.7.2 Lyon County. DOE would use existing rail line along the rail segments in Lyon County. Therefore, there would be no impacts to recreation or access along segments in this county.

4.3.2.2.7.3 Walker River Paiute Reservation. Common and alternative segments crossing through the Walker River Paiute Reservation would intersect a number of roads that provide access to nearby tribal and private lands.

DOE would remove the Department of Defense Branchline through Schurz, and DOE would transfer ownership of the rail roadbed and remaining structures to the Walker River Paiute Tribe. The Tribe would then have the option to convert the railbed to a recreational trail, potentially resulting in a positive impact to recreation on the Reservation. DOE would remove the ties, track, and ballast under the Mina Implementing Alternative.

The Weber Reservoir on the Walker River, which the Walker River Paiute Tribe manages, lies west of the Schurz alternative segments. Access to the reservoir is primarily via a light duty road that runs west-east between Alternate U.S. Highway 95 and U.S. Highway 95. Schurz alternative segments 1 and 4 would intersect this road east of the reservoir. If DOE selected either of these alternative segments, the Department would maintain access to the reservoir from U.S. Highway 95 with an at-grade-crossing of the rail line; access to the reservoir via this unpaved Reservation road from Alternate U.S. Highway 95 would not be affected.

In addition to U.S. Highway 95, which would intersect all of the alternative segments, the Schurz alternative segments would intersect a number of smaller roads and trails (see Figure 3164 and Table 3-89).

There are a number of private properties west of the alternative segments along the Walker River. Because these parcels would lie between the Schurz alternative segments and U.S. Highway 95, access to these areas would not be affected. There are no patented or unpatented mining claims and no active energy leases near any of the Schurz alternative segments.

4.3.2.2.7.4 Mineral County. Common and alternative segments crossing through Mineral County would intersect a number of roads that provide access to nearby public and private lands.

Recreational use along the rail alignment region of influence in Mineral County is generally dispersed, and DOE would maintain access across the rail line to recreation areas. However, access to the dispersed recreation areas east of Walker Lake and east of Mina, Nevada, could be temporarily affected due to construction of Mina common segment 1 at intersections with primary access roads and rail line construction through the extreme western portion of the recreation area near Mina. No impacts to the Gabbs Valley Range Wilderness Study Area or other recreation areas in Mineral County would occur.

The portion of Mina common segment 1 located in Mineral County would intersect a number of roads and trails (see Figures 3-165 through 3-197, and Table 3-89). Because this portion of Mina common segment 1 would essentially follow the route of U.S. Highway 95, there could be small impacts to private-land access east of the rail line during the construction phase. At the intersection of common segment 1 and State Route 361, which provides access to the unimproved roads to the Gabbs Valley Range Wilderness Study Area and several private parcels north of the common segment, a grade-separated crossing would be used to maintain access. Private parcels accessed via roads from U.S. Highway 95 that would be bisected by Mina common segment 1 include an area east of Hawthorne, Nevada, and another east of Mina. Additional private property along the common segment would be located west of U.S. Highway 95; therefore, access would not be affected.

Of the two actively mined claims Mina common segment 1 would bisect, the common segment would only intersect the primary access to the New York Canyon mine.

4.3.2.2.7.5 Nye County. Rail line common and alternative segments crossing through Nye County would intersect a number of roads that provide access to nearby public and private lands. There are no designated recreation areas in the immediate vicinity of rail segments in Nye County.

Bonnie Claire 2 and 3 and Mina common segment 2 would cross a limited number of roads and trails (see Figure 3-169 and Table 3-89). There is no active grazing of the land surrounding these segments. However, there are patented mining claims east of Bonnie Claire alternative segment 3 and west of Bonnie Claire alternative segment 2 (within the Wagner Mining District) (see Figure 3-169). If DOE selected Bonnie Claire alternative segment 3, the rail line would cross one access road to these mining claims.

There are more than a dozen privately owned properties that would be west of common segment 5 clustered at Scottys Junction. These properties lie on either side of U.S. Highway 95. Because the rail line would be to the east of these properties and not interfere with access from U.S. Highway 95, it would not impact access to land near Scottys Junction. Common segment 5 would cross one road that provides primary access from U.S. Highway 95 to oil and gas leases that would be north of the rail line and provides access to the Nevada Test and Training Range. DOE proposes an active at-grade crossing for this location (DIRS 176165-Nevada Rail Partners 2006, pp. D-1 and D-2).

Each of the Oasis Valley alternative segments would cross three roads (see Figure 3-170). Roads in this area provide access to private property owned by a cattle company; the northern portion of the Razorback Allotment; oil and gas leases; and the Nevada Test and Training Range. Oasis Valley alternative segment 3 would pose minimal restriction to road access from U.S. Highway 95 to the oil and gas leases and privately owned land, and access within the Razorback Allotment because it would be farthest away from these established areas.

Common segment 6 would cross roads that provide access to the Nevada Test and Training Range and the northern portion of the Razorback Allotment (see Figure 3-170). The only privately owned properties in the vicinity of common segment 6 are west of the rail alignment at its northernmost point. These properties are adjacent to U.S. Highway 95 and the rail line would not impact access thereto.

4.3.2.2.7.6 Esmeralda County. Rail line common and alternative segments crossing through Esmeralda County would intersect a number of roads that provide access to nearby public and private lands.

Recreation along the proposed rail alignment in Esmeralda County is generally dispersed, and there are no developed BLM recreation areas within the region of influence. Mina common segment 1 would cross a small portion of the proposed site for the Monte Cristo State Park directly adjacent to U.S. Highways 95 and 96. The common segment would not approach the geologic features cited by park proponents as the basis for designation, because it would not enter the Monte Cristo Range, and thus would not affect the area or its unique attributes. Additionally, the common segment would not cross the existing access road to the area. There would be no impacts to the Silver Peak Wilderness Study Area, Clayton Valley Special Recreation Management Area, or other designated recreation features in Esmeralda County.

Private property along Mina common segment 1 would be primarily located west of U.S. Highway 95; and therefore, access to these areas would not be affected.

In addition to U.S. Highway 95 (grade-separated crossing), the Montezuma alternative segments would cross a number of roads and trails (see Figures 3-167 and 3-168, and Table 3-89).

Access to private land near Montezuma, Nevada, from Silver Peak Road is via Montezuma Wells Road, which Montezuma alternative segment 1 would cross twice; access to private land north of Silver Peak from State Route 265 is via Paymaster Canyon Road, which the alternative segment would cross once. Montezuma alternative segment 1 would intersect Silver Peak Road, the primary access to the active lithium mining area near Silver Peak, but DOE would maintain access with a passive road crossing. The alternative segment would also bisect East Railroad Springs Road and several unnamed off-road vehicle trails, which provide access from U.S. Highway 95 to areas of the Montezuma Range and Goldfield Hills that contain numerous unpatented mining claims (see Figure 3-168).

Montezuma alternative segment 2 would cross through or near numerous unpatented and patented mining claims, resulting in small temporary impacts to access during rail line construction. Access to claims near Goldfield is from U.S. Highway 95 and Silver Peak Road via a series of unpaved roads and off-road vehicle trails. The alternative segment would intersect Silver Peak Road (at-grade passive crossing) and a number of minor roads and off-road vehicle trails in this area (see Figure 3-168). Montezuma alternative segment 2 would also intersect additional roads and trails that provide access from U.S. Highway 95 to the active ***mining areas*** near Stonewall Flats (see Figure 3-168).

Access to private parcels near Montezuma alternative segment 2 in Goldfield and Millers, Nevada, could experience temporary impacts during rail line construction. Access to the private parcels near Millers from U.S. Highway 95 is via two unnamed roads, both of which would intersect the alternative segment; access to private parcels just west of U.S. Highway 95 in Goldfield is via several roads and off-road vehicle trails that would intersect the segment.

Montezuma alternative segment 3 would bisect East Railroad Springs Road and several unnamed jeep trails that provide access from U.S. Highway 95 to areas of the Montezuma Range and Goldfield Hills containing unpatented mining claims. Access to private parcels near Montezuma alternative segment 3 in the historic towns of Millers and Montezuma could suffer temporary small impacts due to rail line construction where the alternative segment and primary access roads intersect. Access to private parcels near Millers is from U.S. Highway 95 via two unnamed roads; access to private land near the town of Montezuma from Silver Peak Road is via Montezuma Wells Road.

4.3.2.2.8 Land-Use Conflicts with Utility Corridors and Rights-of-Way

Where the rail line would cross an existing utility right-of-way, DOE would take precautions to minimize disturbance and disruption of the utilities. Section 4.3.11, Utilities, Energy, and Materials, describes measures the Department would implement to protect existing utilities.

Of the 367 kilometers (228 miles) of new rail line proposed under the longest possible alignment, 161 kilometers (100 miles), or 44 percent, would fall within corridors designated by applicable resource management plans (this does not include use of existing rail line or rail line through the Walker River Paiute Reservation). However, the resource management plans allow for transportation rights-of-way outside these designated corridors if no other option is feasible and the right-of-way would not substantially conflict with other land-use goals and designations. No parts of the rail line common segments or alternative segments would cross right-of-way avoidance areas. DOE would perform field verifications of utility right-of-way locations and would incorporate the information into the final rail line design.

Because final engineering design for utility connections is still underway, the exact tie-in locations for electricity along the rail alignment are unknown. While it is expected that transmission lines could be tapped where they currently cross the rail line, there is a possibility that the project could require additional utility rights-of-way for small feeder lines.

4.3.2.3 Operations Impacts

Land-use and ownership impacts would occur before or during the railroad construction phase. The operations right-of-way would be generally narrower than the construction right-of-way along most of the rail alignment, and some of the land could therefore be returned to its previous uses.

Topics related to the quality-of-life aspects of land use include visual quality, air quality, and noise and vibration, as described in other sections of this Rail Alignment EIS (see Section 4.3.3, Aesthetic Resources; Section 4.3.4, Air Quality and Climate; and Section 4.3.8, Noise and Vibration).

Railroad operations could affect the use of grazing land. For example, the presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes after construction of the rail line was complete. The noise and presence of people along the rail alignment during construction activities could cause livestock to avoid nearby areas at first, although they could become accustomed to the presence of people over time (DIRS 176920-Metscher 2005, p. 4).

Nevada is an open-range state, where it is the responsibility of private landowners to fence their properties to prevent livestock from damaging their property and where ranchers could be compensated for the loss of their livestock killed by vehicles and trains. If DOE trains struck and killed livestock, DOE or the commercial carrier (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate.

As discussed in 4.3.2.2.6, the BLM could issue new unpatented mining claims and energy leases on lands near the rail line during the construction and operations phases. While the presence of the rail line would not necessarily preclude non-surface resource extraction activities, the applicant would be required to work closely with the BLM and DOE to ensure they would not interfere with the safe operation of the railroad. Engineering solutions for the safe extraction of mineral and energy resources near or beneath the rail line could include directional (lateral) drilling of wells or ensuring all mining shafts or tunnels were sufficiently deep and reinforced to prevent subsidence.

The parallel rail alignment access roads (unpaved) could improve land access along most of the rail alignment. While most of the rail alignment would follow or be within a few kilometers of existing unpaved roads and trails that are currently open for public use, the new access roads could be of better quality in some areas than nearby existing roads, increasing the likelihood of use. Off-road vehicle use, hunting intensity, and other recreational activities could increase along the rail alignment access roads. Improved human and vehicle access to surrounding areas could result in indirect impacts to vegetation and wildlife, as described in Section 4.3.7, Biological Resources. Recreational use of public land along the access roads (as with other similar roads on public land) would be monitored by the BLM to ensure compliance with its land management goals, as stated in applicable BLM resource management plans. It is important to note that DOE would not maintain the access roads as public roads, except in locations where they would be used for rerouting to consolidate rail line crossings, and the Department would post signs indicating potential users would proceed on the roads at their own risk.

Lastly, future Special Recreation Permits issued by applicable BLM offices would take the presence of the rail line into consideration to minimize impacts to both the applicant and operation of the rail line. This may require new routes to minimize or avoid crossing the rail line and greater manpower to implement and monitor these new routes during recreation events.

4.3.2.4 Impacts under the Shared-Use Option

Impacts to land use and ownership under the Shared-Use Option would be similar to those described for the Proposed Action without shared use, with a small addition of impacts from the construction and operation of commercial sidings. Under the Shared-Use Option, commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials (see Section 2.2.6.3). DOE cannot predict the exact locations of these possible commercial-use sidings, but locations could include Luning, Mina, the Goldfield area, Silver Peak, and the Beatty/Oasis Valley area. The sidings would likely be constructed within the operations right-of-way; if so, there would be no additional impacts to land use and ownership (see Figure 2-55). Because only approximately 0.5 percent (approximately 0.5 square kilometer [121 acres]) of land within the rail line construction right-of-way is privately owned, any commercial sidings or commercial facilities that would be outside the construction right-of-way would likely be on BLM-administered land, and implemented under a separate BLM-issued right-of-way.

Implementation of the Shared-Use Option could facilitate the expansion or introduction of industrial (mining) or commercial operations in the region. This could have future, ***long-term impacts*** on land use, such as new or revised land-use zoning plans to accommodate industrial and commercial land uses in the vicinity of the rail line. The expansion of industrial or commercial activity from shared use of the rail line could also indirectly result in land-use changes in relation to additional residential development. Increased rail traffic could also increase the likelihood of livestock mortality along the rail line within active grazing allotments.

4.3.2.5 Summary

The Mina rail alignment construction right-of-way would occupy between 102 and 125 square kilometers (25,200 to 30,900 acres) of land. Most of this would be public land, although DOE would need to gain access to up to 0.5 square kilometer (121 acres) of private land along the rail alignment. This amount of private land would be very small (about 0.5 percent) compared to the total amount of land that would be required for the project. The Mina rail alignment would not displace existing or planned land uses over a substantial area, nor would it substantially conflict with applicable land-use plans or goals. The area with the highest density of private land the rail alignment would cross is Goldfield (Montezuma alternative segment 2). These lands include private yet vacant land, including patented mining claims and state and county land.

The Schurz alternative segments would cross the Walker River Paiute Reservation, utilizing between 0.3 and 0.5 percent of the Reservation's land (up to 5.3 square kilometers [1,300 acres]), depending on segment. At present, the Walker River Paiute Tribe does not support routes over their Reservation and their concurrence would be necessary to secure a right-of-way for the rail line. Under the Mina Implementing Alternative, DOE would remove existing Department of Defense rail line through Schurz, providing a perceived benefit to the town's existing residential land uses; the Tribe could also use the existing roadbed as a recreational trail. DOE developed the Bonnie Claire alternative segments to avoid American Indian lands. The closest segment, common segment 5, would be approximately 3 kilometers (2 miles) east of the Timbisha Shoshone Trust Land.

The Mina rail alignment would use up to 113.3 square kilometers (28,000 acres) of BLM-administered land. Some of the rail line segments would pass through lands the BLM has identified for potential disposal (sale). However, the land withdrawals already in place for the rail alignment and the potential use by another federal agency would take precedence over disposal actions that could affect the project.

The Mina rail alignment would cross 4.6 square kilometers (1,145 acres) of land within the Hawthorne Army Depot near its northern border where it would not pose a conflict with the base's mission or land uses.

Where the rail segments and facilities would cross active grazing allotments on BLM-administered land, some grazing land would be lost. Because the land would be restored after the construction phase and the operations right-of-way would be smaller than the construction right-of-way, long-term impacts to grazing allotments would be small. In total, the Mina rail alignment would result in less than a 2-percent loss of animal unit months across all affected allotments. The presence of a rail line could require livestock on some allotments to adjust to new routes to access water and forage. Generally, livestock could learn these new routes and acclimate to and cross the rail line in most areas. The rail line could affect ranching operations because livestock could be struck by passing trains. DOE or the railroad's commercial operator (under the Shared-Use Option) would reimburse ranchers for such losses, as appropriate. DOE would consult with the BLM during the final design phase to determine if any of the rail line would need to be fenced.

Construction wells located on grazing allotments outside the construction right-of-way would have small and temporary impacts in terms of loss of grazing area. Once each well was drilled, DOE would reclaim the site in accordance with DOE and BLM requirements. The Department would construct a 10- to 15-centimeter (4- to 6-inch)-diameter temporary pipeline on top of the ground along access roads to transport water to the construction right-of-way. Wells not needed for railroad operations would be properly abandoned in compliance with State of Nevada regulations and sites and access roads would be reclaimed (DIRS 176172-Nevada Rail Partners 2006, p. 4-12).

Most of the local mining activity would be outside the rail line construction right-of-way. DOE would need to negotiate the surface rights to cross the few affected unpatented mining claims the rail line would cross. The Mina rail alignment would cross potentially up to half the number of unpatented mining claims than the Caliente rail alignment. Mina common segment 1 would cross sections with 388 unpatented mining claims and the Montezuma alternative segments would cross sections with 202 and

655 unpatented mining claims. The rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design phase of the project, DOE would perform a survey to verify the locations of tunnels and shafts to avoid adverse impacts.

DOE developed the Mina rail alignment to avoid Wilderness Areas and other scenic and recreational areas. Road crossings would be constructed to prevent the rail line from obstructing access to private and public land. While there could be temporary road closures or detours during the rail line construction phase, there would be no impact to land access during the operations phase. In addition, organized off-highway vehicle events permitted in the past by BLM might need to alter their routes to avoid the rail line.

Depending on the alternative segments selected, the rail line would cross between 22 and 29 known utility lines. DOE would negotiate crossing agreements with the right-of-way holders and the BLM to determine the duration of use, access needs, mitigation, and compensation, as applicable. DOE would protect existing utilities from damage so that disruption to utility service or damage to lines would be at most small and temporary. The project would require a new BLM right-of-way outside the existing planning corridors, which would be outside of right-of-way avoidance areas. Under the longest potential route, approximately 40 percent of the Mina rail alignment would fall within existing BLM planning corridors (not including existing Department of Defense Branchlines and alternative segments with the Walker River Paiute Reservation).

In addition, to avoid the proliferation of new rights-of-way, the BLM may elect to ***grant*** future rights-of-way for new utilities adjacent to the proposed rail line.

Construction and operation of a railroad along the Mina rail alignment could result in the following general impacts to land use and ownership along the entire alignment:

- Changes in land uses on private and public lands within the construction and operations rights-of-way
- Possible increase in livestock mortality (collisions with trains)
- Reduced animal unit months on affected grazing allotments as determined by the BLM
- Reduction in land available for BLM disposal
- Alteration of past routes for BLM-permitted off-highway vehicle events
- Possible expansion of mining, manufacturing, industrial, or commercial land uses under the Shared-Use Option

Tables 4-162 through 4-167 summarize potential impacts to land use and ownership for each rail line segment and construction and operations support facility.

Table 4-162. Summary of potential impacts to land use and ownership – Schurz alternative segments (Walker River Paiute Reservation).

Construction impacts	Schurz 1	Schurz 4	Schurz 5	Schurz 6
Private parcels the alignment would cross (construction right-of-way)	0	0	0	0
Affected property owners	0	0	0	0
Grazing allotments the alignment would cross	0	0	0	0
Stockwater pipelines the alignment would cross	0	0	0	0
Unpatented mining claims the alignment would cross	0	0	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0	0	0
Roads and trails the alignment would intersect	12	13	12	15
Utility lines/rights-of-way the alignment would cross or overlap	3	3	3	3

Table 4-163. Summary of potential impacts to land use and ownership – Mina common segments 1 through 6 (Mineral, Esmeralda, and Nye Counties) (page 1 of 2).

Construction impacts	Mina common segment 1	Mina common segment 2	Common segment 5	Common segment 6
Private parcels the alignment would cross (construction right-of-way)	1	0	0	0
Affected property owners	1	0	0	0
Land area of private land affected (including patented mining claims)	0.21 square kilometer[a]	Not applicable	Not applicable	Not applicable
Grazing allotments the alignment would cross	4 (1 inactive)	1, inactive	1, inactive	1, inactive
Stockwater pipelines the alignment would cross	1	0	0	0
Animal unit months lost (estimated) or percent of allotment(s)	104 or 0.6 percent	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)
Active grazing allotment land that would be within the construction right-of-way	26 square kilometers	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)	Not applicable (grazing allotment inactive)
Unpatented mining claims the alignment would cross	0	0	0	Four sections with 34 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0	0	0
Linear distance outside BLM utility corridors	53 kilometers[b]	3.4 kilometers	20.2 kilometers	39.2 kilometers
Roads and trails the alignment would intersect	31	1	14	7
Utility lines/rights-of-way the alignment would cross or overlap	15	0	1	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-164. Summary of potential impacts to land use and ownership – Montezuma alternative segments (Esmeralda and Nye Counties) (page 1 of 2).

Construction impacts	Montezuma 1	Montezuma 2	Montezuma 3
Private parcels the alignment would cross (construction right-of-way)	0	38	1
Affected property owners	0	21	1
Land area of private land affected (including patented mining claims)	0	0.34 square kilometers	0.1 square kilometers
Grazing allotments the alignment would cross	6 (2 inactive)	3 (2 inactive)	4 (2 inactive)
Stockwater pipelines the alignment would cross	1	7	2
Animal unit months lost (estimated) or percent of allotment(s)	117 or 1.2 percent	47 or 0.5 percent	129 or 0.8 percent

Table 4-164. Summary of potential impacts to land use and ownership – Montezuma alternative segments (Esmeralda and Nye Counties) (page 2 of 2).

Construction impacts	Montezuma 1	Montezuma 2	Montezuma 3
Active grazing allotment land that would be within the construction right-of-way	55 square kilometers[a]	26 square kilometers	42 square kilometers
Unpatented mining claims the alignment would cross	17 sections containing 202 claims	24 sections containing 655 claims	19 sections containing 249 claims
Underground mines, shafts, and tunnels the alignment would cross	1	2	2
Linear distance outside BLM utility corridors	66 kilometers[b]	82 kilometers	92 kilometers
Roads and trails the alignment would intersect	19	34	30
Utility lines/rights-of-way the alignment would cross or overlap	3	10	10

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-165. Summary of potential impacts to land use and ownership – Bonnie Claire alternative segments (Nye County).

Construction impacts	Bonnie Claire 2	Bonnie Claire 3
Private parcels the alignment would cross (construction right-of-way)	0	0
Affected property owners	0	0
Grazing allotments the alignment would cross	1, inactive	1, inactive
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	Not applicable	Not applicable
Allotment land that would be within the construction right-of-way	Not applicable	Not applicable
Unpatented mining claims the alignment would cross	0	0
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	20 kilometers[a]	18.4 kilometers
Roads and trails the alignment would intersect	1	4
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert kilometers to miles, multiply by 0.62137.

Table 4-166. Summary of potential impacts to land use and ownership – Oasis Valley alternative segments (Nye County) (page 1 of 2).

Construction impacts	Oasis Valley 1	Oasis Valley 3
Private parcels the alignment would cross (construction right-of-way)	1	0
Affected property owners	1	0
Land area of private land affected (including patented mining claims)	0.04 square kilometer[a]	Not applicable

Table 4-166. Summary of potential impacts to land use and ownership – Oasis Valley alternative segments (Nye County) (page 2 of 2).

Construction impacts	Oasis Valley 1	Oasis Valley 3
Grazing allotments the alignment would cross	1	1
Stockwater pipelines the alignment would cross	0	0
Animal unit months lost (estimated) or percent of allotment(s)	8 or 0.8 percent	13 or 1.4 percent
Allotment land that would be within the construction right-of-way	2.3 square kilometers	3.8 square kilometers
Unpatented mining claims the alignment would cross	2 sections containing 14 claims	2 sections containing 14 claims
Underground mines, shafts, and tunnels the alignment would cross	0	0
Linear distance outside BLM utility corridors	1.7 kilometers[b]	4 kilometers
Roads and trails the alignment would intersect	3	3
Utility lines/rights-of-way the alignment would cross or overlap	0	0

a. To convert square kilometers to acres, multiply by 247.10.
b. To convert kilometers to miles, multiply by 0.62137.

Table 4-167. Summary of potential impacts to land use and ownership – railroad construction and operations support facilities (Mineral, Esmeralda, and Nye Counties).

Potential quarries	Construction impacts
Garfield Hills	This quarry would result in the loss of 0.99 square kilometer[a] of grazing land on the Garfield Flat Allotment and 0.09 square kilometer on the Pilot-Table Mountain Allotment, reducing overall animal unit months by five. The quarry would also impact 0.42 square kilometer of land on the Hawthorne Army Depot.
Gabbs Range	This quarry would result in the loss of 0.97 square kilometer of grazing land on the Pilot-Table Mountain Allotment, and the loss of four animal unit months.
North Clayton	This quarry would be on 1.78 square kilometers of public land within an inactive grazing allotment.
ES-7	This quarry would be located on 1.46 square kilometers of public land within an inactive grazing allotment.
Malpais Mesa	This quarry would be on 2.67 square kilometers of public land within an inactive grazing allotment.
Facility	**Construction impacts**
Staging Yard	Yard would be on 1.1 square kilometers on the Hawthorne Army Depot and 0.25 square kilometer on BLM-administered grazing land.
Maintenance-of-Way Facility	The facility would be on approximately 0.02 square kilometer within the rail alignment construction right-of-way. If located at Silver Peak (Montezuma alternative segment 1), it would be on the active Silver Peak Allotment. If located at Klondike (Montezuma alternative segments 2 and 3), it would be on the inactive Montezuma Allotment.
Rail Equipment Maintenance Yard, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center	These facilities would be entirely on the Nevada Test Site. There would be no charge in land use or ownership.

a. To convert square kilometers to acres, multiply by 247.10

4.3.3 AESTHETIC RESOURCES

This section describes potential impacts to aesthetic (visual) resources from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.3.1 describes the methods DOE used to assess potential impacts; Section 4.3.3.2 describes potential impacts during the construction phase; Section 4.3.3.3 describes potential impacts during the operations phase; Section 4.3.3.4 describes potential impacts under the Shared-Use Option; and Section 4.3.3.5 summarizes potential impacts to aesthetic resources.

Section 3.3.3.1 describes the region of influence for aesthetic resources along the Mina rail alignment.

4.3.3.1 Impact Assessment Methodology

4.3.3.1.1 Approach

Most of the lands along the Mina rail alignment are BLM-administered public lands. For this reason, DOE used BLM methods to evaluate potential impacts to visual resources.

The BLM uses a process to rate visual resource contrast and evaluate the magnitude of a project's impact on existing visual resources (DIRS 173053-BLM 1986, all). The BLM evaluates the contrast between existing conditions and conditions expected during a project, drawing on information from the BLM visual resource management inventory, which the BLM uses to classify the aesthetic value of BLM-administered lands (DIRS 101505-BLM 1986, all). BLM management objectives allow different levels of project-related contrast for each visual resource management class (DIRS 101505-BLM 1986, Section VB). Figure 4-23 shows the visual resource management classes for lands surrounding the Mina rail alignment. DOE used the BLM methodology to assign visual resource management classes to non-BLM public and private land.

To identify potential impacts to aesthetic resources, DOE applied the process for rating visual resource contrast specified in BLM Manual Handbook 8431-1 (DIRS 173053-BLM 1986, all). This process involved comparing the existing aesthetic conditions to conditions that would exist during proposed railroad construction and operations in relation to:

- Landform attributes, vegetative features, and structural features (such as existing and proposed rail roadbeds, power distribution lines, buildings, and communications towers)
- Form, line, color, and texture
- Other factors including distance, angle of observation, how long the project feature would be visible, relative size or scale, season of use, light conditions, recovery time for vegetation after construction, spatial relationships, and atmospheric conditions

DOE developed contrast ratings using the methodology in BLM Manual Handbook 8410-1 (DIRS 101505-BLM 1986, all) from the key observation points identified in Section 3.3.3 (see Figure 3-176). DOE prepared simulations to illustrate the expected project-related contrast at some key observation points. Appendix D, Aesthetics, Section D.2, provides baseline photographs and simulations for the Mina rail alignment.

4.3.3.1.2 Criteria for Determining Impacts

DOE used the criteria listed in Table 4-168 to rank the contrast between existing conditions and conditions expected during the railroad construction and operations phases at each key observation point.

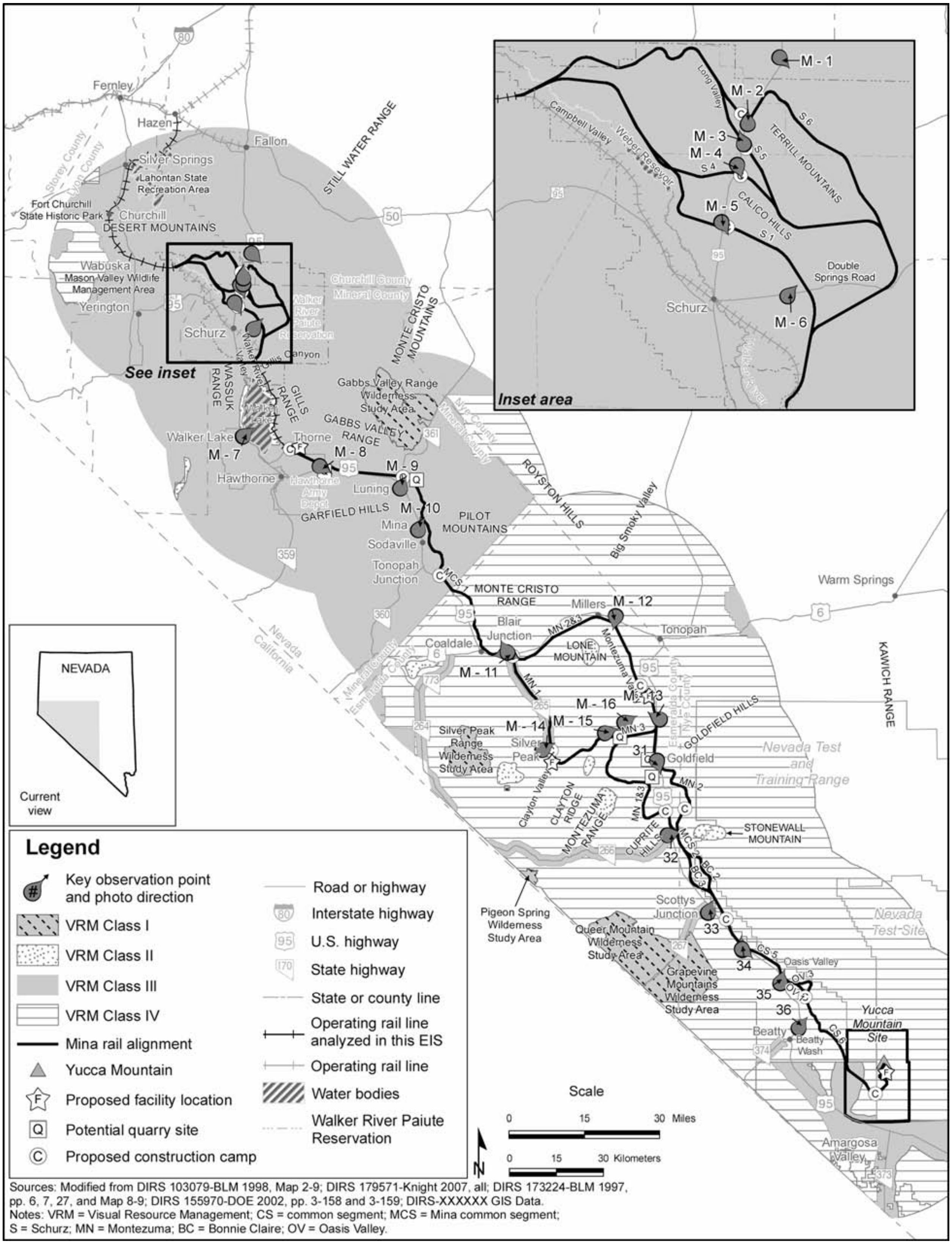


Figure 4-23. Visual resource management classifications and key observation points along the Mina rail alignment.

Table 4-168. Criteria for determining degree of visual contrast.[a]

Degree of contrast	Criteria
None	The element contrast is not visible or perceived.
Weak	The element contrast can be seen but does not attract attention.
Moderate	The element contrast begins to attract attention and begins to dominate the characteristic landscape.
Strong	The element contrast demands attention, will not be overlooked, and is dominant in the landscape.

a. Source: DIRS 173053-BLM 1986, Section III.D.2.a.

DOE then considered contrast ratings against the BLM visual resource management objectives listed in Table 4.-169, where applicable. In general, the BLM manages areas of high visual value (Classes I and II) to minimize contrast, while allowing more contrast in areas of lower visual value (Classes III and IV).

Table 4-169. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

In this analysis, the primary basis for identifying potential adverse impacts to aesthetic resources is inconsistency with BLM management objectives for a ***viewshed***. This includes consideration of effects on the visual values of parks, recreation areas, and other scenic resources (recognized at the national, state, or local level) and visual intrusions or contrasts affecting the quality of landscapes. Along much of the Mina rail alignment, where the landscape is sparsely populated and undeveloped, the visual impact of equipment, facilities, and activities could create a weak or moderate contrast, according to the criteria listed in Table 4-168. That is, from key observation points that are within a few miles, equipment, facilities, and activities could be seen (weak contrast) or would begin to attract attention and begin to dominate the viewshed (moderate contrast). However, as noted in BLM guidance, distance and duration of project activities affect perceptions of contrast (DIRS 173053-BLM 1986, Section III.D.2.b).

Distance of an observer from project activities and facilities would greatly affect the observer's perception of project-related contrasts with the landscape. The likelihood that activities or facilities would divert an observer's attention away from the landscape would decrease as distance increased. Thus, views from observation points where the project would appear in the foreground or middleground would usually be affected more than views from observation points where the project was in the background.

Duration of activities also affects conclusions about a project's consistency with BLM visual resource management objectives in a particular location. For example, visible construction activities over 18 months could cause a moderate degree of contrast and be inconsistent with Class II objectives. Such activities would be recognized as a moderate adverse impact of construction in Class II areas, although BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7). In contrast, passage of a train on a track more than approximately 1.6 kilometers (1 mile) from observers for a few minutes three times a day for up to 50 years might comply with Class II objectives if the track itself did not attract attention or dominate the view of a casual viewer, thus creating only a weak degree of contrast. In such a case, presence of the proposed rail line would be recognized as a small adverse impact of operation.

4.3.3.2 Construction Impacts

Table 4-170 lists contrast ratings for views from each key observation point along the Mina rail alignment and consideration of project consistency with BLM management objectives. In cases where construction and operations activities would cause different levels of contrast, the table identifies the phase for each rating; otherwise, a single rating applies to both construction and operations. Figure 4-23 is the same as Figure 3-177 in Section 3.3.3, showing visual resource management classifications of lands around each key observation point. It is a useful reference when reading impact discussions in this section. Appendix D, Section D.2, provides photographs of views from each key observation point and simulations of views including the track, trains, or other features.

4.3.3.2.1 Construction Impacts Common to the Entire Mina Rail Alignment

Construction-related equipment, facilities, and activities would be potential sources of short-term (temporary) impacts to visual resources during the construction phase. Most of the equipment, facilities, and activities would be within the ***nominal*** width of the ***construction right-of-way***. From some viewpoints, the presence of workers, vehicles, equipment, supply trains, ***borrow pits***, quarries, laydown yards, well pads, construction camps, and electric distribution lines, and the generation of dust and vehicle exhaust, might be seen or might attract the attention of a casual observer during construction. These would result in small impacts to visual setting except in areas discussed in Section 4.3.3.2.2.

Newly constructed ***cut*** and ***fill*** slopes could temporarily result in a weak to strong contrast with adjacent soils and vegetation. The short-term level of impact to the visual setting from this contrast would be small to large, and would decrease with the reestablishment of vegetation. Cuts in virgin rock would initially show a weak to strong contrast between freshly exposed rock and previously weathered rock. Without mitigation, this contrast would result in long-term small to large impacts to the visual setting.

Construction supply trains consisting of 8 to 20 cars would pass eight times per day, at most (loaded on the trip out, empty on the return), along rail line segments under active construction. Construction trains would likely be visible for 5 to 20 minutes from a single vantage point, depending on train speed and terrain.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 1 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
M-1	U.S. Highway 95, view over Rawhide Flats toward Schurz alternative segment 6 against hills	Surrounding lands (III)	Weak	Yes	Small	None
M-2[e]	U.S. Highway 95 view of Schurz alternative segment 6 rail-over-road crossing	Surrounding lands (III)	Construction: strong	No	Construction: moderate to large	Extensive earthworks would be required for approach to the rail-over-road crossing.
			Operations: moderate	Yes	Operations: small to moderate	
M-3[e]	U.S. Highway 95 in Long Valley, views of Schurz alternative segment 5 and road-over-rail crossing	Surrounding lands (III)	Construction: moderate Operations: weak	Yes	Construction: moderate Operations: small	Typical road-over-rail highway crossing.
M-4[e]	U.S. Highway 95 at intersection with Weber Dam Road, view of Schurz alternative segment 4 and road-over-rail crossing	Surrounding lands (III)	Construction: moderate Operations: weak	Yes	Construction: moderate Operations: small	Typical road-over-rail highway crossing.
M-5[e]	U.S. Highway 95, view of Schurz alternative segment 1 and road-over-rail crossing	Surrounding lands (III)	Construction: moderate Operations: weak	Yes	Construction: moderate Operations: small	Typical road-over-rail highway crossing.
M-6[e]	Double Springs Road, view of Schurz alternative segment 1 and at-grade crossing	Surrounding lands (III)	Weak	Yes	Small	At-grade crossing of dirt road, typical of crossing of this type.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 2 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
M-7	Town of Walker Lake, view across lake to Department of Defense Branchline South	Surrounding lands (II and III), western and eastern perimeters of Walker Lake (II)	None	Yes	Small	Existing rail line.
M-8	U.S. Highway 95 just west of Hawthorne, view of potential Garfield Hills quarry facilities	Surrounding lands (III)	Construction: moderate Operations: weak to none	Yes	Construction: moderate Operations: small	Conveyor and support facilities associated with quarry would be visible. DOE would dismantle the quarry conveyor system and facilities after construction was complete.
M-9	Town of Luning, view of potential Gabbs Range quarry site	Surrounding lands (III)	Construction: weak to moderate Operations: none	Yes	Construction: Small to moderate Operations: small	DOE would dismantle the facilities after construction was complete.
M-10	Town of Mina, view of Mina common segment 1	Surrounding lands (III)	Weak	Yes	Small	Buildings and vegetation might shield segment from most homes.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 3 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross? [c]	Impact level[d]	Notes
M-11	Near intersection of State Route 265 and U.S. Highway 95 (Blair Junction), views of Mina common segment 1 toward Monte Cristo Range; south/southeast over State Route 265 to Montezuma alternative segment 1; west over Mina common segment 1	Surrounding lands (III and IV), State Route 265 (III), Monte Cristo Range (IV)	Construction of Mina common segment 1: moderate	Yes	Moderate	None
			Construction of Montezuma alternative segment 1: moderate	Yes	Moderate	None
			Operation of Mina common segment 1: weak to moderate	Yes	Small	View west might not show rail line due to topography.
			Operation of Montezuma alternative segment 1: weak	Yes	Small	None
M-12	U.S. Highway 95 in Montezuma Valley, view south across Montezuma alternative segment 2 toward Lone Mountain	Surrounding lands (IV)	Weak	Yes	Small	Follows existing rail bed.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 4 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
M-13	U.S. Highway 95, view toward Montezuma alternative segment 2 and proposed Maintenance-of-Way Facility	Surrounding lands (IV)	Weak to none	Yes	Small	None
M-14	Main Street in Silver Peak (just past the Chemetall Foote Corporation processing plant), view east over Montezuma alternative segment 1	Surrounding lands (IV), State Route 265 (III)	Weak to moderate	Yes	Small to Moderate	Buildings and vegetation would shield segment from most viewers.
M-15	Silver Peak Road, view toward Montezuma alternative segment 1 and potential North Clayton quarry	Surrounding lands (IV)	Weak	Yes	Small	None
M-16	Silver Peak Road intersection with road to Klondike, views over Montezuma alternative segment 2	Surrounding lands (IV)	Weak to none	Yes	Small	Rail line would barely be visible in background.
31	Rail line crossing U.S. Highway 95 south of Goldfield, view south-southeast toward Montezuma alternative segment 2	Surrounding lands (IV)	Weak	Yes	Small	Typical highway crossing structure would not draw attention.
32	U.S. Highway 95 at State Route 266, view east to Montezuma alternative segments	Surrounding lands (IV), State Route 266 (III), Stonewall Mountain (II)	Weak	Yes	Small	Montezuma alternative segment 2 would be distant from Class II feature, which would be in background; Class III lands would not be visible in views from highway over the rail line.

Table 4-170. Contrast ratings along the Mina rail alignment and consistency with BLM objectives (page 5 of 5).

Key observation point	Location	Visual resource management classes in viewshed[a]	Contrast rating[b]	Consistent with visual resource management class rail line would cross?[c]	Impact level[d]	Notes
33	U.S. Highway 95 at State Route 267, view north-northeast over common segment 5	Surrounding lands (IV), State Route 267 (III)	Weak	Yes	Small	None
34	U.S. Highway 95 (typical cut), view toward common segment 5 hill cuts	Surrounding lands (IV)	Strong to moderate	Yes	Large to moderate	None
35	U.S. Highway 95 north of Oasis Valley (typical landscape)	Surrounding lands (IV)	Weak	Yes	Small	Rail line would be visible but would not attract attention away from topography in background.
36	U.S. Highway 95 and Beatty Wash access road, view northeast to construction access road	Surrounding lands (IV)	None to weak	Yes	Small	Rail line would not be visible from key observation point; increased traffic along access road would be visible but would not attract attention.

a. Source: DIRS 101505-BLM 1986, Section V.B.
b. Contrast rating definitions from DIRS 173053-BLM 1986, Section III.D.2.a; see Table 4.4-1.
c. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).
d. Impact level definitions from Section 4.1.
e. Key observation point is located on the Walker River Paiute Reservation.

In addition, small pieces of equipment such as track tampers, ballast regulators, tie handlers, rail clip applicators, and ballast consolidators would pass two to eight times per day (DIRS 180874-Nevada Rail Partners 2007, Appendix A). The level of impact to visual resources would be small.

Activities associated with three of the potential quarry sites (see Figure 2-23) would be visible from towns, highways, or county roads. At the potential Garfield Hills quarry just south of the Hawthorne Army Depot, the plant, a conveyor and a siding would be visible from U.S. Highway 95. This site would be entirely within Class III land and would present a moderate degree of contrast from the highway (see Appendix D, Figure D-102). The potential Gabbs Range quarry, 4 kilometers (2.5 miles) east of Luning, would be in a Class III area visible from U.S. Highway 95 and Luning. Viewers in Luning and on the highway would see a weak to moderate contrast from the quarry and associated facilities (see Appendix D, Figure D-104). Moderate levels of contrast are compatible with BLM Class III management objectives. The potential North Clayton quarry would be in Class IV land and the plant site, siding, and waste dump areas would be visible from Silver Peak Road, though the quarry itself would not be visible from any frequently traveled roads. A weak to moderate degree of contrast would result from the quarry facilities. The potential Malpais Mesa quarry would not be visible from U.S. Highway 95, but would be visible from Railroad Springs Road. Viewers passing on Railroad Springs Road would encounter a moderate to strong contrast from the quarry and associated facilities. A moderate or strong contrast is compatible with BLM Class IV management objectives. Potential quarry site ES-7 west of Goldfield would not be visible from highways or county roads.

In situations where water wells could not be constructed within the nominal width of the construction right-of-way (see Figure 2-3), they would lie within a 23-square-meter (250-square-foot) drilling area connected to the construction right-of-way by small pipelines feeding temporary 9.3-square-meter (100-square-foot) reservoirs. These would cause localized short-term weak-to-moderate contrast, compatible with BLM management objectives in surrounding lands.

There would be up to 10 temporary construction camps along the rail alignment at intervals of approximately 50 kilometers (30 miles) (see Figure 2-23). The camps, which would each average 0.1 square kilometer (25 acres) in size, would have a long and narrow layout of approximately 730 meters by 120 meters (2,400 feet by 400 feet) and would be within the nominal width of the rail line construction right-of-way as close as possible to intersections of existing public roads and the rail alignment access roads. Each camp would consist of single-story housing, offices, support facilities (commissary, kitchen, cafeteria, recreation facilities, service station, fueling area, and medical facilities), utilities (power lines, water- and wastewater-treatment facilities, and trash storage), a contractor work area (sections for maintenance and parts and materials storage), and parking (DIRS 180875-Nevada Rail Partners 2007, Chapter 4). The most visible structures at each construction camp would be the housing facilities. The camps would contrast weakly against the landscape as observed by passing motorists, resulting in short-term small impacts to the visual setting. See Figure 4-24 for a simulation showing a construction camp along the Caliente rail alignment, with camp layout and design identical to that planned for camps along the Mina rail alignment.

Electricity distribution lines would be buried within the operations right-of-way over the length of the rail line (see Section 4.3.11, Utilities, Energy, and Materials). Where the lines connected to the commercial power grid, an electrical substation and a line of power poles extending from the substation to the rail line would be visible. Temporary electrical distribution poles would be visible carrying power to facilities within construction camps, contributing to short-term small impacts to the visual setting around the camps.

Construction duration at most individual locations along the rail line would be a period of weeks or a few months under a 4-year construction schedule. Under a 10-year schedule, there would be multiple phases

Figure 4-24. Simulation of a typical construction camp.

of work (of weeks or a few months) separated by years of inactivity. Active construction would be longer at locations of major structures, such as bridges and railroad operations support facilities, but nowhere would construction of earthworks and rail line be expected to exceed 18 continuous months except at the bridge over Beatty Wash, which DOE expects would take 2 years to construct. DOE would withdraw construction camps from service and keep them in reserve during periods of construction inactivity, and would close camps and reclaim the land as sections of the rail line were completed. Thus, a longer construction schedule would not increase the level of visual impact because inactivity would minimize the visual contrast at individual locations where construction was halted, although the impact of disturbed soil and vegetation would be prolonged. Under either construction schedule, DOE would consider requests by local governments to leave individual construction camp sites (the cleared and hardened site the camp occupied) in place after permanent closure of the facility for possible use by these governments or their designees. The visual impacts from these sites would likely be small because the Department would remove equipment and structures prior to transfer, and rail line-related construction activities would cease.

Considering the effects of distance and duration, construction activities or facilities would either not be visible or would be noticeable during the construction phase but would not dominate the attention of a viewer. That is, they would create no contrast or a weak degree of contrast at key observation points, with the exception of those discussed in Section 4.3.3.2.2. A weak degree of contrast, even where Class I and II lands are present in the viewshed, is compatible with BLM management objectives for all classes of land. Thus, there would be small, temporary project-related impacts to the visual setting during construction of any of the Mina rail alignment alternative segments and common segments, except as described in Section 4.3.3.2.2. As noted in Section 4.3.3.1.2, BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

The section of Department of Defense rail line currently in operation on the Walker River Paiute Reservation (Department of Defense Branchline Schurz) would be decommissioned, and the ballast and rail would be removed, with the selection of any of the Schurz alternative segments. Removal of the rail and ballast material would result in a small decrease in the contrast with the surrounding landscape, though the linear feature of the railbed would remain. A weaker contrast would likely result in a small positive impact to the visual setting near the site of this existing rail line. Department of Defense Branchline Schurz as it currently appears from Alternate U.S. Highway 95 north of the town of Schurz is shown in Figure 4-25.

4.3.3.2.2 Construction Impacts along Alternative Segments and Common Segments

The aesthetic resources impact analysis identified moderate or strong contrast ratings associated with rail line construction along three portions of the Mina rail alignment, as described in Sections 4.3.3.2.2.1 through 4.3.3.2.2.3.

4.3.3.2.2.1 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross through non-BLM-administered lands treated in this analysis as Class III. The construction of several of the crossings of U.S. Highway 95 could present a moderate to strong contrast to passing motorists due to topography, cuts and fills, and installation of crossing structures. Construction activities for the crossing of Schurz alternative segment 6 over U.S. Highway 95 near the crest of the hills between Long Valley and Rawhide Flats would begin to dominate the viewscape of drivers approaching key observation point M-2 from the south due to the large amount of earthworks required for the long approach and the type and span of the crossing structure. The construction of this crossing would not be compatible with BLM Class III management objectives, as it would represent a strong degree of contrast. Construction of the Schurz alternative segments 1, 4, and 5 road-over-rail

Figure 4-25. View south from key observation point M-4 toward typical road-over-rail crossing structure.

crossing structures of U.S. Highway 95, seen from key observation points M-3, 4, and 5 (see Appendix D, Figures D-91 through D-96), would result in a moderate degree of contrast due to hill cuts and the construction of the crossing structures and rail line. A moderate contrast rating would meet BLM management objectives for the Class III lands in the area of these crossings.

4.3.3.2.2.2 Mina Common Segment 1 (Hawthorne Army Ammunition Depot to Blair Junction). Mina common segment 1 would cross exclusively through Class III land in the Carson City BLM District and Class IV land in the Battle Mountain BLM District. From key observation point M-8 on U.S. Highway 95 overlooking the potential Garfield Hills quarry site (see Appendix D, Figure D-101), ballast production facilities and a conveyor crossing the highway would cause a moderate degree of contrast. Similarly, development and use of the potential Gabbs Range quarry site (see Appendix D, Figure D-101) would cause a weak to moderate contrast when viewed from key observation point M-9 at U.S. Highway 95 and Luning. Either quarry would be in Class III areas, where a moderate contrast would be consistent with BLM management objectives.

4.3.3.2.2.3 Montezuma Alternative Segments. The Montezuma alternative segments would cross Class III and Class IV lands as they head south. Because of the close proximity of Montezuma alternative segment 1 to the Class III area surrounding State Route 265, and the unobstructed view of the segment viewers would have from this highway, the contrast due to construction would be moderate as seen from key observation point M-11. For viewers at key observation point M-14 in Silver Peak, construction of the rail line through the Class IV Clayton Valley would cause a moderate contrast due to the color disparity between the ballast and playa bottom, although topography and structures and vegetation in Silver Peak would screen the construction from most viewers in Silver Peak. A moderate degree of contrast is compatible with BLM Class III and IV management objectives.

4.3.3.3 Operations Impacts

4.3.3.3.1 Operations Impacts Common to the Entire Mina Rail Alignment

Sources of potential impacts to the visual setting during the operations phase would be the presence of the rail line and operations support facilities in the landscape, and the passage of trains to and from the repository. For sections of new rail line, there would be less impact to the visual setting during the operations phase than during the construction phase, because there would be less activity (fewer, shorter trains and equipment, and fewer people), the operations right-of-way (nominally 61 meters [200 feet] on either side of the centerline of the rail line) would be narrower in some areas, and disturbed areas outside the operations right-of-way would be reclaimed (see Chapter 7 for a discussion of best management practices). For existing sections of rail line, operations impacts to the visual setting would be less noticeable than during construction because there would be comparatively fewer and shorter trains.
The decommissioning and removal of Department of Defense Branchline Schurz would result in a small positive impact to viewers near the current rail line, which runs directly through the town of Schurz, as all traffic would cease.

The primary visual impact of railroad operations would be the existence of the linear track for up to 571 kilometers (355 miles) (of which 112 kilometers [70 miles] would be existing rail line), with ***wayside signals*** and communications towers visible from short distances. No new linear feature would be created along some sections of rail line, as portions of some common and alternative segments would follow existing, abandoned rail beds (Mina common segment 1, Montezuma alternative segments 2 and 3, and a small portion of Schurz alternative segments 4, 5, and 6). Additionally, the electrical distribution line currently located along U.S. Highway 95 creates a linear feature between this commonly traveled route and the potential location of Mina common segment 1.

In addition to the impact of the track itself, the passage of a train would attract the attention of a casual observer, both because of the sound associated with the train and its appearance on the track, but this would be an infrequent, short-duration visual distraction. Travel along the rail line is expected to peak at 17 one-way train trips per week (DIRS 180874-Nevada Rail Partners 2007, Appendix C). This would average fewer than three one-way trips per day. Trains would be up to 19 cars long, and would likely be visible for between 5 and 20 minutes from a single vantage point, depending on train speed and terrain. Passage of these trains would create a small impact to the visual setting.

Along the rail alignment, DOE would install 4.6-meter (15-foot)-tall wayside signals to control train movements at intervals sufficient to connect each by line-of-sight. DOE would place 23-to-30-meter (75-to-100 foot)-tall radio communications towers at the beginning and the end of the line and at intervals along the rail line as needed to ensure signal transmission (DIRS 180923-Nevada Rail Partners 2007, Chapter 6). See Figure D-27 and D-33 in Appendix D for simulations showing signals and communications towers along the Caliente rail alignment, which would utilize designs identical to those along the Mina alignment. The substations and distribution lines that connect the buried power lines to the grid would remain during the operations phase. The wayside signals, radio communication towers, substations, and distribution lines all would create small impacts to the visual setting unless placed in visually sensitive areas close to observers, where impacts could be moderate or large.

DOE established contrast ratings at key observation points considering the view of the rail line or operations support facilities and the nature and extent of operations activities that would be visible. The Department compared ratings with BLM visual resource management objectives for the lands in the viewshed. Contrast ratings at key observation points confirmed that the presence of the rail line and associated crossing structures, while noticeable in some cases, would not dominate a viewer's attention and would result in a weak level of contrast (see Figure 4-26), except in some cases where the rail line would be close to the viewer and at some grade-separated crossings. In some instances where the rail line would run close to the viewer, the linear track would cause a moderate contrast (see Section 4.3.3.3.2). Ratings from key observation points with views of road crossings (all of which would be in Class III and IV lands) found contrasts would range from moderate to none. A weak level of contrast is compatible with BLM management objectives for all classes of land, a moderate level of contrast is compatible with BLM management objectives for Class III and IV lands but not for Class II lands, and a strong level of contrast is sometimes compatible with BLM Class IV objectives but not with Class III objectives.

Contrast ratings confirmed that the level of contrast between a passing train and the landscape would be strong (demanding a viewer's attention) or moderate (beginning to attract attention) where the rail line would fall in the foreground or middleground of the viewshed. Contrast between the landscape and a passing train would be less where the rail line would be in the background. In such cases, the level of contrast would be moderate or weak, where the passing of a train could be noticeable but would not demand attention (see Figure 4-27). The extremely short duration of the passage would diminish the effect, so that management objectives would be met for Class II, III, and IV lands, even if the rail line were to fall in the foreground or middleground of the viewshed, as long as it would not create a linear feature across the landscape that would attract attention or would begin to dominate the landscape.

4.3.3.3.2 Operations Impacts along Alternative Segments and Common Segments

The analysis of impacts to aesthetic resources identified moderate contrast ratings associated with railroad operations along two portions of the Mina rail alignment, as discussed in Sections 4.3.3.3.2.1 and 4.3.3.3.2.2.

4.3.3.3.2.1 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross through non-BLM-administered lands treated in this analysis as Class III. Because it would cross directly over U.S. Highway 95 near where the road crests the hills between

Figure 4-26. View east from key observation point M-10 in the town of Mina showing passage of a train in background.

Figure 4-27. View of Department of Defense Branchline Schurz from Alternate U.S. Highway 95 on the Walker River Paiute Reservation north of the town of Schurz.

Long Valley and Rawhide Flats, the Schurz alternative segment 6 rail-over-road grade-separated crossing seen in Appendix D, Figures D-89 and D-90, would likely draw the attention of viewers. This structure would cause a moderate degree of contrast compatible with BLM management objectives for the Class III lands in the area.

4.3.3.3.2.2 Montezuma Alternative Segments. The Montezuma alternative segments would cross Class III and Class IV lands as they head south. From key observation point M-14 (Appendix D, Figure D-116) in Silver Peak, Montezuma alternative segment 1 running through the Class IV Clayton Valley would be clearly evident due to the color discrepancy between the ballast and playa bottom, causing a moderate contrast where visible (though topography and structures and vegetation would screen the rail line from most viewers in Silver Peak). A moderate level of contrast is compatible with BLM management objectives for Class III and IV lands.

4.3.3.4 Impacts under the Shared-Use Option

Impacts to aesthetic resources during the construction phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.3.3.2.1). Construction of additional sidings or short spurs would create small impacts to the visual setting because of the short duration of construction.

Impacts to the visual setting during the operations phase under the Shared-Use Option would be the same as those under the Proposed Action without shared use (see Section 4.3.3.3.1). Under the Shared-Use Option, there would be an additional five round-trip trains per week on rail line sections south of Hawthorne and nine round trips on the sections north of Hawthorne (DIRS 180694-Ang-Olson and Gallivan 2007, p. 3). These additional trains would not substantially increase the assumed three one-way trips per day DOE used to establish visual contrast ratings under the Proposed Action without shared use.

4.3.3.5 Summary

Table 4-171 summarizes potential impacts to aesthetic resources from constructing and operating the proposed railroad along the Mina rail alignment.

Table 4-171. Summary of potential impacts to aesthetic resources – Mina rail alignment[a] (page 1 of 2).

Location (county)	Construction impacts[b]	Operations impacts
Rail alignment		
Impacts common to all portions of the Mina rail alignment	Small impact. Weak to moderate contrast in the short term from dust and exhaust; lighting, temporary power poles, construction camps, and material laydowns; operation of supply trains. Small to large impact. Weak to strong contrast in the short term from visible construction equipment either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads. Small to large impact. Weak to strong contrast in the long term from scars on rock from cuts, and from access roads.	Small to moderate impact. No to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads. Small impact. No to strong contrast in the short term from passing trains.

Table 4-171. Summary of potential impacts to aesthetic resources – Mina rail alignment[a] (page 2 of 2).

Location (county)	Construction impacts[b]	Operations impacts
Rail alignment (continued)		
Schurz alternative alignments 1, 4, 5, and 6 (Churchill County and Mineral County)	Small to large, but temporary, impact. Moderate to strong contrast in the short term for rail-over-road crossing of U.S. Highway 95 by Schurz 6, which would not meet BLM Class III management objectives. Weak to moderate contrast in the short term for other rail line sections and structures, which would meet Class III objectives.	Small to moderate impact. Weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives.
Montezuma alternative segment 1 (Esmeralda County)	Moderate impact. Moderate contrast due to proximity to viewers on State Route 265 and in some parts of town of Silver Peak; would meet BLM Class III and IV management objectives.	Small to moderate impact. Weak contrast from new linear feature adjacent to State Route 265 and weak to moderate contrast in Clayton Valley; would meet BLM Class III and IV management objectives.
Quarries		
Potential Garfield Hill quarry (Mineral County)	Moderate impact. Moderate contrast in the short term from quarrying, ballast production facilities, and conveyor close to viewers that would be compatible with BLM Class III management objectives.	Small to no impact. Production facilities and conveyor would be removed and quarried areas restored after closure of quarry at end of construction phase.
Potential Gabbs Range quarry (Mineral County)	Small to moderate impact. Weak to moderate contrast in the short term from ballast production facilities close to viewers that would be compatible with BLM Class III management objectives.	Small to no impact. Production facilities would be removed after closure of quarry at end of construction phase.
Potential North Clayton quarry (Esmeralda County)	Small to moderate impact. Moderate contrast in the short term from production facilities close to viewers that would be compatible with BLM Class IV management objectives.	Small to no impact. Production facilities would be removed and waste dumps restored after closure of quarry at end of construction phase.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. BLM methodology recognizes that "few projects meet the VRM [visual resource management] management objectives during construction" (DIRS 173053-BLM 1986, Section III.D.2.b.7).

4.3.4 AIR QUALITY AND CLIMATE

This section describes potential impacts to ***air quality*** from constructing and operating a railroad along the Mina rail alignment. Section 4.3.4.1 describes the methodology DOE used to assess potential impacts; Section 4.3.4.2 discusses conformity with the appropriate State Implementation Plan(s); Section 4.3.4.3 describes potential construction and operations impacts; Section 4.3.4.4 describes potential impacts under the Shared-Use Option; and Section 4.3.4.5 summarizes potential impacts to air quality.

Section 3.3.4.1 describes the region of influence for the air quality impacts analysis.

4.3.4.1 Impact Assessment Methodology

DOE calculated project-related emissions and examined county emissions inventories to determine county-level increases in air pollutant emissions, and performed air quality simulations to determine potential changes in air pollutant concentrations at specific receptors (population centers). Appendix E, Air Quality Assessment Methodology, provides a detailed description of the approach DOE used to perform the air quality assessment.

For areas along the Mina rail alignment for which no local air quality data are available, DOE compared projected emissions under the Proposed Action with the U.S. Environmental Protection Agency county-level emissions data in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). DOE compared emissions from proposed railroad construction and operations in Churchill, Lyon, Mineral, Esmeralda, and Nye Counties to existing emissions in three categories: highway emissions, off-highway emissions, and all county sources. Section 4.3.4.3.1 describes projected emissions associated with construction of the proposed railroad and Section 4.3.4.3.2 describes emissions from railroad operations.

To assess potential impacts to air quality in the region of influence, DOE modeled air quality where there are population centers that would be relatively close to the proposed railroad: Schurz, Hawthorne, and Mina in Mineral County; and Silver Peak and Goldfield in Esmeralda County. In each case, DOE compared the modeling results to the Nevada and National ***Ambient Air Quality Standards*** (NAAQS). These two standards are nearly identical (Section 3.2.4 explains differences), but DOE primarily references the NAAQS in this section with noted exceptions. DOE also modeled air quality and assessed impacts for construction and operations of associated railroad facilities: the Staging Yard at Hawthorne and for construction-related activities at the northern potential quarry site of Garfield Hills and the southerly potential quarry site of Malpais Mesa. Appendix E provides a detailed description of the air quality modeling methodology and assumptions.

There would be an adverse impact to air quality if the Proposed Action:

- Would conflict with or obstruct implementation of a state or regional air quality management plan
- Would violate a NAAQS primary standard or contribute to existing or projected violations

4.3.4.2 The Conformity Rule

Section 176(c) of the Clean Air Act (42 U.S.C. 7401 *et seq.*) requires that federal actions conform to the appropriate State Implementation Plan. The final rule for "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (called the Conformity Rule) is codified in 40 CFR Parts 6, 51, and 93. This Conformity Rule established the conformity criteria and procedures necessary to ensure that federal actions conform to the State Implementation Plans and meet the provisions of the Clean Air Act. In general, this rule ensures that all emissions of ***criteria air pollutants*** and ***volatile***

organic compounds are specifically identified and accounted for in the State Implementation Plan's attainment or maintenance demonstration, and conform to the State Implementation Plan's purpose of eliminating or reducing the severity and number of violations of the NAAQS and achieving expeditious attainment of such standards.

The provisions of the Conformity Rule apply only where the action is undertaken in a federally classified ***nonattainment*** or maintenance area. Apart from Clark and Washoe Counties, the rest of the State of Nevada is classified as ***in attainment*** for all criteria air pollutants. There are no nonattainment or maintenance areas in the proposed rail alignment's host counties of Churchill, Lyon, Mineral, Esmeralda and Nye. Hence, the provisions of the Conformity Rule do not apply to the Proposed Action.

4.3.4.3 Impacts to Air Quality

4.3.4.3.1 Construction Impacts

Potential impacts to air quality from construction of a rail line and railroad construction and operations support facilities along the Mina rail alignment would include (1) exhaust emissions from construction equipment and (2) fugitive dust ***particulate matter*** emissions resulting from construction activities. These impacts would be small, except in the vicinity of the potential Garfield Hills quarry, the Staging Yard at Hawthorne, and near the rail line construction right-of-way in the vicinity of Mina and Schurz.

Appendix E describes the modeling approach and methodology DOE used to estimate emissions and air quality impacts that would result from these activities.

DOE evaluated emissions and air quality impacts by county because the most complete and comprehensive annual emissions data available from the U.S. Environmental Protection Agency National Emission Inventory are at the county level (DIRS 177709-MO0607NEI2002D.000). DOE assessed emissions impacts by comparing construction emissions with 2002 annual county-wide emissions for ***nitrogen oxides*** (NO_x), particulate matter with aerodynamic diameters equal to or less than 10 micrometers (***PM_{10}***) and 2.5 micrometers (***$PM_{2.5}$***), ***sulfur dioxide*** (SO_2), ***carbon monoxide*** (CO), and volatile organic compounds (VOCs). DOE assessed air quality impacts by comparing resulting concentrations of these air pollutants against the NAAQS.

Churchill, Lyon, Mineral, Esmeralda, and Nye Counties are all in attainment for ***ozone(O_3)***. Ozone is generally recognized as a regional-scale air quality problem. The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with rail line construction would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not be anticipated to cause a violation of the ozone standard.

Sections 4.3.4.3.1.1 through 4.3.4.3.1.5 describe potential exhaust emissions and air quality impacts from constructing the proposed rail line and railroad construction and operations support facilities along the Mina rail alignment in Churchill, Lyon, Mineral, Esmeralda, and Nye Counties.

4.3.4.3.1.1 Churchill County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. In Churchill County, the Mina rail alignment is anticipated to use the existing Union Pacific Railroad Hazen Branchline. Hence, the only construction emissions in Churchill County would be from the operation of construction materials trains through the county. Appendix E, Section E.3.1.2.1, provides additional detail on the Churchill County emissions inventory.

Table 4-172 compares the highest modeled annual total emissions under a 4-year construction schedule in Churchill County to the county's 2002 emissions estimates in the National Emission Inventory (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the existing Union Pacific Railroad Hazen Branchline and new construction of rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, CO, NO_x, PM_{10}, $PM_{2.5}$, and SO_2 would be small fractions of the county's 2002 annual emissions for these air pollutants. Given that these emissions would be distributed over the entire length of the existing Union Pacific Railroad Hazen Branchline in Churchill County, 17 to 31 kilometers (11 to 20 miles), exceedance of any air quality standards is not likely.

As shown in Table 4-172, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction of Schurz alternative segment 6. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 39 percent (or 100 metric tons [110 tons] per year).

4.3.4.3.1.2 Lyon County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.3.1 provides additional detail on the Lyon County emissions inventory.

Table 4-173 compares the highest annual total emissions under a 4-year construction schedule in Lyon County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000 2006). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the existing and proposed rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, CO, NOx, PM_{10}, $PM_{2.5}$, and SO_2 would be small fractions of the county's 2002 annual emissions for these air pollutants. Given that these emissions would be distributed over the entire length of the rail alignment in Lyon County, 61 to approximately 81 kilometers (38 to 51 miles), exceedance of any air quality standards is not likely.

As shown in Table 4-173, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 39 percent (or 260 metric tons [290 tons] per year) of this amount; construction camp 18C or 18D would contribute about 1 percent.

4.3.4.3.1.3 Mineral County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.4.1 provides additional detail on the Mineral County emissions inventory.

Table 4-174 compares the highest annual total emissions under a 4-year construction schedule in Mineral County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the existing and proposed rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Table 4-172. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Churchill County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	70	40	540	290	650	350	40	20	40	20	-	-
Construction fugitive dust	-	-	-	-	-	-	250	140	50	30	-	-
Totals	70	40	540	290	650	350	290	160	90	50	-	-
Off highway (2002)[e]	748		2,431		527		35		33		36	
Highway vehicles (2002)[e]	1,782		19,067		1,796		50		39		45	
All county sources (2002)[e]	4,353		27,556		2,524		5,248		1,138		280	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Churchill County would be 31 kilometers (20 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Churchill County would be 17 kilometers (11 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-173. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Lyon County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length [c]	Min. length [d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	190	140	1,400	1,050	1,690	1,270	100	80	100	70	-	-
Construction fugitive dust							670	510	130	100	-	-
Totals	190	140	1,400	1,050	1,690	1,270	770	590	230	170	-	-
Off highway (2002)[e]	374		2,605		387		34		32		32	
Highway vehicles (2002)[e]	2,631		27,354		2,413		72		57		62	
All county sources (2002)[e]	4,269		32,110		7,559		7,264		1,132		612	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lyon County would be 81 kilometers (51 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lyon County would be 61 kilometers (38 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Table 4-174. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Mineral County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length [c]	Min. length [d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	420	380	3,110	2,810	3,700	3,430	220	200	210	190	-	-
Construction fugitive dust	-	-	-	-	-	-	2,560	2,420	490	460	-	-
Totals	420	380	3,110	2,810	3,700	3,430	2,780	2,620	700	650	-	-
Off highway (2002)[e]	258		872		54		9		9		4	
Highway vehicles (2002)[e]	221		2,069		172		5		4		5	
All county sources (2002)[e]	1,260		3,093		248		1,636		436		23	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Mineral County would be 171 kilometers (100 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Mineral County would be 153 kilometers (95 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Simulated construction-related emissions for VOCs, CO, PM_{10}, and $PM_{2.5}$ would be comparable to the county's 2002 annual emissions for these air pollutants. NO_x emissions would be 3,500 metric tons (3,800 tons) per year greater than the 2002 county-wide emissions. However, these emissions would be distributed over the entire length of the rail line in Mineral County, 153 to 171 kilometers (95 to 106 miles), and would not lead to a localized problem.

As shown in Table 4-174, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 39 percent (or 1,000 metric tons [1,100 tons] per year) of this amount; while construction of the Staging Yard would contribute about 1 percent, construction camps 15,16, and 17, about 1 percent each, and all wells about 4 percent.

Air Quality Impacts, Construction Activities DOE modeled air quality to determine how construction of the proposed railroad would be likely to impact air pollutant concentrations near Mina, Hawthorne, and Schurz, in Mineral County. In addition to the rail line, the air quality modeling included the impact from constructing the Staging Yard at Hawthorne. Appendix E, Section E.3.1.4.2, summarizes the modeling methodology DOE used to assess construction-related air quality impacts in Mineral County.

Table 4-175 shows the maximum modeled concentrations at any receptor point within the construction right-of-way of criteria air pollutants that could be emitted during the construction phase near Mina. Tables 4-176 and 4-177 show the maximum modeled concentrations at any receptor point during the construction phase near Hawthorne and Schurz, respectively. In each case, DOE modeled a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The following tables also list the highest background concentration (see Section 3.3.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

Table 4-175. Maximum air pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Mina, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	2.2	4	35	11
3-hours	SO_2	ppm	0.072	< 0.0001	0.072	0.5	14
8-hours	CO	ppm	1.4	0.33	1.73	9	19
24-hours	PM_{10}	μg/m³	99	68	167	150	111
	$PM_{2.5}$	μg/m³	16[e]	7.9	23.9	35	68
	SO_2	ppm	0.025	< 0.0001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.002	0.006	0.053	11
	PM_{10}	μg/m³	23	10	33	50[f]	66
	$PM_{2.5}$	μg/m³	5.4	1.8	7.2	15	48
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = ***nitrogen dioxide***; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m³ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-176. Maximum air pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Hawthorne, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	1.3	3.1	35	9
3-hours	SO_2	ppm	0.072	< 0.0001	0.072	0.5	14
8-hours	CO	ppm	1.4	0.24	1.6	9	18
24-hours	PM_{10}	$\mu g/m^3$	99	46	145	150	97
	$PM_{2.5}$	$\mu g/m^3$	16[e]	5.7	21.7	35	62
	SO_2	ppm	0.025	< 0.0001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.003	0.007	0.053	13
	PM_{10}	$\mu g/m^3$	23	8	31	50[f]	62
	$PM_{2.5}$	$\mu g/m^3$	5.4	2.2	7.6	15	51
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98^{th} percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-177. Maximum pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Schurz, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	4.9	6.7	35	19
3-hours	SO_2	ppm	0.072	< 0.0001	0.072	0.5	26
8-hours	CO	ppm	1.4	0.91	2.3	9	10
24-hours	PM_{10}	$\mu g/m^3$	99	180	279	150	186
	$PM_{2.5}$	$\mu g/m^3$	16[e]	27	43	35	124
	SO_2	ppm	0.025	< 0.0001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.008	0.012	0.053	23
	PM_{10}	$\mu g/m^3$	23	29	52	50[f]	103
	$PM_{2.5}$	$\mu g/m^3$	5.4	6.6	12	15	80
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98^{th} percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

At Hawthorne, the maximum concentrations from construction of the proposed rail line would be below the NAAQS for all air pollutants and all averaging periods. For rail line construction at Mina and Schurz, under current, conservative estimates of emissions and dispersion from the associated activities, PM_{10} would exceed the 24-hour average NAAQS levels, while for Schurz the 24-hour $PM_{2.5}$ concentrations would also be above the NAAQS levels. However, each of these exceedances would apply only at the edge of the construction right-of-way and would only occur during the relatively short time of construction activities (less than 6 months). Air quality disposition modeling for Schurz shows that the highest simulated 24-hour PM_{10} and $PM_{2.5}$ concentrations in town, including background concentration, would be 105 and 25 micrograms per cubic meter, respectively, both of which would be well below the NAAQS levels. Similarly, air quality modeling in the town of Mina, showed that the simulated maximum 24-hour PM_{10} and $PM_{2.5}$ concentrations, including background concentration, would be 128 and 28 micrograms per cubic meter, respectively, also below the NAAQS levels.

Table 4-178 shows the maximum concentrations at any modeled receptor point of criteria air pollutants that would be emitted over the 3-year modeling period as a result of construction of the proposed Staging Yard at Hawthorne. The table also shows the highest background concentration (second highest for 24-hour PM_{10}) of each air pollutant (see Section 3.3.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. Figure 4-28 shows the predicted second highest 24-hour PM_{10} concentration near the proposed site of the Staging Yard at Hawthorne to illustrate the construction-related air pollutant concentrations relative to the form of the NAAQS in this area.

Table 4-178. Maximum air pollutant concentrations at the facility fence line from construction of the proposed Staging Yard at Hawthorne, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	4.9	6.7	35	19
3-hours	SO_2	ppm	0.072	0.001	0.073	0.5	15
8-hours	CO	ppm	1.4	0.83	2.2	9	25
24-hours	PM_{10}	μg/m^3	99	148	247	150	165
	$PM_{2.5}$	μg/m^3	16[e]	25	41	35	118
	SO_2	ppm	0.025	0.0002	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.005	0.009	0.053	18
	PM_{10}	μg/m^3	23	28	51	50[f]	102
	$PM_{2.5}$	μg/m^3	5.4	5.7	11	15	74
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

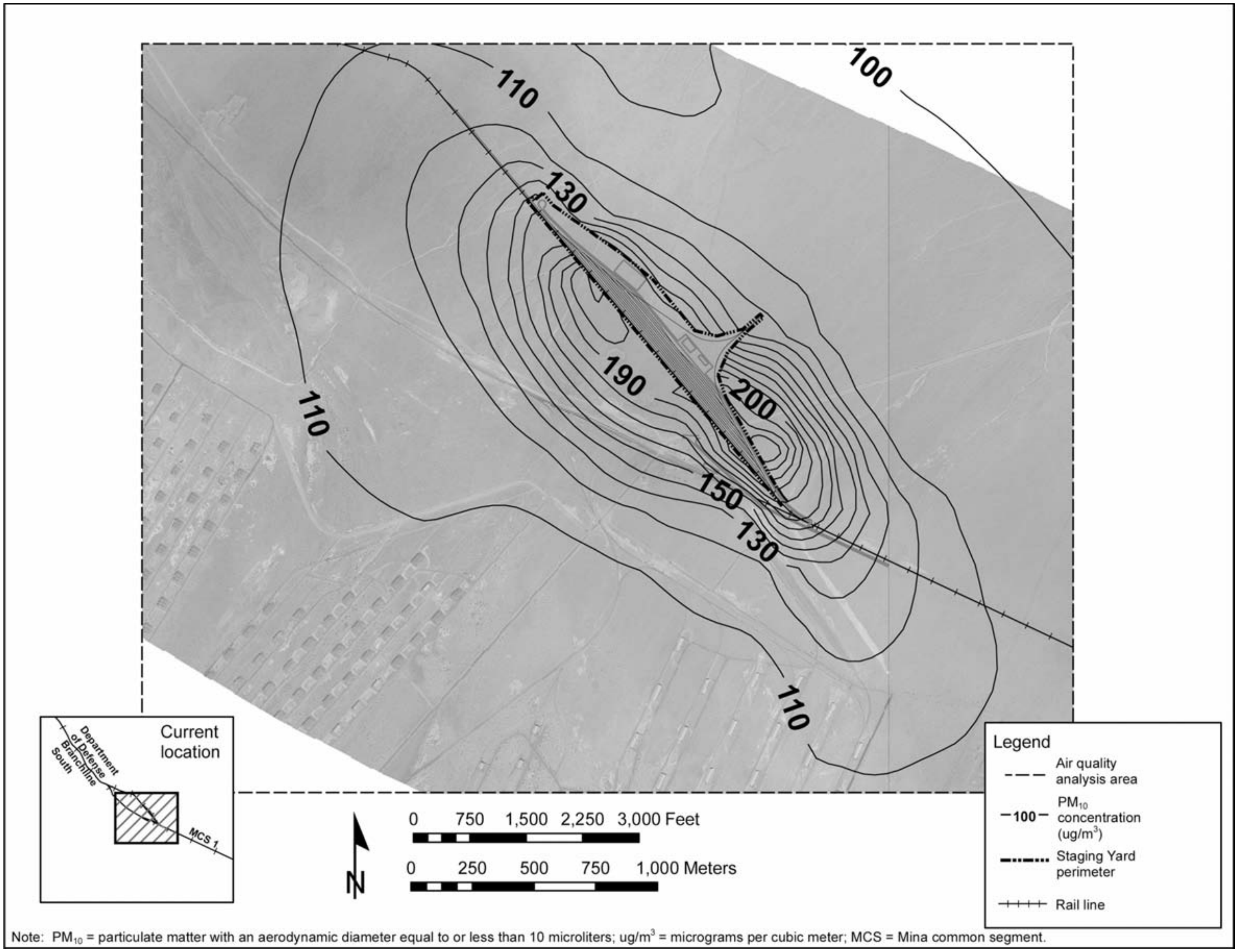


Figure 4-28. Simulated maximum modeled 24-hour PM_{10} concentrations, including background, from construction of the proposed Staging Yard near Hawthorne, Nevada.

The maximum concentrations from construction of the Staging Yard at Hawthorne would be below NAAQS for all air pollutants except for the 24-hour PM_{10} and $PM_{2.5}$ concentration at the facility fence line under the conservative modeling approach DOE employed here, and would only occur during the 12-month construction period. Also, as shown in Figure 4-28, air pollutant concentrations in the population centers farther from the facility than the fence line would have lower concentrations, below all applicable air quality standards.

In addition, under Nevada Administrative Code 445B.22037, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan, which would address in detail the best types of fugitive dust control methods to be used. Specifics as to the best control methods would depend on the specific layout, operation, and activity level at the Staging Yard. These details are not fully available at this time, but would be when DOE filed the Surface Disturbance Permit Dust Control Plan with the State of Nevada. More than one method to control fugitive dust could be necessary to prevent fugitive dust generation, and use of multiple methods to control fugitive dust must be addressed, if needed. The Permit Plan could require such measures as paving roads, cessation of operations when winds make control of fugitive dust difficult, and limitations on the areas worked per day. DOE anticipates that these measures would reduce the PM_{10} emissions, making an exceedance of the 24-hour PM_{10} NAAQS unlikely. Further, DOE could reduce this concern by acquiring additional land and moving public access (the fence line) farther away from the Staging Yard.

Air Quality Impacts, Quarry Activities DOE also performed simulations to determine potential impacts to air quality associated with activity at the potential Garfield Hills quarry near the town of Hawthorne (DIRS 180919-Nevada Rail Partners 2007, Appendixes A and B; DIRS 180881-Shannon & Wilson 2007, pp. 24 to 27). Appendix E, Section E.3.1.4.2.2, describes the methodology DOE used to simulate quarry-related impacts to air quality.

Table 4-179 shows the maximum concentrations at any modeled receptor point of criteria air pollutants that could be emitted from quarry-related activities over the 3-year period. The table also shows the highest background concentration of each air pollutant (see Section 3.3.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

The maximum concentrations from operation of the potential Garfield Hills quarry would be during the quarry construction, for which the results shows that concentrations would be below the NAAQS for all air pollutants except the 24-hour PM_{10} and $PM_{2.5}$ concentration at the facility fence line under the conservative modeling approach DOE employed here. However, air pollutant concentrations in the population centers farther from the facility than the fence line would have much lower concentrations. In developing the quarry, under Nevada Administrative Code 445B.22037, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan, which would address in detail the best types of fugitive dust control methods to be used. Specifics as to the best control methods would depend on the specific layout, operation, and activity level at the quarry. These details are not fully available at this time, but would be when DOE filed the Surface Disturbance Permit Dust Control Plan with the State of Nevada. More than one method to control fugitive dust could be necessary to prevent fugitive dust generation, and use of multiple methods to control fugitive dust must be addressed, if needed. The Permit Plan could require such measures as paving roads and cessation of operations when winds make control of fugitive dust difficult, the use of wet suppression during rock crushing, screening, and conveyor transfer. DOE anticipates that these measures would reduce the PM_{10} emissions, making an exceedance of the 24-hour PM_{10} NAAQS unlikely. During quarry operations, PM_{10} emissions would be more than 80 percent lower than during quarry construction and no exceedance of the 24-hour PM_{10} NAAQS would be expected. Further, DOE could reduce this concern by acquiring additional land and moving public access (the fence line) farther away from the quarry (see Chapter 7, Best Management Practices and Mitigation).

Table 4-179. Maximum pollutant concentration at the facility fence line from operation of the potential Garfield Hills quarry during the construction phase.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	1.7	3.5	35	10
3-hours	SO_2	ppm	0.072	0.001	0.07	0.5	14
8-hours	CO	ppm	1.4	0.34	1.74	9	15
24-hours	PM_{10}	$\mu g/m^3$	99	201.	300	150	200
	$PM_{2.5}$	$\mu g/m^3$	16[e]	17.4	33.4	35	95
	SO_2	ppm	0.025	< 0.0001	0.03	0.14	18
Annual	NO_2	ppm	0.004	0.001	0.005	0.053	10
	PM_{10}	$\mu g/m^3$	23	23	46	50[f]	93
	$PM_{2.5}$	$\mu g/m^3$	5.4	2.9	8.3	15	55
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations during the operations phase; therefore, emissions would be well below NAAQS for all air pollutants.

4.3.4.3.1.4 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.5.1 provides additional detail on the Esmeralda County emissions inventory.

Table 4-180 compares the highest annual total emissions under a 4-year construction schedule in Esmeralda County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail line through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, CO, NOx, PM_{10}, and $PM_{2.5}$ would be much larger than the county's 2002 annual emissions for these air pollutants. The emissions of NO_x during rail line construction could increase emissions by 3,570 metric tons (3,940 tons) per year over the county's 2002 annual emissions. Similarly, emissions of PM_{10} and $PM_{2.5}$ could increase by as much as 1,370 and 480 metric tons (1,500 and 530 tons) per year, respectively, over the 2002 county annual emission values. VOCs and CO would increase by 180 and 1,750 metric tons (198 and 1,930 tons) per year, respectively, over the 2002 county annual emissions. However, these emissions would be distributed over the entire length of the rail alignment in Esmeralda County (134 to 175 kilometers [83 to 109 miles]), greatly reducing any air quality impacts and would not lead to a localized problem; thus, no air quality standard would be exceeded during the construction phase in Esmeralda County, as shown in Table 4-181 for Silver Peak.

Table 4-180. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction exhaust	420	330	3,100	2,400	3,720	2,860	220	170	210	170	-	-
Construction fugitive dust	-	-	-	-	-	-	2,470	2,210	460	390	-	-
Totals	420	330	3,100	2,400	3,720	2,860	2,690	2,290	670	560	-	-
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; HC = hydrocarbons; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 175 kilometers (109 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 134 kilometers (83 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

As shown in Table 4-180, fugitive dust would be the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 39 percent (or 960 metric tons [1,060 tons] per year) of this amount; while construction of the Maintenance-of-Way Facility would contribute less than 1 percent, construction camps 9 or 9A, 13A or 13B, and 14 would contribute about 1 percent each, and the wells would contribute about 4 percent.

Air Quality Impacts, Construction Activities DOE modeled air quality to determine how construction of the proposed rail line would be likely to impact air pollutant concentrations near Silver Peak, in Esmeralda County. Appendix E, Section 3.1.5.2.1 summarizes the modeling methodology DOE used to assess construction-related air quality impacts in Esmeralda County.

Table 4-181 lists the maximum concentrations at any receptor point within the modeled domain of criteria air pollutants that could be emitted during the construction phase near Silver Peak. DOE modeled the effects near Silver Peak for a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The table also lists the highest background concentration of each air pollutant (see Section 3.3.4 for the basis of the background concentration) since 1991 and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS.

Under the conservative modeling approach DOE employed, PM_{10} concentrations were the closest to the standard at 63 percent of the NAAQS, while all other pollutants were lower. Additionally, for any distance greater than immediately at the fence line where populations are likely to be, concentrations would be below the standard. Modeling results for the central area of Silver Peak show the highest 24-hour PM_{10} and $PM_{2.5}$ concentrations, including peak background concentration, are 94 and 19 $\mu g/m^3$ (micrograms per cubic meter), respectively, both of which are below the NAAQS levels.

Air Quality Impacts, Quarry Activities DOE also performed simulations to determine potential impacts to air quality associated with activity at the potential Malpais Mesa quarry near the town of Goldfield (DIRS 180919-Nevada Rail Partners 2007, Appendixes A and B; DIRS 180881-Shannon & Wilson 2007, pp. 24 to 27). Appendix E, Section E.3.1.5.2.2, describes the methodology DOE used to simulate quarry-related impacts to air quality.

Table 4-182 shows the maximum concentrations at any receptor point of criteria air pollutants that would be emitted over the 3-year period and that would result from quarry-related activities. The table also shows the highest background concentration of each air pollutant (see Section 3.2.4 for the basis of the background concentration) since 1991 and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. Modeling results show that the highest 24-hour PM_{10} and $PM_{2.5}$ concentrations, including peak background concentration, would be 71 and 15 $\mu g/m^3$, respectively, both of which are below the NAAQS levels.

DOE did not model other construction activities (access roads, construction camps, and wells) because their emissions would smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, these emissions would be well below NAAQS for all air pollutants.

4.3.4.3.1.5 Nye County.

Emissions Appendix E describes the methodology DOE used to determine construction-related emissions. Section E.3.1.6.1 provides additional detail on the Nye County emissions inventory.

Table 4-183 compares the highest annual total emissions under a 4-year construction schedule in Nye County to the county's 2002 emissions estimates in the National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000).

Table 4-181. Maximum pollutant concentrations in the construction right-of-way from construction of the proposed railroad near Silver Peak, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	2.5	2.7	35	8
3-hours	SO_2	ppm	0.002	< 0.0001	0.002	0.5	< 1
8-hours	CO	ppm	0.2	0.45	0.65	9	7
24-hours	PM_{10}	$\mu g/m^3$	39	55	94	150	63
	$PM_{2.5}$	$\mu g/m^3$	12	6.5	19	35	54
	SO_2	ppm	0.002	< 0.0001	0.002	0.14	14
Annual	NO_2	ppm	0.002	0.002	0.004	0.053	7.5
	PM_{10}	$\mu g/m^3$	12	7.4	19.4	50[e]	39
	$PM_{2.5}$	$\mu g/m^3$	3.6	1.6	5.2	15	35
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 147771-CRWMS M&O 1996, p. 13; DIRS 102877-CRWMS M&O 1999, p. 14; DIRS 147780-SAIC 1992, p. 13; DIRS 168842-DOE 2003, all; DIRS 173738-DOE 2002, all; DIRS 173740-DOE 2004, all; DIRS 176996-DOE 2005, p. 38; DIRS 179948-DOE 2006, p. 40; 40 CFR 50.4 through 50.11.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-182. Maximum pollutant concentrations at the facility fence line from operation of the potential Malpais Mesa quarry during the construction phase.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.27	0.47	35	1
3-hours	SO_2	ppm	0.002	0.00004	0.002	0.5	0
8-hours	CO	ppm	0.2	0.048	0.25	9	3
24-hours	PM_{10}	$\mu g/m^3$	39	32	71	150	47
	$PM_{2.5}$	$\mu g/m^3$	12	2.6	14.6	35	42
	SO_2	ppm	0.002	0.00001	0.002	0.14	1
Annual	NO_2	ppm	0.002	0.0001	0.0021	0.053	4
	PM_{10}	$\mu g/m^3$	12	3.2	15.2	50[e]	30
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.4	4	15	27
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all; DIRS 179933-State of Nevada 2007; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the proposed rail alignment through the county, and increased equipment activity that would be necessary when construction was in rugged terrain.

Simulated construction-related emissions for VOCs, SOx, CO, PM_{10}, and $PM_{2.5}$ would be less than the county's 2002 annual emissions for these air pollutants. The emissions of NO_x during the construction phase could increase emissions by 2,300 metric tons (2,500 tons) per year over the county's 2002 annual emissions. Given that these emissions would be distributed over the entire length of the rail line in Nye County (126 to 148 kilometers [78 to 92 miles]), no air quality standards would be exceeded.

As shown in Table 4-183, fugitive dust would the principal source of particulate matter emissions. More than half of these fugitive dust emissions would be directly associated with rail line construction. Access roads (including the alignment access roads) fugitive dust emissions would contribute about 39 percent (or 780 metric tons [860 tons] per year) of this amount; while construction camps 9 or 9A, 10, 11 and 12 would contribute about 1 percent each, and all wells would contribute about 4 percent.

DOE did not model other construction activities (at access roads, construction camps, and wells) because emissions from those construction activities would be smaller than emissions during rail line construction and would be expected to show even lower concentrations; therefore, those emissions would be well below NAAQS for all air pollutants.

4.3.4.3.2 Operations Impacts

Exhaust emissions during the railroad operations phase would impact air quality, but these impacts would be small.

Appendix E describes the modeling approach and methodology DOE used to estimate operations exhaust emissions and impacts to air quality.

DOE evaluated exhaust emissions and impacts to air quality by county because the most complete and comprehensive emissions data are available only at the county level. To assess emissions impacts, DOE compared modeled operations emissions with 2002 annual county-wide emissions for NO_x, $PM_{10,}$ $PM_{2.5}$, SO_2, CO, and VOCs. To assess impacts to air quality, DOE compared resulting concentrations of these air pollutants to the NAAQS. Churchill, Lyon, Mineral, Esmeralda, and Nye Counties are all in attainment for ozone. Ozone is generally recognized as a regional-scale air quality problem.
The potential increase in the emissions of VOCs (a precursor to ozone formation) associated with the operations phase would be small in relation to the existing regional emissions of VOCs. Thus, the impact on ozone formation would not cause a violation of the ozone standard.

Sections 4.3.4.3.2.1 through 4.3.4.3.2.5 detail the potential emissions and air quality impacts during the railroad operations phase in Churchill, Lyon, Mineral, Esmeralda, and Nye Counties.

4.3.4.3.2.1 Churchill County.

<u>Emissions</u> Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.2.1 provides additional detail on the Churchill County emissions inventory.

Table 4-184 compares the modeled highest annual total emissions during operation of the rail line in Churchill County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Churchill County.

Table 4-183. Maximum and minimum peak annual emissions anticipated from construction of a railroad along the Mina rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Construction[f] exhaust	370	320	2,700	2,320	3,200	2,750	190	160	180	160	< 1	< 1
Construction fugitive dust	0	0	0	0	0	0	1,990	1,820	400	360	0	0
Totals	370	320	2,700	2,320	3,720	2,860	2,180	1,980	580	520	< 1	< 1
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3,324		650		237	

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 126 kilometers (78 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-184. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Churchill County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	-	-	2	1	9	5	-	-	-	-	-	-
Off highway (2002)[e]	748		2,431		527		35		33		36	
Highway vehicles (2002)[e]	1,782		19,067		1,796		50		39		45	
All county sources (2002)[e]	4,353		27,556		2,524		5,248		1,138		280	
Percent increase[f] (projected emission/county emission × 100)	< 0.1	< 0.1	< 0.1	< 0.1	0	0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Churchill County would be 17 kilometers (11 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Churchill County would be 31 kilometers (20 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Churchill County (17 to 31 kilometers [11 to 20 miles]); thus, no air quality standard would be exceeded.

4.3.4.3.2.2 Lyon County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.3.1 provides additional detail on the Lyon County emissions inventory.

Table 4-185 compares the modeled highest annual total emissions during operation of the rail line in Lyon County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through Lyon County.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Lyon County (61 to 81 kilometers [38 to 51 miles]); thus, no air quality standard would be exceeded.

4.3.4.3.2.3 Mineral County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.4.1 provides additional detail on the Mineral County emissions inventory.

Table 4-186 compares the modeled highest annual total emissions during operation of the rail line in Mineral County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Mineral County (153 to 171 kilometers [95 to 106 miles]); thus, no air quality standard would be exceeded.

Air Quality Impacts DOE modeled air quality to determine how railroad operations would be likely to impact air pollutant concentrations near the towns of Mina, Hawthorne, and Schurz, and the Staging Yard at Hawthorne. Appendix E, Section E.3.2.4.2, summarizes the modeling methodology DOE used to assess operations-related impacts to air quality in Mineral County.

Table 4-187 lists the maximum concentrations at any modeled receptor point of the criteria air pollutants that would result from operation of the proposed rail line near Mina. DOE modeled a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The table also lists the highest background concentration of each air pollutant (see Section 3.3.4 for the basis of the background concentration) since 1991 and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. Similarly, Tables 4-188 and 4-189 list the maximum concentrations for Hawthorne and Schurz, respectively. In each case, the maximum concentrations from operation of the proposed rail line would be below the NAAQS for all air pollutants. The maximum fraction of the NAAQS modeled at each location was for the 24-hour PM_{10} concentration with 66 percent at Mina, 66 percent at Hawthorne, and 67 percent at Schurz. Table 4-190 lists the maximum concentrations for operation of the Staging Yard at Hawthorne. Figure 4-29 shows the predicted second highest 24-hour PM_{10} concentration near the proposed site of the Staging Yard near Hawthorne to illustrate the operations-related air pollutant concentrations, in the form of the NAAQS, in the vicinity of the Yard.

Table 4-185. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Lyon County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	1	1	4	3	23	17	1	1	1	1	-	-
Off highway (2002)[e]	374		2,605		387		34		32		32	
Highway vehicles (2002)[e]	2,631		27,354		2,413		72		57		62	
All county sources (2002)[e]	4,269		32,110		7,559		7,264		1,132		612	
Percent increase[f] (projected emission/county emission × 100)	< 0.1	< 0.1	< 0.1	< 0.1	0	0	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lyon County would be 81 kilometers (51 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lyon County would be 61 kilometers (38 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-186. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Mineral County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOC		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	14	13	52	51	193	188	6	6	6	5	-	-
Off highway (2002)[e]	358		872		54		9		9		4	
Highway vehicles (2002)[e]	221		2,069		172		5		4		5	
All county sources (2002)[e]	1,260		3,093		248		1,636		436		23	
Percent increase[f] (projected emission/county emission × 100)	1	1	2	2	78	76	0	0	1	1	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Mineral County would be 171 kilometers (100 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Mineral County would be 153 kilometers (95 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-187. Maximum pollutant concentrations from operation of the proposed railroad near Mina, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	0.003	1.8	35	5
3-hours	SO_2	ppm	0.072	0.00001	0.072	0.5	14
8-hours	CO	ppm	1.4	0.002	1.4	9	16
24-hours	PM_{10}	μg/m³	99	0.05	99	150	66
	$PM_{2.5}$	μg/m³	16[e]	0.04	16	35	46
	SO_2	ppm	0.025	0.000003	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.0001	0.0041	0.053	8
	PM_{10}	μg/m³	23	0.02	23	50[f]	46
	$PM_{2.5}$	μg/m³	5.4	0.02	5.42	15	36
	SO_2	ppm	0.002	< 0.000001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m³ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-188. Maximum pollutant concentrations from operation of the proposed railroad near Hawthorne, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	0.01	1.81	35	5
3-hours	SO_2	ppm	0.07	< 0.0001	0.07	0.5	14
8-hours	CO	ppm	1.4	0.007	1.4	9	16
24-hours	PM_{10}	μg/m³	99	0.17	99.2	150	66
	$PM_{2.5}$	μg/m³	16[e]	0.14	16.1	35	46
	SO_2	ppm	0.025	< 0.00001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.0002	0.004	0.053	8
	PM_{10}	μg/m³	23	0.07	23.1	50[f]	46
	$PM_{2.5}$	μg/m³	5.4	0.07	5.5	15	37
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m³ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-189. Maximum pollutant concentrations from operation of the proposed railroad near Schurz, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	0.01	1.81	35	5
3-hours	SO_2	ppm	0.072	< 0.00001	0.072	0.5	14
8-hours	CO	ppm	1.4	< 0.01	1.4	9	11
24-hours	PM_{10}	μg/m^3	99	0.57	100	150	67
	$PM_{2.5}$	μg/m^3	16[e]	0.51	16.5	35	47
	SO_2	ppm	0.025	< 0.00001	0.025	0.14	18
Annual	NO_2	ppm	0.004	0.001	0.005	0.053	9
	PM_{10}	μg/m^3	23	0.25	23.3	50[f]	47
	$PM_{2.5}$	μg/m^3	5.4	0.24	5.6	15	37
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

Table 4-190. Maximum pollutant concentrations from operation of the proposed Staging Yard at Hawthorne, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	1.8	1.1	2.9	35	8
3-hours	SO_2	ppm	0.07	< 0.001	0.07	0.5	15
8-hours	CO	ppm	1.4	0.04	1.44	9	16
24-hours	PM_{10}	μg/m^3	99	16.3	115	150	77
	$PM_{2.5}$	μg/m^3	16[e]	11	27	35	77
	SO_2	ppm	0.03	0.0002	0.03	0.14	18
Annual	NO_2	ppm	0.004	0.02	0.024	0.05	48
	PM_{10}	μg/m^3	23	5.3	28.3	50[f]	59
	$PM_{2.5}$	μg/m^3	5.4	4.8	10.2	15	68
	SO_2	ppm	0.002	< 0.0001	0.002	0.03	7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; μg/m^3 = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all for CO, SO_2, and NO_2; 40 CFR 50.4 through 50.11; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. For comparison to the air quality standard, the 3-year average of the 98th percentile is 16 micrograms per cubic meter.
f. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

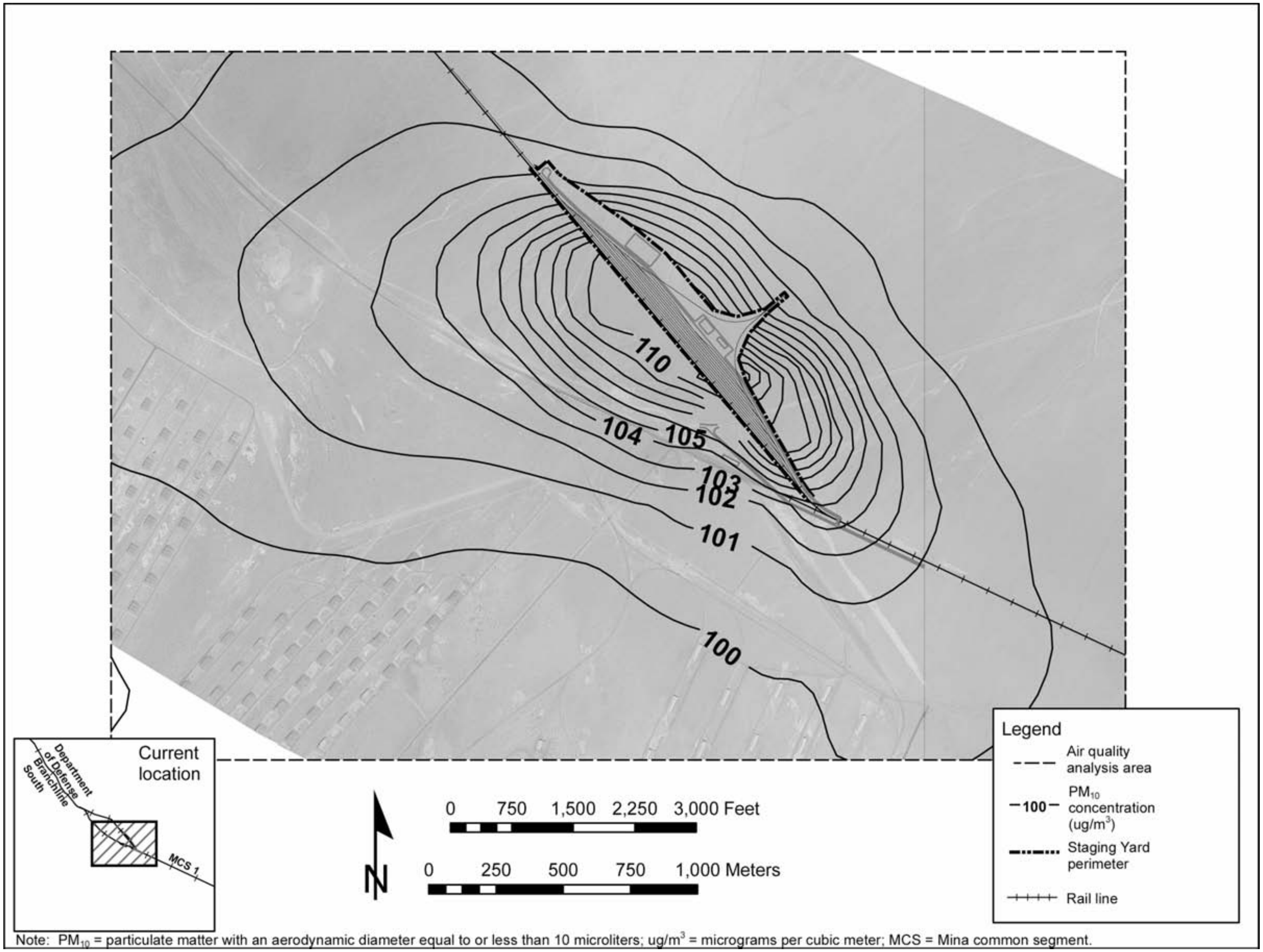


Figure 4-29. Simulated maximum modeled 24-hour PM_{10} concentrations, including background, from operation of the proposed Staging Yard at Hawthorne, Nevada.

The maximum fraction of the NAAQS at the Staging Yard would be 77 percent for 24-hour $PM_{2.5}$ (DIRS 177709-MO0607NEI2002D.000). The table lists potential project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Mineral County (153 to 171 kilometers [95 to 106 miles]); thus, no air quality standard would be exceeded.

4.3.4.3.2.4 Esmeralda County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.5.1 provides additional detail on the Esmeralda County emissions inventory.

Table 4-191 compares the modeled highest annual total emissions during the railroad operations phase in Esmeralda County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be distributed over the entire length of the rail alignment through Esmeralda County (134 to 175 kilometers [83 to 109 miles]); thus, no air quality standard would be exceeded.

Air Quality Impacts DOE modeled air quality to determine how the operations phase would be likely to impact air pollutant concentrations near Silver Peak. Appendix E, Section E.3.2.5.2, summarizes the modeling methodology DOE used to assess operations-related impacts to air quality in Esmeralda County.

Table 4-192 lists the maximum concentrations at any modeled receptor point of the criteria air pollutants that would result from operation of the proposed rail line near Silver Peak. DOE modeled a 3-year period using 3 years of actual meteorological data from 2004 through 2006. The table also lists the highest background concentration of each air pollutant since 1991 (see Section 3.3.4 for the basis of the background concentration) and the relevant NAAQS for each air pollutant, and the maximum resulting concentration as a fraction of the NAAQS. The maximum concentrations from railroad operations near Silver Peak would be 34 percent for the 24-hour $PM_{2.5}$ standard which is well below the NAAQS.

4.3.4.3.2.5 Nye County.

Emissions Appendix E describes the methodology DOE used to assess operations-related emissions. Section E.3.2.6.1 provides additional detail on the Nye County emissions inventory.

Table 4-193 compares the modeled highest annual total emissions during operation of the rail line in Nye County to the county's 2002 National Emission Inventory database emissions estimates (DIRS 177709-MO0607NEI2002D.000). The table lists project-related emissions as a maximum and minimum range according to the possible lengths of the rail alignment through the county.

The projected operations-related emissions for all air pollutants considered in this analysis would be much less than the county's 2002 annual emissions for these air pollutants. These emissions would be primarily from operation of the rail line, Cask Maintenance Facility, and Rail Equipment Maintenance Yard, with the bulk of the emissions associated with the operation of the Cask Maintenance Facility and Rail Equipment Maintenance Yard. The rail line emissions would be distributed over the entire length of the rail alignment through Nye County (126 to 148 kilometers [78 to 92 miles]); thus, no air quality standard

Table 4-191. Maximum and minimum peak annual emissions anticipated from operation a railroad along the Mina rail alignment through Esmeralda County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length [c]	Min. length [d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Operations exhaust	3	2	9	7	50	38	2	1	2	1	-	-
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	
Percent increase[f] (projected emission/county emission × 100)	1	1	1	1	34	26	0	< 0.1	1	1	< 0.1	< 0.1

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 175 kilometers (109 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda County would be 134 kilometers (83 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-192. Maximum pollutant concentrations from operation of a railroad near Silver Peak, Nevada.

Averaging period	Air pollutant[a]		Background concentration[b]	Maximum project impact[c]	Maximum resulting concentration	NAAQS[d]	Maximum concentration (percent of standard)
1-hour	CO	ppm	0.2	0.004	0.2	35	< 1
3-hours	SO_2	ppm	0.002	0.00001	0.002	0.5	< 1
8-hours	CO	ppm	0.2	0.003	0.2	9	< 2
24-hours	PM_{10}	$\mu g/m^3$	39	0.07	39	150	< 26
	$PM_{2.5}$	$\mu g/m^3$	12	0.06	12	35	< 34
	SO_2	ppm	0.002	< 0.000001	0.002	0.14	< 1
Annual	NO_2	ppm	0.002	0.00008	0.002	0.053	< 4
	PM_{10}	$\mu g/m^3$	12	0.03	12	50[e]	< 24
	$PM_{2.5}$	$\mu g/m^3$	3.6	0.03	3.6	15	< 24
	SO_2	ppm	0.002	< 0.00001	0.002	0.03	< 7

a. CO = carbon monoxide; NO_2 = nitrogen dioxide; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; ppm = parts per million; SO_2 = sulfur dioxide; $\mu g/m^3$ = micrograms per cubic meter.
b. Sources: DIRS 182287-Hoelscher 2007, all; DIRS 179933-State of Nevada 2007; DIRS 180073-Tribal Environmental Exchange Network 2007, all.
c. < = less than.
d. NAAQS = National Ambient Air Quality Standards.
e. The Environmental Protection Agency revoked the annual PM_{10} standard effective December 18, 2006 (71 *FR* 60853, October 17, 2006), but the Nevada annual average PM_{10} standard remains in effect.

would be exceeded. Similarly, no air quality problems would be anticipated from operation of the Cask Maintenance Facility and Rail Equipment Maintenance Yard inside the Yucca Mountain Site boundary because the distance from those facilities to the nearest point of public access would be more than 11 kilometers (7 miles). At that distance, there would be no or small impacts on air quality from operation of the facilities.

4.3.4.4 Shared-Use Option

Impacts to air quality along the Mina rail alignment under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

Under the Shared-Use Option, commercial entities could construct additional sidings of 300 meters (980 feet) in length at a number of locations along the rail alignment. Operationally, the Shared-Use Option would consist of up to 60 railcars pulled by three or four locomotives at a frequency of up to 18 additional one-way trips per week along the Mina rail alignment north of Schurz and ten additional one-way trips south of Schurz.

The additional sidings would be placed parallel to track within the construction right-of-way and would not require additional rail roadbed foundation, only additional laying of track. Overall, additional construction-related emissions would be very small. Appendix E, Section E.3.3, describes the rationale for not conducting additional emissions inventory calculations or air quality simulations to assess construction-related impacts under the Shared-Use Option.

Table 4-193. Maximum and minimum peak annual emissions anticipated from operation of a railroad along the Mina rail alignment through Nye County, Nevada, compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length[c]	Min. length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min length	Max length	Min length
Operation exhaust	44	44	168	166	437	431	13	13	12	12	1	1
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3,324		650		237	
Percent increase (projected emission/county emission × 100)	2	2	1	1	30	30	0	0	2	2	0	0

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 126 kilometers (78 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

Appendix E, Section E.3.3, also describes the methodology DOE used to calculate potential emissions that would result from the five additional round trips per week of commercial train activity associated with the Shared-Use Option south of Schurz and nine round trips north of Schurz. For Churchill, Lyon, Mineral, Esmeralda, and Nye Counties, Tables 4-194 to 4-198 compare the minimum and maximum annual incremental emissions expected from operation of commercial trains under the Shared-Use Option with each county's 2002 National Emission Inventory database emissions (DIRS 177709-MO0607NEI2002D.000), based on the shortest and longest routes through the counties. Also shown is the range of peak county-wide emissions that would result from the Proposed Action, as discussed in Section 4.3.4.3, and the resulting range of peak emissions totals by county.

As shown in Tables 4-194 through 4-198, under the Shared-Use Option, total emissions would be increased marginally (as discussed above) beyond those associated with railroad operations under the Proposed Action. Likewise, the maximum air pollutant concentrations expected under the Shared-Use Option would be marginally increased. These levels have been shown to be low (see Tables 4-187, 4-188, 4-189 and 4-192). Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for the Shared-Use Option.

4.3.4.5 Summary

Potential impacts to air quality from construction and operation of the proposed railroad along the Mina rail alignment would be as follows:

- The project would not cause conflicts with state or regional air quality management plans.
- The highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities.
- The highest increase in air pollutant emissions would occur during the construction phase.
- Air pollutant concentrations would not exceed the NAAQS during the construction or operations phase, with the exception of the 24-hour NAAQS for both PM_{10} and $PM_{2.5}$ that could be exceeded near the construction right-of-way at Mina and Schurz during the relatively short (less than 6 months) construction period, at the Staging Yard at Hawthorne, and at the potential Garfield Hills quarry. However, DOE would be required to obtain a Surface Area Disturbance Permit Dust Control Plan prior to quarry and Staging Yard development, and it is likely that requirements in the plan would reduce fugitive dust emissions, thus reducing the possibility of NAAQS exceedances.
- The highest increase in emissions would be for NO_x in Esmeralda County during the construction phase, where emissions could be 3,570 metric tons (3,940 tons) per year higher than the county's 2002 annual NO_x emissions.
- The Shared-Use Option would result in a slightly higher increase in air pollutant emissions and air pollutant concentrations than under the Proposed Action without shared use.

Annualized emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the NAAQS, except for particulate matter during the construction phase, which could exceed the 24-hour NAAQS under some conditions. Therefore, the projected impacts throughout the region of influence, during both the construction and operations phases, would be small, except possibly in the vicinity of the potential Garfield Hills quarry, the Staging Yard at Hawthorne, and segments of the rail line (only during construction). Under the Shared-Use Option, there would be in an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small. Table 4-199 summarizes impacts to air quality.

Table 4-194. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Churchill County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	1	1	3	2	15	8	1	1	1	1	1	1
Proposed railroad operations exhaust	0	0	2	1	9	5	-	-	-	-	0	0
Totals	1	1	5	3	24	13	1	1	1	1	1	1
Off highway (2002)[e]	748		2,431		527		35		33		36	
Highway vehicles (2002)[e]	1,782		19,067		1,796		50		39		45	
All county sources (2002)[e]	4,353		27,556		2,524		5,248		1,138		280	
Percent increase[f] (projected emission/county emission × 100)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

a. To convert metric tons to tons, multiply by 1.1023.

b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.

c. Maximum (Max.) length of rail alignment in Mineral County would be 31 kilometers (20 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)

d. Minimum (Min.) length of rail alignment in Mineral County would be 17 kilometers (11 miles).

e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).

f. < = less than.

Table 4-195. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains under the Shared-Use Option through Lyon County, Nevada and county-wide total railroad operations emissions, compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	3	3	8	6	39	29	3	2	3	2	1	1
Proposed railroad operations exhaust	1	1	4	3	23	17	1	1	1	1	0	0
Totals	4	4	12	9	62	46	4	3	4	3	1	1
Off highway (2002)[e]	374		2,605		387		34		32		32	
Highway vehicles (2002)[e]	2,631		27,354		2,413		72		57		62	
All county sources (2002)[e]	4,269		32,110		7,559		7,264		1,132		612	
Percent increase[f] (projected emission/county emission × 100)	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Lyon County would 81 kilometers (51 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Lyon County would be 61 kilometers (38 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000.
f. < = less than.

Table 4-196. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Mineral County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	6	5	17	15	88	79	4	3	4	3	1	1
Proposed railroad operations exhaust	14	13	52	51	193	188	6	6	6	5	0	0
Totals	20	18	69	66	281	267	10	9	10	8	1	1
Off highway (2002)[e]	358		872		54		9		9		4	
Highway vehicles (2002)[e]	221		2,069		172		5		4		5	
All county sources (2002)[e]	1,260		3,093		248		1,636		436		23	
Percent increase[f] (projected emission/county emission × 100)	2	1	2	2	113	108	< 1	< 1	2	2	5	4

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Mineral County would be 171 kilometers (106 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Mineral County would be 153 kilometers (95 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-197. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Esmeralda County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_2	
Emissions source	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	5	3	15	11	81	62	3	2	3	2	-	-
Proposed railroad operations exhaust	3	2	9	7	50	38	2	1	2	1	0	0
Totals	8	5	24	18	131	100	5	3	5	3	-	-
Off highway (2002)[e]	9		68		26		3		3		3	
Highway vehicles (2002)[e]	131		1,247		107		3		3		3	
All county sources (2002)[e]	240		1,352		149		1,105		194		55	
Percent increase[f] (projected emission/county emission × 100)	3	2	2	1	88	67	< 1	< 1	3	2	< 1	< 1

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO_2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Esmeralda County would be 175 kilometers (109 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Esmeralda l County would be 134 kilometers (83 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-198. Maximum and minimum peak annual incremental emissions anticipated from operation of commercial trains along the Mina rail alignment under the Shared-Use Option through Nye County, Nevada, and county-wide total railroad operations emissions compared to 2002 existing county emissions.

Emissions source	Total emissions (metric tons per year)[a,b]											
	VOCs		CO		NO_x		PM_{10}		$PM_{2.5}$		SO_x	
	Max. length[c]	Min length[d]	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length	Max. length	Min. length
Commercial trains/shared use operations exhaust	4	4	14	12	76	64	3	2	3	2	0	0
Proposed railroad operations exhaust	44	44	168	166	437	431	13	13	12	12	1	1
Totals	48	48	182	178	513	495	16	15	15	14	1	1
Off highway (2002)[e]	338		1,788		199		27		25		22	
Highway vehicles (2002)[e]	1,335		13,977		1,050		32		25		28	
All county sources (2002)[e]	2,279		17,071		1,436		3,324		650		237	
Percent increase[f] (projected emission/county emission × 100)	2	2	1	1	36	35	< 1	< 1	2	2	< 1	< 1

a. To convert metric tons to tons, multiply by 1.1023.
b. CO = carbon monoxide; NOx = nitrogen oxides; PM10 = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; PM2.5 = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO2 = sulfur dioxide; VOCs = volatile organic compounds.
c. Maximum (Max.) length of rail alignment in Nye County would be 148 kilometers (92 miles). (The maximum and minimum lengths along the complete rail alignment are not equal to the sum of the possible maxima or the minima in individual counties.)
d. Minimum (Min.) length of rail alignment in Nye County would be 126 kilometers (78 miles).
e. Only includes anthropogenic (the influence of humans on the environment) source of emissions (DIRS 177709-MO0607NEI2002D.000).
f. < = less than.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 1 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Rail line		
Churchill County		
Union Pacific Railroad Hazen Branchline; Schurz alternative segment 6	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, NO_x, $PM_{2.5}$, PM_{10}, and VOCs. In addition, these emissions would be distributed over the length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 1 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
Lyon County		
Union Pacific Railroad Hazen Branchline; Department of Defense Branchline North; Schurz alternative segments 1, 4, 5, and 6	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, NO_x, $PM_{2.5}$, PM_{10}, and VOCs. In addition, these emissions would be distributed over the length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 1 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
Mineral County		
Schurz alternative segments 1, 4, 5, and 6; Department of Defense Branchline South; Mina common segment 1	Construction activities would add less than the 2002 county-wide burden of SO_2 and VOCs. CO, $PM_{2.5}$, PM_{10}, and NO_x would each have an increase greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 2 percent to the 2002 county-wide emissions for SO_2, CO, $PM_{2.5}$, PM_{10}, and VOCs, and about 80 percent for NOx emissions; however, these increases should not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Mina showed there is potential for the 24-hour PM_{10} NAAQS to be exceeded in the immediate vicinity of the rail line under some conditions. Within the town of Mina, concentrations would be below the NAAQS.	Modeling of emissions from operation of the rail line near Mina showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.
	Modeling of emissions from construction of the rail line near Hawthorne showed that no air pollutant would exceed the NAAQS.	Modeling of emissions from operation of the rail line near Hawthorne showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.
	Modeling of emissions during construction of the rail line near Schurz showed there is potential for the 24-hour PM_{10} and $PM_{2.5}$ NAAQS to be exceeded in the immediate vicinity of the rail line under some conditions. Within the town of Schurz, concentrations would be below the NAAQS.	Modeling of emissions from operation of the rail line near Schurz showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 2 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Esmeralda County		
Mina common segment 1; Montezuma alternative segments 1, 2, and 3; Mina common segment 2	Construction activities would add less than the 2002 county-wide burden of SO_2. CO, VOCs, $PM_{2.5}$, PM_{10}, and NO_x would each have an increase greater than the 2002 county-wide burden. However, these emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than 35 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
	Modeling of emissions from construction of the rail line near Silver Peak showed no air pollutant would exceed 70 percent of the NAAQS for any averaging period.	Modeling of emissions from operation of the rail line near Silver Peak showed no air pollutant would exceed 35 percent of the NAAQS for any averaging period.
Nye County		
Montezuma common segments 1 and 3; Mina common segment 2; Bonnie Claire alternative segments 2 and 3; common segment 5; Oasis Valley alternative segments 1 and 3; common segment 6	Construction activities would add less than the 2002 county-wide burden of SO_2, CO, PM_{10}, $PM_{2.5}$, and VOCs. NO_x would have an increase greater than the 2002 county-wide burden. However, emissions would be distributed over the entire length of the rail line in the county; thus, no air quality standard would be exceeded.	Operations activities would add less than about 35 percent to the 2002 county-wide burden of all criteria air pollutants and would not lead to a violation of air quality standards.
Construction and operations support facilities		
Churchill County		
Access roads (including the alignment access road) Schurz alternative segment 6	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Lyon County		
Access roads (including the alignment access road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Construction camp 18C or 18D	Only about 1 percent of the fugitive dust emissions would be due to construction of the construction camp. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camp would be reclaimed following the construction phase and would have no emissions during the operations phase.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 3 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Mineral County		
Access roads (including the alignment access road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Staging Yard at Hawthorne	Modeling of emissions from construction of the Staging Yard at Hawthorne found that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be exceeded in the immediate vicinity of the Staging Yard under some conditions.	Modeling of emissions from operation of the Staging Yard at Hawthorne showed no air pollutant would exceed 80 percent of the NAAQS for any averaging period.
Quarry	Modeling of emissions from the potential Garfield Hills quarry indicates that the 24-hour PM_{10} and $PM_{2.5}$ NAAQS could be exceeded. However, the required Surface Disturbance Permit would greatly reduce PM_{10} and $PM_{2.5}$ emissions, making an exceedance of the NAAQS unlikely.	Quarries would be reclaimed following rail line construction and would have no emissions during the operations phase.
Construction camps 15, 16, and 17	Only about 3 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and would have no emissions during the operations phase.
Wells	Well construction would be responsible for about 4 percent of the fugitive PM_{10} emissions. In no case would the construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of construction to serve as the water source for facility operations.
Esmeralda County		
Access roads (including alignment access road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Maintenance-of-Way Facility	Construction of the Maintenance-of-Way Facility would account for less than 1 percent of construction fugitive dust emissions. In no case would this be expected to cause an exceedance of any air quality standards.	The Maintenance-of-Way Facility would be responsible for less than 1 percent of the operations emissions in Esmeralda County and would not lead to a violation of air quality standards.
Quarries	Modeling of emissions from the operation of the potential quarry at Malpais Mesa during construction of the rail line shows no air pollutant would exceed 60 percent of the NAAQS for any averaging period.	Quarries would be reclaimed following the construction phase and have no emissions during the operations phase.

Table 4-199. Summary of potential impacts to air quality – Mina rail alignment[a,b] (page 4 of 4).

County/rail line segment/facility	Construction impacts	Operations impacts
Construction camp		
14, 13A or 13B	Only about 3 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and have no emissions during the operations phase.
Wells	Well construction would be responsible for about 4 percent of the fugitive PM_{10} emissions. In no case would the construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of the construction phase to serve as the water source for facility operations.
Nye County		
Access roads (including alignment access road)	About 39 percent of PM_{10} construction fugitive dust emissions would be from access roads. In no case would this be expected to lead to an exceedance of any air quality standards.	Operations would result in very small emissions from access roads.
Construction camps 10, 11 and 12	Only about 4 percent of the fugitive dust emissions would be due to construction of the construction camps. In no case would construction camp emissions be expected to cause an exceedance of any air quality standards.	Construction camps would be reclaimed following the construction phase and have no emissions during the operations phase.
Wells	Well construction would be responsible for about 4 percent of fugitive PM_{10} emissions. In no case would the construction of the wells be expected to cause an exceedance of any air quality standards.	Operation of the wells would result in very small emissions because only a few wells would continue to operate after the completion of the construction phase to serve as the water source for facility operations.
Rail Equipment Maintenance Yard and Cask Maintenance Facility	Combined, construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility would account for less than 2 percent of fugitive dust emissions. In no case would these emissions be expected to cause an exceedance of any air quality standards.	Combined, the Rail Equipment Maintenance Yard and Cask Maintenance Facilities would be responsible for about 93 percent of the operations emissions in Nye County.
Nevada Railroad Control Center and National Transportation Operations Center	Construction dust and exhaust emissions would be very small.	Operation of the Nevada Railroad Control Facility would result in very small emissions.

a. Impacts to air quality under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. CO = carbon monoxide; NO_x = nitrogen oxides; PM_{10} = particulate matter with an aerodynamic diameter equal to or less than 10 micrometers; $PM_{2.5}$ = particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers; SO2 = sulfur dioxide; NAAQS = National Ambient Air Quality Standards; VOCs = volatile organic compounds.

4.3.5 SURFACE-WATER RESOURCES

This section describes potential impacts to surface-water resources (***washes***, playas, ***floodplains***, and ***wetland*** areas) from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.5.1 describes the methodology DOE used to analyze potential impacts; Section 4.3.5.2 describes potential construction impacts; Section 4.3.5.3 describes potential operations impacts; Section 4.3.5.4 describes potential impacts under the Shared-Use Option; and Section 4.3.5.5 summarizes potential impacts to surface-water resources.

4.3.5.1 Impact Assessment Methodology

As described in Section 3.3.5.1, the region of influence for surface-water resources would be limited in most cases to the nominal width of the rail line construction right-of-way. In some cases the region of influence would extend beyond the construction right-of-way. Construction and operations activities along the rail alignment could impact a larger distance from the rail line in cases where surface-water drainages could carry pollutants (such as petroleum-based lubricants and fuels) and eroded soil downstream of the rail line or in cases where floodwaters backed up on the upstream side of the rail line.

DOE evaluated potential impacts to surface-water resources based on a series of criteria, as listed in Table 4-200. There would be an impact if construction and operations would cause any of the conditions listed in Table 4-200. To avoid or limit adverse impacts to surface-water resources, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Most importantly, careful pre-planning of construction and operations activities would allow the Department to assess and minimize potential impacts before they occurred (see Section 2.1).

Table 4-200. Impact assessment criteria for surface-water resources (page 1 of 2).

Resource criteria	Basis for assessing adverse impact
Stormwater drainage	Would railroad construction or operations: • Alter stormwater discharges, which could adversely affect drainage patterns, flooding, and/or erosion and sedimentation • Alter infiltration rates, which could adversely affect (increase or decrease) the volume of surface water that flows downstream • Conflict with applicable stormwater management plans or ordinances
Surface-water quality	Would railroad construction or operations: • Contaminate public water supplies and other surface waters, exceeding water quality criteria or standards established in accordance with the Clean Water Act, state regulations, or permits • Conflict with regional water quality management plans or goals
Surface-water availability and uses	Would railroad construction or operations: • Alter the capacity of available surface-water resources such that human health, the environment, or personal property would be adversely affected • Conflict with established water rights or regulations protecting surface water resources for future beneficial uses
Wetlands and waters of the United States	Would railroad construction or operations: • Cause filling of wetlands or otherwise alter drainage patterns such that wetlands or waters would be adversely affected

Table 4-200. Impact assessment criteria for surface-water resources (page 2 of 2).

Resource criteria	Basis for assessing adverse impact
Floodplains and floodwaters	Would railroad construction or operations: • Alter floodway or floodplain or otherwise impede or redirect flows such that human health, the environment, or personal property would be adversely affected • Conflict with applicable flood management plans or ordinances
Springs	Would railroad construction or operations: • Reduce or eliminate access to springs such that human health, the environment, or personal property would be adversely affected

The areas where surface-water impacts would be greatest and where DOE would implement direct controls (such as erosion and sedimentation controls) would be within the construction right-of-way. The Department expects that the numbers and types of surface-water features within the construction right-of-way would have a direct relationship to the degree of impacts within this area. To evaluate potential impacts to surface water, the Department identified areas where there are drainage channels, floodplains, springs, and wetlands along the rail alignment (including those it would cross or cover) and identified the activities associated with construction or operations that would have the potential to impact these surface-water resources.

4.3.5.2 Construction Impacts

Section 3.3.5 describes surface-water resources along the Mina rail alignment. Table 4-201 lists the numbers of surface-water features within the nominal width of the rail line construction right-of-way and support facilities. The table includes estimates of the number of drainage channels the Mina rail alignment alternative segments and common segments would cross. DOE identified drainage channels using the National Hydrological Dataset, a U.S. Geological Survey dataset of hydrologic features. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.3.5.2.1. The second subset is the washes DOE classified as ***waters of the United States*** during field studies in support of this Rail Alignment EIS.

This section also addresses impacts to surface-water quality, and water availability and usage. Springs are also evaluated because they are a significant source of surface water within and near the Mina rail alignment region of influence.

Floodplains and wetlands are two other important surface-water features the Department evaluated as part of this analysis. Appendix F, Floodplain and Wetlands Assessment, provides additional information on wetlands and floodplains the Mina rail alignment could encounter. Appendix F includes figures showing the locations of these surface-water features and provides more detail on their characteristics.

4.3.5.2.1 Impacts Common to the Entire Rail Alignment

The following sections describe common impacts identified and assessed for activities associated with construction of the proposed railroad along the Mina rail alignment. DOE would minimize impacts through the engineering design (see Chapter 2.2) and the implementation of best management practices (see Chapter 7).

4.3.5.2.1.1 Stormwater Drainage. Construction of the proposed railroad could result in both direct and indirect impacts to surface-water resources. Direct impacts would result from the temporary or permanent grading, dredging, rerouting, or filling of e***phemeral*** or ***intermittent streambeds***.

Table 4-201. Summary of drainages the rail line and support facilities would cross – Mina rail alignment.

Rail line segments/facilities	Total[a]	Notable drainages[b]	Waters of the United States[c]
Schurz alternative segment 1	21	9	4
Schurz alternative segment 4	42	18	6
Schurz alternative segment 5	61	21	1
Schurz alternative segment 6	67	28	1
Mina common segment 1	141	123	0
Staging Yard at Hawthorne	3	0	0
Potential Gabbs Range quarry	2	0	0
Montezuma alternative segment 1	187	93	0
Maintenance-of-Way Facility (Silver Peak option)	0	0	0
Montezuma alternative segment 2	85	42	0
Maintenance-of-Way Facility (Klondike option)	2	1	0
Montezuma alternative segment 3	148	60	0
Mina common segment 2	3	0	0
Bonnie Claire alternative segment 2	31	11	0
Bonnie Claire alternative segment 3	23	9	0
Common segment 5	124	84	0
Oasis Valley alternative segment 1	24	15	2
Oasis Valley alternative segment 3	28	11	1
Common segment 6	43	20	14
Rail Equipment Maintenance Yard	1	0	0

a. All drainages identified in National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
b. Only includes drainages with stream order equal to or greater than two from the National Hydrologic Dataset (DIRS 177714-MO0607NHDFLM06.000).
c. Source: DIRS 180889-PBS&J 2007, Figures 3A through 3C.

Indirect impacts would include increases in ***nonpoint source pollution*** resulting from runoff from construction areas where surface grades and characteristics had been changed (such as the rail roadbed, support facilities, and access roads).

Cut and fill operations during rail line construction would cause the alteration of natural drainage patterns and runoff rates in some areas could affect downgradient resources. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the track platform and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and movement of equipment to the construction initiation points. Depending on site conditions, construction could include regrading so that a number of minor drainage channels would collect in a single ***culvert*** or pass under a single bridge, resulting in water flowing from a single location on the downstream side rather than across a broader area. As a result, there would be some localized changes in drainage patterns.

Regrading and rerouting washes through channelization, including the installation of culverts and stabilization of existing stream banks, could increase the flow rate in relation to natural flow conditions. Culverts and improved channels would provide less resistance to flow so that the flow rate of runoff could increase as it passed through such a structure. The speed by which water flows through a drainage structure (a culvert, a bridge, or a stream channel) affects the erosive potential of the flow; therefore, the design of drainage structures must account for the potential for scour and erosion and incorporate outlet protection and velocity-dissipating devices that calm the flow and lessen its erosive potential. Without such protective measures, scour might occur, especially around bridge piers and abutments, where water flowing past a pier or abutment could erode the supporting soil and sediment around these structures. As the speed of flow increased, the chances for the entire streambed and bank to be exposed to scour and erosion would increase.

Subgrade elevation of the rail line is the elevation of the top of the ***subballast***.

Subballast is a layer of crushed gravel that is used to separate the ***ballast*** and roadbed for the purpose of load distribution and drainage.

Ballast is crushed stone used to support the railroad ties and provide drainage.

DOE would incorporate hydraulic modeling into the final design process to ensure that crossings are properly engineered so that they would not contribute to erosion and sediment pollution, and impacts to surface-water resources downstream of the rail line would be greatly minimized. Therefore, impacts associated with surface-water drainage patterns from rail line construction would be small.

DOE would employ standard engineering design practices to size and place culverts to move runoff water from one side of the track to the other. These culverts or other means of runoff control would be put in place as part of subgrade construction to prevent water from backing up. Preliminary rail line design includes various structures to accommodate drainage features the rail line would cross (DIRS 176166-Nevada Rail Partners 2006, all). These structures include slab bridges with multiple piers spaced at 4-meter (13-foot) intervals; double cell bridges with multiple piers spaced at 10-meter (33-foot) intervals; shaft-supported bridge structures with spans between end shafts of 14 to 24 meters (45 to 80 feet); precast reinforced concrete box culverts with a maximum cross-section size of 3.7 meters by 3.7 meters (12 feet by 12 feet); and corrugated metal pipe culverts of various diameters.

Except in areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, hydraulic design would be based on typical Class 1 freight railroad standard design criteria. Floodplain crossings are described in Section 4.3.5.2.1.6. Class 1 freight railroad standard criteria require that the ***50-year flood*** should not come into contact with the top (crown) of the culvert or the lowest point of the bridge, whichever is applicable. For the ***100-year flood***, these criteria require that the floodwaters should not rise above the ***subgrade elevation*** at the structure. To conform to these standards, DOE would use circular culverts where flow rates would be small (less than 4 cubic meters per second [140 cubic feet per second]). For larger flows (up to 28 cubic meters per second [1,000 cubic feet per second]), DOE would use box culverts. The Department would construct bridges where flows were larger and where the rail surface would not be tall enough to accommodate a sufficiently sized culvert, and would install the culverts with ***riprap*** around the exposed ends to protect the fill material from erosion (DIRS 176166-Nevada Rail Partners 2006, p. ii). Bridge abutments and piers would be similarly protected. In some places, training dikes or ***berms*** would be required to redirect flow and ensure that the flow would be conveyed through the structure. In places, channel improvements might be necessary for a short distance upstream and downstream of the rail line to intercept and effectively redirect flows through drainage structures.

50-year flood is a flood that has a 2-percent chance of being equaled or exceeded in any given year.

100-year flood is a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

500-year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any given year.

DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible. Where there would be very wide and shallow depths of flow during a 100-year flood, or the flow would be divided into multiple natural channels that would cross the rail line, the Department would use a series of multiple culverts, potentially in concert with small bridges to span the main flow channel. In locations where there were very high fill conditions, it would be more economical to use multiple culverts than to construct a bridge (DIRS 176166-Nevada Rail Partners 2006, p. ii). Because DOE would design stormwater conveyance systems to safely convey design floods (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater conveyance associated with construction of the rail line would be small.

Construction activities that disturbed the land surface, such as grading, excavation, or stockpiling, would have the potential to alter the rate at which water could infiltrate the disturbed areas. Depending on the type of disturbance, the ***infiltration*** rate could increase (for example, in areas with loosened soil) or decrease (for example, in areas where construction activities had compacted the soil or involved the installation of impermeable surfaces like asphalt pads, concrete surfaces, or buildings). Most of the land disturbance during the construction phase would result in surfaces with lower infiltration rates; that is, the surfaces would be less ***permeable*** than natural soil conditions and would cause an increase in runoff. The change in the amount of runoff that would actually reach the drainage channels would be minor, because construction would affect a small amount of the overall natural drainage area (DIRS 155970-DOE 2002, p. 4-24). Therefore, impacts associated with changes in stormwater infiltration and runoff rates would be small.

DOE would construct two access roads (each up to 7.3 meters [24 feet] wide) along most of the rail line within the rail line construction right-of-way (one on each side of the rail line) to support operations. Additional access roads could be needed to provide access to the construction support facilities, such as construction camps, wells, and quarries. DOE would improve all access roads, as necessary, in accordance with the parameters for rural roads as defined by the Nevada Department of Transportation and the American Association of State Highway and Transportation Officials (DIRS 180922-Nevada Rail Partners 2007, p. 4-20). The Department would excavate roadside ditches on both sides of the roadway as necessary to direct stormwater to drainage features and washes. Most access roads would likely have gravel surfaces, except for those to wells. Dip sections (depressions in a road that allow stormwater to flow across the road surface) would be used to convey ephemeral flows across the road surfaces (DIRS 180922-Nevada Rail Partners 2007, p. 4-20).

DOE would locate most wells along the two alignment access roads or adjacent to existing roads; however, construction of new access roads to distant wells might be required in four cases (total distance of less than 5.5 kilometers [3.5 miles]). These roads would be needed to reach the well sites and to accommodate temporary pipelines constructed to convey water to the construction right-of-way. DOE would construct temporary pipelines on top of the ground next to an existing road or a new access road (DIRS 176172-Nevada Rail Partners 2006, p. 4-11). The Department would position the temporary pipelines so they would not obstruct or redirect surface runoff or natural drainage channels. Therefore, there would be no adverse impacts to surface-water resources from construction of temporary pipelines.

Water would be required for compaction of fill material to construct the embankment areas of the rail roadbed. Compaction of fill would require approximately 6.4 billion liters (1.7 billion gallons) of water (DIRS 180857-Nevada Rail Partners 2007, p. 4-4). To stay within the plastic limits of the soil, fill would not be completely saturated, and runoff would be intentionally avoided. DOE would use standard erosion-control practices during compaction activities. Water would also be required for dust control along roads used to access the rail alignment during construction activities. Approximately 250 million liters (65 million gallons) of water would be required for dust control over a 3-year period. DOE would use standard construction dust-control measures. Water used for dust suppression in these areas would not be expected to result in runoff.

DOE would minimize construction impacts to stormwater drainage through engineering design (see Section 2.2) and implementation of best management practices (see Chapter 7). A National Pollutant Discharge Elimination System General Construction Permit would be required for construction activities. In accordance with this permit, construction contractors would be required to prepare and submit a Stormwater Pollution Prevention Plan, which would be prepared consistent with state and federal standards for construction activities and would detail the best management practices that would be employed to minimize soil loss and degradation to nearby water resources. Design of the best management practices program would be based on practices listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all) and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all).

Best management practices are structural and nonstructural controls that would be used to control non-point source pollution such as sedimentation and stormwater runoff. Structural controls are those best management practices that need to be constructed (such as detention or retention basins). Nonstructural controls refer to best management practices that typically do not require construction, such as planning, education, revegetation, or other similar measures. Sedimentation and stormwater runoff are typically addressed through the use of temporary and permanent best management practices, including techniques such as grading that would induce positive drainage; silt fences; and revegetation to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite. Best management practices would be implemented, inspected, and maintained to minimize the potential for adverse impacts to downstream water quality. Chapter 7 describes best management practices in more detail.

4.3.5.2.1.2 Surface-Water Quality. Construction activities could adversely impact surface-water quality due to increased sedimentation because rail line construction activities would result in the potential for erosion and sediment during precipitation events. Sediment would generally be contained onsite through the use of best management practices, including erosion- and sedimentation-control measures. For the areas of the Mina rail alignment near surface-water bodies, ***contaminants*** could be released directly to surface water. The Mina rail alignment would encounter a wide variety of surface drainage features. As described in Section 3.3.5.2.1.1, the Carson River and the Walker River appear on the Nevada 303(d) list of impaired waters. Suspended solids are pollutants of concern in these areas. DOE would implement direct controls (such as erosion and sedimentation controls) within the construction right-of-way to minimize surface-water impacts (DIRS 180120-NDEP 2005, Appendix A).

Water quality impacts are also possible from potential release and spread of contaminants (materials potentially harmful to human health or the environment), which could be released through an accidental spill or discharge. These types of releases could be localized if there was a small spill or widespread if precipitation or intermittent runoff carried contaminants away from the site of the spill. For the areas of the Mina rail alignment near surface-water bodies, contaminants could be released directly to surface water; however, there are only a few places where there are surface-water bodies along the rail alignment.

Section 4.3.12, Hazardous Materials and Waste, describes construction materials that could be mishandled (spilled), including petroleum products (such fuels and lubricants) and coolants (such as antifreeze). Incidental spills could also include solvents used for cleaning or for degreasing equipment. The construction camps would include some bulk storage of hazardous materials, and supply trucks would routinely bring new materials and remove used materials and wastes (such as lubricants and coolants) from the construction sites (see Section 4.3.12). These activities would present some potential for incidental spills and releases, the significance of which would depend largely on the nature and volume of the material spilled and its location. A release or spill of pollutants to a stream or river, or stormwater runoff carrying pollutants to such receptors, would have the greatest potential to adversely impact surface-water quality.

The potential for such impacts during the construction phase would be small because the environment along the Mina rail alignment is arid and there is little flowing water. Also, construction contractors would be required to comply with regulatory requirements for spill-prevention measures, reporting and remediating spills, and properly disposing of or recycling used materials (as described in Chapter 7). Common stormwater pollution control practices mandate that hazardous materials be stored inside facilities or have secondary containment or other protective devices and that spill control and containment equipment be stationed close to hazardous material (for example, fuel) storage.

Sanitary sewage generated at construction camps would be treated onsite or collected and trucked to a ***wastewater treatment*** plant. A portable wastewater treatment facility could be installed at each construction camp. As a water conservation measure, the Department could use treated wastewater effluent (***gray water***) produced at the camps for dust suppression and soil compaction. These water conservation measures would help reduce the demands placed on groundwater wells. The portable wastewater treatment plants would be designed and operated so that generated effluent would not adversely impact the quality of surface water with which it comes in contact; therefore, impacts to surface-water quality from wastewater treatment operations during the construction phase would be small. There would be no on-site discharges of industrial wastewater during the construction phase.

The wastewater treatment process would result in the production of biosolids (sludge). DOE would store biosolids on the sites and allowed them to dry until the conditions specified in federal regulations (40 CFR Part 503) and state regulations are met. DOE would dispose of biosolids at a licensed facility in accordance with all applicable state and federal laws (DIRS 176172-Nevada Rail Partners 2006, p. 4-6).

4.3.5.2.1.3 Surface-Water Availability and Uses. See Section 4.3.2, Land Use and Ownership, for a discussion of impacts to manmade water systems.

4.3.5.2.1.4 Waters of the United States. Jurisdictional waters of the United States subject to Section 404 of the Clean Water Act include interstate waters and intrastate waters with a connection to interstate commerce, tributaries to such waters, and wetlands that are adjacent to waters of the United States. The Section 404 permitting program prohibits discharge of dredged or fill material into jurisdictional waters if a practicable alternative exists that would be less damaging to the aquatic environment, or if the Nation's waters would be significantly degraded. In other words, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts and that potential impacts to waters of the United States have been minimized and mitigation is provided for any remaining unavoidable impacts (if required). See Chapter 6, Statutory, Regulatory, and Other Applicable Requirements, for further discussion of the Clean Water Act Section 404 permitting requirements.

The U.S. Army Corps of Engineers is responsible for determining whether drainages and wetlands along the rail alignment are regulated under Section 404; therefore, all conclusions in this analysis about the classification of washes and wetlands as waters of the United States are tentative. On June 5, 2007, the U.S. Environmental Protection Agency and U.S. Army Corps of Engineers released interim guidance that addresses jurisdiction over waters of the United States under the Clean Water Act. Based on this guidance, it is likely that many of the drainages along the rail alignment that DOE currently considers to be waters of the United States might not be considered as such according to the new guidance. If DOE selected the Mina rail alignment for construction of the proposed railroad, the Department would request that the U.S. Army Corps of Engineers determine the limits of jurisdiction under Section 404 along the rail alignment before beginning construction.

Estimates for potential fill area and quantity of fill are provided in this section to support Section 404 permitting requirements (see Table 4-202). These estimates were calculated based on the depth and width of the water body that would be crossed and the type of engineered structure planned for each crossing. For crossings with culverts, DOE assumed that culverts would be extended 12 meters (40 feet) on either side of the cut/fill boundary for the rail roadbed. For bridges over waters of the United States having a width of less than 3 meters (10 feet), DOE assumed that no fill would be placed in the channel. For bridges over wider channels, DOE assumed that there would be one bridge pier every 6 meters (20 feet) and that each pier would cover a surface area of 1.9 square meters (20 square feet). Fill estimates calculated for these crossings depend on channel depths. These fill estimates represent an upper bound estimate, because many of the drainages currently identified during this analysis as waters of the United States might not be considered waters of the United States under the new U.S. Army Corps of Engineers guidance.

If DOE constructed the railroad along the Mina rail alignment there would be no practicable alternative to crossing some ***ephemeral streams*** that are waters of the United States. There are numerous ephemeral waters of the United States that flow perpendicular to the general direction of the rail line and the rail line would have to cross them. DOE would construct bridges across many of the ephemeral waters of the United States along the rail line and very little or no fill in regulated stream channels would be required for those crossings. The Department would place culverts in the smaller ephemeral streams. Because the size of these regulated channels is generally less than 1 to 2 meters (3.3 to 6.6 feet), the area filled per crossing would typically be less than about 100 square meters (0.03 acre). The crossings would be designed so that they would not alter stream flow and best management practices (see Chapter 7) would be implemented to minimize sedimentation during and after construction.

Impacts to drainages classified as waters of the United States would be the same as impacts described in Section 4.3.5.2.1.1.

4.3.5.2.1.5 Wetlands. Executive Order 11990, *Protection of Wetlands*, requires that federal agencies "…take action to minimize the destruction, loss, or degradation of wetlands…" The Executive Order requires consideration of all wetlands regardless of whether they are regulated under Section 404 of the Clean Water Act. DOE regulations at 10 CFR Part 1022 direct that impacts to wetlands be avoided wherever possible and minimized to the extent practicable during construction projects. In accordance with Executive Order 11990 and 10 CFR Part 1022, this Rail Alignment EIS examines impacts to all wetlands regardless of whether they are considered jurisdictional under Section 404 of the Clean Water Act.

Under 10 CFR 1022, the Department is required to preserve and enhance the natural and beneficial values of wetlands. The values of wetlands are a function of the importance or worth of the functions that wetlands serve to society. Functions of wetlands include storage of water (floodwater protection), water filtration (wetlands can trap nutrients, sediment, and pollutants), and biological productivity (plant and animal ***habitat***). Impacts to these functions can eliminate or diminish the value of wetlands (DIRS 176797-USEPA 2001, p. 1). Temporary or permanent filling or draining of wetlands would result in direct impacts to those resources.

Actions in and around wetlands could result in indirect impacts, such as potential degradation of water quality and disruption of water flow. To meet the requirements of 10 CFR Part 1022, Appendix F, Floodplain and Wetlands Assessment, includes a detailed analysis of wetlands and wetland functions. Specifically, this appendix includes a more detailed presentation of the data sources the Department used to identify wetlands and floodplains along the Mina rail alignment, a discussion of potential impacts (repeated in this section), and an alternatives analysis. The discussion of impacts in this section and Appendix F is limited to the water storage and filtration functions of wetlands. Section 4.3.7, Biological Resources, addresses impacts to the biological-productivity functions of wetlands.

Table 4-202. Summary of waters of the United States – Mina rail alignment.[a]

Rail line segments/facilities	Crossings[b]	Fill area (square meters)[c]	Fill volume (cubic meters)[d]
Schurz alternative segment 1	4	420	18
Schurz alternative segment 4	6	510	19
Schurz alternative segment 5	1	1.9	1.7
Schurz alternative segment 6	1	1.9	1.7
Oasis Valley alternative segment 1	2 (bridged)	0	0
Oasis Valley alternative segment 3	1 (bridged)	0	0
Common segment 6	14	560	37

a. Source: DIRS 180889-PBS&J 2007, Figure 3A through 3C.
b. Any water of the United States within 12 meters (40 feet) of the construction footprint is considered to be crossed.
c. To convert square meters to acres, multiply by 2.4711.
d. To convert cubic meters to cubic feet, multiply by 35.314.

DOE would minimize filling of wetlands by keeping the rail line footprint to a minimum and incorporating avoidance into rail line engineering and design to the extent practicable. DOE would mitigate loss of wetlands, as required under Section 404 of the Clean Water Act, by enhancing existing wetlands adjacent to or near the rail line that have been degraded by grazing and other impacts, or by creating new wetlands adjacent to or near the rail line. The exact acreage of wetlands to be enhanced or created would be determined in coordination with the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency and would be based in part on the amount of wetlands that would have to be filled to construct the rail line, the function and quality of the wetlands that would be lost, and the likelihood of success of the methods used to enhance or replace wetlands. This section describes impacts to wetlands in the segment-specific sections.

4.3.5.2.1.6 Floodplains and Floodwaters. DOE has prepared a floodplain assessment (see Appendix F) for the area along the Mina rail alignment in accordance with the requirements of 10 CFR Part 1022. Appendix F includes figures that show the Federal Emergency Management Agency floodplain maps that cover the Mina rail alignment region of influence. DOE obtained floodplain data from the Agency, which has published Flood Insurance Rate Maps that, depending on the combination of alternative segments, cover only 20 percent of the Mina rail alignment (see Appendix F, Table F-2). The Agency has not mapped areas that are uninhabited. These floodplain maps depict, as applicable, the lateral boundaries or spread of water that could be expected in drainage channels or around collection basins from a 100-year and a ***500-year flood***.

DOE overlaid a map of the Mina rail alignment on the available floodplain maps and estimated the crossing distances for each alternative segment and common segment. Table 4-203 lists the crossing distances and the percentage of the area for which floodplain map coverage is available. Areas with little or no floodplain map coverage could contain floodplains not listed in the table. Appendix F discusses floodplains in more detail.

Construction activities would affect floodplains, either through direct alteration of the stream-channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain. Based on Federal Emergency Management Agency floodplain maps and flood studies completed in the area of the Yucca Mountain Site, the Mina rail alignment would cross more than six floodplains.

Construction impacts associated with these floodplains would be similar to any other identified drainage areas (the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas could reduce the area through which floodwaters would naturally flow, which could cause water levels to rise on the upstream side of crossings.

Table 4-203. 100-year floodplains the Mina rail alignment would cross.

Rail line segment	Percent covered by FEMA[b] floodplain maps	Floodplain crossing distance (kilometers)[a]		Floodplain description
		Mapped	Additional estimated	
Schurz alternative segment 1	0	0	0	No floodplains mapped.
Schurz alternative segment 4	0	0	0	No floodplains mapped.
Schurz alternative segment 5	0	0	0	No floodplains mapped.
Schurz alternative segment 6	0	0	0	No floodplains mapped.
Mina common segment 1	0	0	0	No floodplains mapped.
Montezuma alternative segment 1	0.1	0.01	0	The very southern end of Montezuma alternative segment 1 would cross a very small section of FEMA floodplains just before it joined with Mina common segment 2.
Montezuma alternative segment 2	10	2	0	The floodplain is located between the Stonewall Mountains and Cuprite Hills and is associated with Stonewall Flat.
Montezuma alternative segment 3	0.1	0.01	0	The very southern end of Montezuma alternative segment 3 would cross a very small section of FEMA floodplains just before it joined with Mina common segment 2.
Mina common segment 2	100	1.3	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.9	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.3	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	1.1	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.4	0	Floodplain of the Amargosa River within Thirsty Canyon.
Common segment 6	55	0.1	0	Beatty Wash floodplain extending from Amargosa River Floodplain.
		0.23[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (rail line would cross wash and tributaries).

a. To convert kilometers to miles, multiply by 0.62137.
b. FEMA = Federal Emergency Management Agency.
c. There are no FEMA floodplain maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of floodplain crossings in this area are from DIRS 155970-DOE 2002, Figure 3-12 floodplain mapping efforts.

Sedimentation would be likely to occur on the upstream side of crossings in areas where the flow of water was restricted enough to cause ponding. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, p. 6-79). Therefore, impacts to floodplains from construction of the rail line that result in restrictions in flow and sedimentation would be small.

Construction within floodplains would cause direct impacts to floodplains. The Mina rail alignment would be in a region where flash flooding is the primary concern. Although such flooding can be violent and hazardous, it is generally limited in its extent and duration, limiting the potential for impacts associated with the proposed railroad; that is, any damage would be expected to be confined to a small portion of the rail line.

Although DOE would generally design rail line features to accommodate 100-year floods, based on typical Class 1 freight railroad standard design criteria (see Section 4.3.5.2.1.1), the final design process could also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2 c). In areas where drainage structures would cross a Federal Emergency Management Agency-designated 100-year floodplain, DOE would design the bridge to comply with Agency standards and appropriate county regulations. Federal Emergency Management Agency standards require that floodway surcharge (the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. These standards are designed to limit the impacts of floodwater to structures built in or adjacent to floodplains (DIRS 176166-Nevada Rail Partners 2006, p. ii). By adhering to these standards, the Department would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

Bridge constructing usually involves placing a portion of the bridge abutment in the floodplain (called encroachment). For this reason, the abutment can have some impact on the height of floodwaters upstream of the bridge. Excessive encroachment can result in increased scour potential at the abutments, piers, and the stream bottom through the bridge opening due to increases in flow velocities. Based on the conceptual design for the Mina rail alignment, there could be encroachments up to 30 percent of the floodplain width, which could result in an approximately 0.3-meter (1-foot) increase in water surface elevation at the upstream side of the bridge where the floodplain is wide and shallow (DIRS 176166-Nevada Rail Partners 2006, p. ii).

DOE would reduce impacts to floodplains and the resources close to the floodplains by adhering to the design standards that limit the degree to which floodwaters would be allowed to rise. The Department would incorporate hydraulic modeling into the engineering design process to ensure that all crossings were designed to limit impacts to nearby populations and resources.

4.3.5.2.1.7 Springs. DOE designed the rail line to avoid springs and other surface-water resources whenever practicable. In the few cases where there would be springs within the construction right-of-way, the Department would incorporate avoidance into final engineering and design of the rail line to the extent practicable. To minimize temporary impacts, springs would be marked prior to construction and avoided where possible. Section 4.3.6, Groundwater Resources, addresses impacts to springs from a groundwater-supply perspective.

4.3.5.2.2 Impacts along Alternative Segments and Common Segments

4.3.5.2.2.1 Union Pacific Railroad Hazen Branchline (Hazen to Wabuska). DOE would not perform any construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to surface-water resources along the existing Union Pacific Railroad Hazen Branchline.

4.3.5.2.2.2 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation). DOE would construct a passing siding within the existing right-of-way and no new land would be disturbed. DOE would not perform any additional construction activities along the existing branchline. The construction of the passing siding would not affect current drainage patterns. Therefore, there would be no impacts to surface-water resources along the existing Department of Defense Branchline North.

4.3.5.2.2.3 Department of Defense Branchline through Schurz. DOE would remove track, timber ties, and ballast, and grade the ballast section to a smooth surface along this branchline. This removal activity would not involve land disturbance outside the existing rail line right-of-way because these actions would be performed using equipment designed to move along the track. Impacts resulting from grading would be the same as those described in Section 4.3.5.2.1.1 and are expected to be limited to the existing right-of-way because of best management practices that would be used to control nonpoint source pollution, such as sedimentation and stormwater runoff.

4.3.5.2.2.4 Schurz Alternative Segments. The Schurz alternative segments would cross waters of the United States as summarized in Table 4-201, including the Walker River and tributaries to Walker River. Of the four waters of the United States that Schurz alternative segment 1 would cross, the amount of fill would range from 1.7 cubic meters (60 cubic feet) for the smallest drainage to 8.6 cubic meters (300 cubic feet) for the largest drainage. Of the six waters of the United States that Schurz alternative segment 4 would cross, the amount of fill would range from 1.7 cubic meters (60 cubic feet) for the smallest drainage to 10 cubic meters (360 cubic feet) for the largest drainage. Both Schurz alternative segments 5 and 6 would cross only one water of the United States, therefore the total amount of fill for this drainage would be 1.7 cubic meters (60 cubic feet). The total amount of fill for waters of the United States crossed by Schurz alternative segment 1 would cross would be 18 cubic meters (630 cubic feet) and 19 cubic meters (670 cubic feet) for Schurz alternative segment 4. Section 4.3.5.2.1.4 addresses common impacts to waters of the United States.

Suspended solids have been identified as a contributing factor in the failure of the Walker River to meet water quality standards. Section 4.3.5.2.1.2 addresses common impacts to surface-water quality.

To reduce impacts to the Walker River and the associated floodplain, a bridge would be constructed at the Walker River crossing. The proposed dimensions are 300 meters (1,000 feet) long and 12 meters (40 feet) high (DIRS 180872-Nevada Rail Partners 2007, p. E-1). To construct a bridge over the Walker River, an approximately 18-meter (60-foot)-wide work area would be cleared of trees and other large vegetation along the alignment on both sides of the river. This would result in the temporary disturbance of about 0.002 square kilometer (0.55 acre) of wetlands for Schurz alternative segments 1 and 4, and 0.003 square kilometer (0.73 acre) of wetlands for Schurz alternative segments 5 and 6. DOE would place mats on all wetlands and moist soils within this work area to protect those soils from heavy equipment. The boundaries of the work area would be fenced, flagged, or otherwise marked to minimize disturbances in wetlands. The Department would locate all staging areas and equipment yards in uplands. DOE would revegetate wetlands and other disturbed areas after completion of the bridge. Placement of piers and construction of the bridge in the active stream would occur during low flow (generally September through April). To provide access for cranes and other heavy equipment to the stream channel, which is about 12 meters wide in this area, DOE would sink heavy mats made of wood or other solid material into the stream. There would be sufficient gaps between the mats to allow flow of water. DOE would not place any sand, gravel, or other loose fill in the stream channel. The Department would remove the mats from the channel after the bridge pilings were driven into ground and the concrete bridge sections were erected over the channel. Using these methods, the only permanent fill or loss of wetlands would be a total of about 20 square meters (0.005 acre) for ***emplacement*** of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6. Appendix F, Floodplain and Wetlands Assessment, provides additional information on construction of the bridge on wetlands. Section 4.3.5.2.1.5 addresses common impacts to wetlands.

Although the Federal Emergency Management Agency has not mapped this area, the Schurz alternative segments cross areas with ***ephemeral washes*** and playas where the potential for flash flooding exists. The Department would construct appropriate drainage structures (including box culverts along Schurz alternative segment 6 and a plate girder along Schurz alternative segment 1, 4, 5, or 6). DOE anticipates impacts from construction of the rail line in floodplains would be small (DIRS 180872-Nevada Rail Partners 2007, pp. 3-2 and 3-3). Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

The two springs identified along Schurz alternative segment 1, Double Spring and an unnamed spring, lie within the region of influence but outside the construction right-of-way. Section 4.3.5.2.1.7 addresses common impacts to springs.

Construction camps 18A, 18B, 18C, and 18D, as described in Section 3.3.5.3.4, would be within the construction right-of-way. Construction camp 18C, which would be adjacent to Schurz alternative segment 5, would overlie one small ephemeral wash, and construction camp 18D, which would be adjacent to Schurz alternative segment 6, would overlie two small ephemeral washes. The camps would not cross any waters of the United States or wetlands. Construction camp 18A, which would be adjacent to Schurz alternative segment 1, and construction camp 18B, which would be adjacent to Schurz alternative segment 4, do not overlie any surface-water features. Section 4.3.5.2.1.1 addresses common impacts to surface-water crossings.

4.3.5.2.2.5 Department of Defense Branchline South (Hawthorne to Common Segment 1). DOE would use the existing rail line along the Department of Defense Branchline South for operations along the Mina rail alignment. With the exception of a new siding that would be constructed within the existing right-of-way and the construction of construction camp 17 along the southern portion of the segment, DOE does not anticipate any other construction activities. Construction camp 17 would be 0.3 kilometer (0.2 mile) northeast of Hawthorne and 0.93 kilometer (0.57 mile) northeast of the rail segment. The construction camp would be on the Hawthorne Army Depot and would not require additional road construction. Construction camp 17 would overlie one notable wash. Aside from construction of this camp and the siding, DOE does not anticipate any other surface disturbances along this portion of the Mina rail alignment.

4.3.5.2.2.6 Mina Common Segment 1 (Gillis Canyon to Blair Junction). Mina common segment 1 would cross several notable drainages but no waters of the United States, as summarized in Table 4-201. These drainages are described in Section 3.3.5.3.6 as ephemeral washes and playas. Notably, this segment crosses a large playa in Soda Spring Valley. Section 4.3.5.2.1.1 addresses common impacts to drainages.

There are no waters of the United States identified along Mina common segment 1 (DIRS 180889-PBS&J 2007, p. 7).

The National Wetland Inventory dataset identifies the playas in Soda Spring Valley and Alkali Flat as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas and therefore, no impact is anticipated (DIRS 180889-PBS&J 2007, Figure 4).

The Federal Emergency Management Agency has not mapped the area near Mina common segment 1; however, there are areas such as the Soda Springs playa where the potential for flash flooding exists. Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

The two springs identified along Mina common segment 1, Kinkaid Spring and an unnamed spring, would lie within the Mina rail alignment region of influence but outside the construction right-of-way. Section 4.3.5.2.1.7 addresses common impacts to springs.

Construction camps 14, 15, and 16, as described in Section 3.3.5.3.6, would be within the construction right-of-way of Mina common segment 1. Construction camp 16 would overlie one small ephemeral wash and one notable drainage, and construction camp 14 would overlie one small ephemeral wash and one notable drainage. The camps would not cross any waters of the United States or wetlands. Construction camp 15 would not overlie any surface water. Section 4.3.5.2.1.1 addresses common impacts to surface-water crossings.

4.3.5.2.2.7 Montezuma Alternative Segments. The Montezuma alternative segments would cross over several drainage features, including Jackson Wash and China Wash (Montezuma alternative segment 1) and Big Wash (Montezuma alternative segments 2 and 3). As shown in Table 4-201, the Montezuma alternative segments would cross numerous drainage channels. These drainages are described in Section 3.3.5.3.7 as ephemeral washes and playas. Notably, Montezuma alternative segments 2 and 3 would cross a large playa in Big Smoky Valley. Section 4.3.5.2.1.1 addresses common impacts to drainages.

There are no waters of the United States identified along the Montezuma alternative segments (DIRS 180889-PBS&J 2007, p. 7).

The National Wetland Inventory dataset identifies the playas in Big Smoky Valley (Montezuma alternative segments 2 and 3) and Stonewall Flat (Montezuma alternative segment 2) as wetlands; however, DOE field studies in support of this Rail Alignment EIS confirmed no wetlands in these areas and therefore, no impact is anticipated (DIRS 180889-PBS&J 2007, Figure 4).

Federal Emergency Management Agency flood maps only cover a small portion of the Montezuma alternative segments, near their southern termination. However, there are areas such as Big Smoky Valley, Clayton Valley, Stonewall Flat, and Montezuma Valley where the potential for flash flooding exists. Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

There are three springs identified along the Montezuma alternative segments – Hot Spring (Montezuma alternative segment 1), Slaughterhouse Spring (Montezuma alternative segment 2), and Rabbit Spring (Montezuma alternative segment 2). All three springs are within the Mina rail alignment region of influence but outside the construction right-of-way. Section 4.3.5.2.1.7 addresses common impacts to springs.

Construction camps 9, 9A, 13A, and 13B, as described in Section 3.3.5.3.7, would be within the construction right-of-way of the Montezuma alternative segments. Construction camp 9A would overlie one small ephemeral wash, and construction camp 13B would overlie one small ephemeral wash. The camps would not cross any waters of the United States or wetlands. Construction camps 9 and 13A would not overlie any surface water. Section 4.3.5.2.1.1 addresses common impacts to surface-water crossings.

4.3.5.2.2.8 Mina Common Segment 2. Mina common segment 2 would skirt two playas – Stonewall Flat Playa to the east and Alkali Flat Playa to the southwest. Mina common segment 2 would cross a drainage path that connects these two playas. These features are described in Section 3.3.5.3.8. Section 4.3.5.2.1.1 addresses common impacts to drainages.

There are no waters of the United States or wetlands along Mina common segment 2 (DIRS 180889-PBS&J 2007, pp. 7 and 9).

Federal Emergency Management Agency floodplain maps show a floodplain associated with the drainage path that connects Stonewall Flat Playa and Alkali Flat Playa, as indicated in Table 4-203. Where the Mina common segment would cross the floodplain, a drainage structure would be required that does not result in more than a 0.3-meter (1-foot) increase in water-surface elevations upstream of the crossing. Because of the engineering design process DOE would use and the regulatory requirements DOE would meet, impacts to surface-water drainage patterns would be small. Section 4.3.5.2.1.6 addresses common impacts to floodplains and floodwaters.

There are no springs identified or construction camps planned along Mina common segment 2.

4.3.5.2.2.9 Bonnie Claire Alternative Segments. Both of the Bonnie Claire alternative segments would cross an unnamed drainage channel that drains the area of Stonewall Mountain. Bonnie Claire alternative segment 3, the southwestern alternative segment, would also cross Alkali Flat Playa. These features are described in Section 3.3.5.3.9. Common impacts to drainages are addressed in Section 4.3.5.2.1.1.

There are no waters of the United States or wetlands identified along the Bonnie Claire alternative segments (DIRS 180889-PBS&J 2007, pp. 7 and 9).

Floodplain maps of the area show floodplains associated with the unnamed drainage channel that drains the area of Stonewall Mountain and Alkali Flat Playa; however, map coverage of the unnamed wash terminates just downstream (southwest) of Bonnie Claire alternative segment 3. The coverage stops at an old boundary of the Nevada Test and Training Range, but is close enough to the alternative segment that a reasonable estimate of the crossing distance could be made and included in Table 4-203. The area where Bonnie Claire alternative segment 2, the northeastern alternative segment, would cross the unnamed wash is far enough away from the limit of the floodplain map coverage that a crossing distance was difficult to estimate, which is why no value is shown in Table 4-203. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are no springs identified or construction camps planned along the Bonnie Claire alternative segments.

4.3.5.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Common segment 5 would cross numerous drainage channels, including Tolicha Wash and several unnamed washes, and would skirt playa areas of Sarcobatus Flat. These features are described in Section 3.3.5.3.10. Common impacts to drainages are addressed in Section 4.3.5.2.1.1.

There are no waters of the United States or wetlands identified along common segment 5 (DIRS 180889-PBS&J 2007, pp. 7 and 9).

Where common segment 5 would cross the floodplain associated with Tolicha Wash, a drainage structure would be required that would not result in more than a 0.3-meter (1-foot) increase in water-surface elevations upstream of the crossing. Playa areas near common segment 5 would be subject to occasional flooding and standing water, but the Federal Emergency Management Agency floodplain maps do not show that 100-year flood levels would reach this rail line segment. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are no springs identified along common segment 5.

Construction camp 10, as described in Section 3.3.5.3.10, would be within the construction right-of-way and would overlie two small ephemeral washes and three notable drainages. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.3.5.2.1.1.

4.3.5.2.2.11 Oasis Valley Alternative Segments. The Oasis Valley alternative segments would cross several washes and both would cross the Amargosa River, which is an ephemeral stream in this area. The northeastern alternative segment, Oasis Valley 3, would run within approximately 0.24 kilometer (0.15 mile) from Colson Pond. These features are described in Section 3.3.5.3.11. Common impacts to drainages are addressed in Section 4.3.5.2.1.1.

DOE field surveys of these areas identified two drainage channels along Oasis Valley alternative segment 1 and one drainage channel along Oasis Valley alternative segment 3 that would qualify as waters of the United States (DIRS 180889-PBS&J2007, p. 7 and Figure 3B). Crossings of waters of the United States are summarized in Table 4-201. However, DOE would likely use bridges for these crossings. Therefore, the total amount of fill for waters of the United States the Oasis Valley alternative segments would cross would be very small. Common impacts to waters of the United States are addressed in Section 4.3.5.2.1.4.

DOE field surveys also identified a small isolated wetland, WT-15 (74 square meters [800 square feet]), that would be just outside the construction right-of-way, approximately 160 meters (530 feet) north of Oasis Valley alternative segment 1 (DIRS 180914-PBS&J 2006, p. 13 and Figure 4T). There would be no direct impacts to this wetland during the construction phase because it would be outside the construction right-of-way and would be fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible. Common impacts to wetlands are addressed in Section 4.3.5.2.1.5.

As shown in Table 4-203, both of these alternative segments would cross floodplains associated with Thirsty Canyon. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are 25 springs within the region of influence of the Oasis Valley alternative segments, all of which would be outside the construction right-of-way. Oasis Valley alternative segment 3 would run within 200 to 520 meters (640 to 1,700 feet) of two unnamed springs. Oasis Valley alternative segment 1 would run within 480 to 610 meters (1,600 to 2,000 feet) of seven springs. Because the springs would be downstream of the rail line, there would be the potential for impacts from erosion and sedimentation during the construction phase. Common impacts to springs are addressed in Section 4.3.5.2.1.7.

Construction camp 11, as described in Section 3.3.5.3.11, would be within the Oasis Valley 1 construction right-of-way and would overlie one small ephemeral wash and two notable drainages. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.3.5.2.1.1.

4.3.5.2.2.12 Common Segment 6 (Yucca Mountain Approach). Common segment 6 would cross several drainage features, including Beatty Wash, Tates Wash, Windy Wash, Busted Butte Wash (also known as Dune Wash), and unnamed tributaries of the Amargosa River, Busted Butte Wash, and Drill Hole Wash. These features are described in Section 3.3.5.3.12. Common impacts to drainages are addressed in Section 4.2.5.2.1.1.

Common segment 6 would cross 14 channels that qualify as waters of the United States, including two tributaries of the Amargosa River, Beatty Wash, seven tributaries to Beatty Wash, and four tributaries to Fortymile Wash. Of the 14 waters of the United States that common segment 6 would cross, the amount of fill would range from none for the smallest drainage to 9.9 cubic meters (350 cubic feet) for the largest drainage. The total amount of fill for waters of the United States that common segment 6 would cross would be 37 cubic meters (1,300 cubic feet).

There are no wetlands identified along common segment 6 (DIRS 180889-PBS&J 2007, p. 7).

Federal Emergency Management Agency floodplain maps provide coverage for the western portion of common segment 6, but the coverage terminates at approximately the point where the rail line would reach the Yucca Mountain Site boundary. In the areas covered by floodplain maps, the only floodplain along common segment 6 is one associated with Beatty Wash. The maps also show a floodplain associated with the unnamed wash from Crater Flat, but it does not extend up the wash as far as where common segment 6 would cross. DOE would build a large (370-meter [1,200-foot]-long) special-condition railroad bridge across Beatty Wash. Although the floodplain maps do not provide coverage for the area of the repository site on the east side of Yucca Mountain, there have been flood studies performed on several washes in that area, as described in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Figure 3-12 and pp. 3-38 and 3-39). If the Mina rail alignment is overlain on the figure of the floodplains in the Yucca Mountain FEIS (see Figure F-15 in Appendix F of this Rail Alignment EIS), it can be seen that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash and Drill Hole Wash before it terminated just prior to crossing a floodplain associated with Midway Valley Wash (also known as Sever Wash). Table 4-208 lists the estimated crossing distances for Beatty Wash, Busted Butte Wash, and Drill Hole Wash. Common impacts to floodplains and floodwaters are addressed in Section 4.3.5.2.1.6.

There are no springs identified along common segment 6.

Construction camp 12, as described in Section 3.3.5.3.12, would be within the common segment 6 construction right-of-way and would overlie one small ephemeral wash. The camp would not cross any waters of the United States or wetlands. Common impacts to surface-water crossings are addressed in Section 4.3.5.2.1.1.

4.3.5.2.3 Impacts from Constructing Facilities

4.3.5.2.3.1 Staging Yard. The Staging Yard would be constructed to the east of Hawthorne along Mina common segment 1. The disturbance area of the Staging Yard would be approximately 0.20 square kilometer (50 acres) and would include a 350-square-meter (3,800-square-foot) office, a 560-square-meter (6,000-square-foot) Satellite Maintenance-of-Way Facility, and a paved access road (DIRS 180872-Nevada Rail Partners 2007, p. 3-1 and 3-2). The facility would overlie one notable wash; however, impacts to surface-water features would be small. Impacts to surface waters are summarized in Table 4-204.

4.3.5.2.3.2 Maintenance-of-Way Facility. There are two potential locations for the Maintenance-of-Way Facility along the Mina rail alignment, depending on the selected alternative segment. The Silver Peak option along Montezuma alternative segment 1 would be approximately 1.6 kilometers (1 mile) south of Silver Peak. The Klondike option along Montezuma alternative segment 2 or 3 would be 2.9 kilometers (1.8 miles) west of U.S. Highway 95 between Tonopah and Goldfield (DIRS 180872-Nevada Rail Partners 2007, p. 4-4). The disturbance area of either potential location would be approximately 61,000 square meters (15 acres). There are no surface-water features in the area of either Maintenance-of-Way Facility option; therefore, there are no impacts to surface-water features.

4.3.5.2.3.3 Rail Equipment Maintenance Yard. Because there are no perennial surface waters in the area where the rail line would end at Yucca Mountain, potential impacts to surface-water features from the construction of rail line facilities in that area would be small (similar to the common impacts already described in Section 4.3.5.2.1.1). The Rail Equipment Maintenance Yard would overlie one ephemeral wash, but would not cross any waters of the United States. The Yard construction disturbance area, approximately 0.41 square kilometer (100 acres), would also include the train crew quarters, and could be the location for the Nevada Railroad Control Center and National Transportation Operations Center, and the Cask Maintenance Facility. Construction of the operations support facilities would include stormwater runoff control, as necessary, which would minimize the potential for contaminated runoff to reach any of the washes in the area; therefore, impacts related to construction of the Rail Equipment Maintenance Yard would be small.

4.3.5.2.4 Quarries

Each quarry facility would be comprised of three primary components: an operations plant, the quarry and production area, and possibly a railroad siding. The operations plant would include an office and administration complex, parking areas, services for fueling and maintenance, and sanitary facilities. Portable sanitary systems would be provided onsite; no water supply or wastewater treatment facilities would be provided at the quarry sites. The quarries would be close enough to construction camps that on-site residential facilities would not be necessary.

Ballast quarry operations would require the use of water, primarily to wash excavated rock during crushing and screening operations. Water usage quantities would vary depending on the specific quarry process selected to wash the rock during these operations. It is estimated that approximately 140,000 liters (38,000 gallons) of water would be needed per operational day at each quarry site (DIRS 180875-Nevada Rail Partners 2007, p. 3-1). Water used during these activities would also be used for dust suppression in these quarry areas. The wash water would be contained and recirculated through settling ponds. Relatively small quantities of water would also be used for dust suppression during drilling and blasting, truck loading and unloading, ballast stockpile and waste rock pile operations, and along access roads and in the quarry pit to suppress dust from truck and heavy equipment operations. Water used for dust suppression in these areas would not be expected to result in runoff from the quarry operational areas.

Overburden and waste rock removed from quarry areas would be stockpiled and later used for reclamation of the quarry sites. These piles would be stabilized or, if necessary, covered (for example, with mulch, netting, or synthetic stabilizer) to reduce the potential for erosion and runoff of sediments from these areas. Other best management practices that would be implemented include filter berms, straw bail barriers, fences, or revegetation, as necessary. The change in the amount of runoff that would actually reach drainage channels would be minor, because construction would affect a small amount of the overall natural drainage areas.

Three separate programs established by the Clean Water Act are significant when reviewing activities associated with potential quarries. These include the establishment of water quality standards pursuant to Section 303(c) of the Clean Water Act, National Pollutant Discharge Elimination System permit requirements set forth in Section 402 of the Clean Water Act, and dredge and fill permit requirements set forth in Section 404 of the Clean Water Act. General National Pollutant Discharge Elimination System permits would require that best management practices (including inventorying, assessment, prioritization, and identification and implementation of best management practices) be employed to meet water quality standards. It is expected that any discharges associated with quarry operations would be managed with appropriate stormwater control systems that would effectively minimize off-site impacts from stormwater drainage. Thus, impacts to surface-water features associated with quarry operations would be small.

4.3.5.3 Railroad Operations Impacts

Potential impacts during the operations phase are addressed in relation to the impact assessment standards for surface-water resources identified in Table 4-200, including stormwater drainage and surface-water quality. Section 4.3.5.2.1 addresses surface-water availability, and floodplains and wetlands.

4.3.5.3.1 Operations Impacts Common to the Entire Rail Alignment

Operation of the proposed railroad would result in a small impact to surface waters beyond the permanent drainage alterations from construction. The rail roadbed would be expected to have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas within the overall drainage system, the impact on overall runoff quantities would be small. Thus, impacts related to stormwater increases would be limited to those localized areas where drainage patterns would be altered to convey storm flows.

Rail line maintenance would require periodic inspections of flood-prone areas (particularly after flood events) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. If the eroded areas had to be repaired often, that would be an indication that flow patterns had been changed and sediment was being moved as the water was cutting out a new channel. Regular inspection and maintenance of the rail line would help ensure that erosion and sedimentation problems were identified and addressed in a timely manner so that they did not contribute to upstream or downstream impacts. Therefore, impacts during the operations phase from sediment buildup and floodwater activity would be small.

The primary sources of potential surface-water ***contamination*** during the operations phase would be fuels (diesel and gasoline) and lubricants (oils and greases) required for equipment operation and maintenance. DOE would minimize the potential for contamination by managing spills and implementing best management practices.

4.3.5.3.2 Facility Operations

Activities at the facilities (including quarries) would adhere to a Spill Prevention, Control, and Countermeasures Plan to comply with environmental regulations and would also include a number of best management practices. The plan would describe the actions the Department would take to prevent, control, and remediate spills of fuel or lubricants. It would also describe the reporting requirements that would accompany the identification of a spill (DIRS 155970-DOE 2002, p. 4-23). Therefore, impacts to surface waters from facilities operations would be small.

Sanitary sewage generated at facilities would be contained and removed, sent to treatment facilities, or in some cases, disposed of through on-site septic systems. No industrial wastewater discharges would be expected from the operation of facilities. All wastewater collection and transfer systems would be designed and operated such that untreated wastewater would not be released to the environment; therefore, impacts to surface-water resources from facilities operations would be small.

4.3.5.3.3 Quarry Operations

Quarries would be reclaimed following the construction phase and would not be used during the operations phase. Therefore, there would be no impacts from quarry operations.

4.3.5.4 Shared-Use Option

Construction impacts to surface-water resources under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. The Shared-Use Option would involve the construction of additional sidings, which would be approximately 300 meters (980 feet) long and would be aligned parallel to the rail line within the construction right-of-way. Construction of these additional sidings would involve the same types of land disturbance as for the Proposed Action without shared use, but with minor additive impacts. As for the Proposed Action without shared use, potential impacts would be the release and spread of contaminants by precipitation or intermittent runoff events or, for portions of the rail line near surface-water bodies, possible release to the surface water; the alteration of natural drainage patterns or runoff rates that could affect downgradient resources; and the need for dredging or filling of perennial or ephemeral streams. However, the adverse impacts to surface-water resources from constructing additional sidings under the Shared-Use Option would add little to potential impacts described for the Proposed Action without shared use, because the same control measures would be in effect. Because construction of these additional sidings would not be a DOE action and there are uncertainties regarding the exact locations of needed commercial-use facilities, specific impacts of the Shared-Use Option to surface-water features were not analyzed.

Operations impacts under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Use of a completed rail line from Mina to Yucca Mountain, including additional sidings, would result in small impacts to surface waters beyond the permanent drainage alterations that would result from construction. The rail roadbed would likely have runoff rates different from those of the natural terrain but, given the small size of the potentially affected areas in a single drainage system, the impact from shared-use operations on overall runoff quantities would be small.

Maintenance of the rail line and shared-use sidings would require periodic inspections of flood-prone areas (particularly after floods) to verify the condition of the track and drainage structures. When necessary, sediment accumulating in these areas would be removed and disposed of appropriately. Similarly, eroded areas encroaching on the rail roadbed would be repaired. Therefore, impacts from maintenance of the rail line related to sedimentation and erosion under the Shared-Use Option would be small.

General freight shipped on the proposed railroad could include mineral products, petroleum, agricultural products, or other commodities shipped or received by private companies. Spills of oil or hazardous substances carried on the rail line as general freight could affect surface-water resources. If a spill occurred, the potential for contamination to enter flowing surface water would present the greatest risk of a large contaminant migration until spills were contained and remediated. If there was no routinely flowing surface water, as is the condition for most areas along the Mina rail alignment, it is expected that released materials would not travel far or affect critical resources before corrective action could be taken. Compliance with regulatory requirements on reporting and remediating spills would result in a small probability of spills and, with specific regard to rail line operations, the overall risk of a transportation ***accident*** that could result in a release of a hazardous substance is considered to be small, as discussed in Section 4.3.10, Occupational and Public Health and Safety. Therefore, impacts to surface-water resources from potential accidental releases of contaminants from commercial rail shipments during operations under the Shared-Use Option would be small.

4.3.5.5 Summary

4.3.5.5.1 Common Impacts

Construction and operation of a railroad along the Mina rail alignment could result in both direct and indirect impacts to surface-water resources (see Table 4-204). Direct impacts would include temporary or permanent grading, dredging, rerouting, or filling of surface-water resources. Indirect impacts would potentially increase or impede surface flow. Also, nonpoint source pollution could result from runoff from areas where surface grades and characteristics would be changed (such as the rail roadbed and access roads). Overall, impacts to surface-water resources from railroad construction and operations would be small.

To evaluate potential impacts to surface-water resources, DOE identified areas where there are surface-water resources along the rail alignment (including those that would be crossed, filled, or covered) and identified the activities associated with construction or operations that would have the potential to affect these surface-water resources. Because of their importance in influencing the types and magnitude of potential impacts, Table 4-201 summarizes the numbers of surface-water features the Mina rail alignment would encounter. The table includes estimates of the total number of surface-water features the rail line, facilities, and quarries would cross. Such features include drainage channels, floodplains, and wetlands. The table also identifies two subsets of the total number of drainage channel crossings. The first is the notable channels described in Section 3.3.5.2.1, and the second includes drainage channels that would be classified as waters of the United States.

In all instances where the alignment would cross or come close to a surface-water feature, that feature could be affected to some degree by railroad construction and operation; however, impacts would be substantially minimized through the engineering design process and the implementation of best management practices prior to, during, and after construction. DOE would incorporate hydraulic modeling into the engineering design process to ensure that crossings were properly engineered so they would not contribute to erosion and sediment pollution. The design of drainage structures would account for scour and erosion and incorporate outlet protection and velocity-dissipating devices that would calm the flow and diminish its erosive potential. Because conveyance systems would be designed to safely convey increased flows during storm events (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts on stormwater drainage conveyance from construction of the rail line would be small.

DOE would minimize impacts to surface-water resources through the implementation of engineering design standards (as described above) and best management practices (see Chapter 7). Best management practices would include erosion control measures, such as the use of silt fences and flow-control devices to reduce flow velocities and minimize erosion. Further, the Department would minimize filling of surface-water resources by incorporating avoidance into final engineering and design of the rail line, to the extent practicable. DOE would use a minimum-width rail line footprint whenever possible.

4.3.5.5.2 Alternative Segment-Specific Impacts

The Mina alternative segments are adjacent to wetlands and some wetland fill would be unavoidable. DOE would construct a bridge at the Walker River crossing in part to minimize filling wetlands. Of the 0.07 square kilometer (17 acres) of wetlands delineated along the rail alignment, only about 20 square meters (0.005 acre) for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for Schurz alternative segments 5 and 6 would be permanently filled or lost to construct the alternative segment.

Table 4-204. Summary of impacts to surface-water resources – Mina rail alignment (page 1 of 2).

Rail line segment/facility (county)	Proposed Action[a]	
	Construction impacts[b,c]	Operations impacts
Existing branchlines (Lyon and Mineral Counties)	Not applicable	No additional surface-water impacts are anticipated due to increased rail traffic.
All alternative segments and common segments (Lyon, Mineral, Churchill, Esmeralda, and Nye Counties)	Potential for increases in nonpoint source pollution, alteration of natural drainage patterns and runoff rates, temporary blockage of surface drainage channels, localized changes in drainage patterns, and increases in the flow rate in relation to natural flow conditions. Potential for release and spread of contaminants through an accidental spill or discharge. Potential impact from erosion and sediment loading and reduction of floodwater area flow.	Potential for fuel spills or release of contaminants. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Staging Yard at Hawthorne and Maintenance-of-Way Facility (Mineral and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential for fuel spills or release of contaminants.
Potential quarries (Mineral and Esmeralda Counties)	Potential impact from erosion and sediment loading.	Potential impact from erosion and sediment loading.

Table 4-204. Summary of impacts to surface-water resources – Mina rail alignment (page 2 of 2).

Rail line segment/facility (county)	Proposed Action[a]	
	Construction impacts[b,c]	Operations impacts
Rail Equipment Maintenance Yard; Cask Maintenance Facility; Nevada Railroad Control Center and National Transportation Operations Center (Nye County)	Potential impact from erosion and sediment loading.	Potential for fuel spills during fueling; fuel transfer; or storage tank failure. Drainage crossings (culverts and bridges) might cause floodwaters to back up.
Schurz alternative segment 1 (Lyon and Mineral Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 square meters (220 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Schurz alternative segment 4 (Lyon and Mineral Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 20 square meters (220 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Schurz alternative segment 5 (Lyon and Mineral Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 28 square meters (300 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Schurz alternative segment 6 (Lyon, Mineral, and Churchill Counties)	Of the 0.065 square kilometer (16 acres) of wetlands crossed in this area, only 28 square meters (300 square feet) would be permanently filled to construct the bridge. Potential short-term impacts to wetlands from construction of the bridge over Walker River.	Permanent loss of wetlands.
Common segment 1 (Mineral and Esmeralda Counties)	Potential for impacts from erosion and sedimentation to spring.	No additional surface-water impacts are anticipated.
Montezuma alternative segment 1 (Esmeralda County)	Potential for impacts from erosion and sedimentation to spring.	No additional surface-water impacts are anticipated.
Montezuma alternative segment 2 (Esmeralda and Nye Counties)	Potential for impacts from erosion and sedimentation to springs.	No additional surface-water impacts are anticipated.
Oasis Valley alternative segment 1 (Nye County)	Indirect impacts such as sedimentation, erosion and incidental spills possible to small wetland along Oasis Valley 1. Potential for impacts from erosion and sedimentation to springs downstream of the rail line.	No additional surface-water impacts are anticipated.
Oasis Valley alternative segment 3 (Nye County)	Potential for impacts from erosion and sedimentation to springs downstream of the rail line.	No additional surface-water impacts are anticipated.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.
b. Wetland filling estimates are based on the assumption that the construction right-of-way would be 30 meters (100 feet) wide.
c. Floodplain crossing distance is presented as a range. The minimum crossing distance is represented by the length of the rail line crossing Federal Emergency Management Agency mapped floodplains. The maximum value represents the minimum value in addition to the estimated crossing distance over floodplains that have not been mapped.

4.3.6 GROUNDWATER RESOURCES

This section describes potential impacts to groundwater resources from constructing and operating the proposed railroad along the Mina rail alignment. To analyze potential impacts, DOE considered whether constructing and operating the railroad would result in:

- Possible damage to existing wells as a result of construction work
- Possible declines in groundwater levels or groundwater production rates at existing groundwater production wells
- Possible changes in discharge rates at existing springs
- Possible changes in infiltration rates in disturbed areas
- Possible changes in groundwater quality at wells, springs, or in shallow groundwater
- Possible subsidence of the ground surface

Section 4.3.6.1 and Appendix G describe the methods DOE used to assess potential impacts to existing groundwater resources; Section 4.3.6.2 describes potential construction impacts; Section 4.3.6.3 describes potential impacts of operating the railroad along the Mina rail alignment under the Proposed Action; Section 4.3.6.4 describes potential impacts of operating the railroad along the Mina rail alignment under the Shared-Use Option; and Section 4.3.6.5 summarizes potential impacts to groundwater resources.

Section 3.3.6.1 describes the region of influence for groundwater resources for the Mina rail alignment. The section includes a discussion of existing wells and springs that fall within the Mina rail alignment region of influence that could be affected by new wells that would be installed and used to obtain water to support construction and operation of the proposed rail line.

4.3.6.1 Impact Assessment Methodology

DOE considered a variety of methods for obtaining water that would be needed to support construction and operation of the proposed rail line and railroad construction and operations support facilities along the Mina rail alignment. These methods include, but are not limited to, construction of new water wells; purchasing water from municipalities or other existing water-rights holders; or importing water from other groundwater ***hydrographic areas***. A combination of such methods could reduce potential impacts to groundwater resources. However, acquiring all required water from new wells would place the greatest amount of increased water ***demand*** on existing groundwater resources. Therefore, to develop a conservative or upper bound estimate analysis of potential impacts to groundwater resources, DOE assumed that it would obtain all water required for construction and operation of the Mina rail line and Mina railroad construction and operations support facilities from newly constructed wells. This EIS does not analyze the impacts of obtaining water through other methods.

In this section, DOE evaluates the potential impacts associated with the following types of new water wells that would be installed and utilized to obtain water required for construction and operation of the proposed Mina rail line and associated facilities:

- Construction water wells – These temporary wells (DIRS 180888-Converse Consultants 2007, Section 2.1 and Table 2-2) would furnish approximately 87 percent of the total project water demand. The remaining 13 percent of total water demand would be provided by wells for quarries or permanent wells. Wells in this category include wells that would provide water for earthwork compaction during rail roadbed construction and wells that would supply water for temporary construction camps. Nearly all water obtained from wells to support rail roadbed construction within each hydrographic area would be pumped within a 1-year period. The average groundwater withdrawal (usage) rate for these wells would vary according to location. Water wells at construction camps would have production rates of 76 liters (20 gallons) per minute.

- Quarry water wells – These wells would supply water to support start-up and operation of quarry operations, with each quarry being in operation over an estimated period of about 2 years, following an initial start-up period. The average withdrawal rate for these wells would be approximately 91 liters (24 gallons) per minute.
- Permanent water wells – These wells would supply water to meet water requirements for rail sidings and railroad operations facilities and provide water for fire protection purposes. Average withdrawal rates for these wells would be very low (less than 3.8 liters [1 gallon] to approximately 16 liters [4.2 gallons] per minute). DOE would use these new wells during the 50 years of railroad operations.

DOE would install most of the new water wells adjacent to new access roads that would be constructed on either side of the rail roadbed and within the rail line construction right-of-way. DOE assumes that if it could not obtain adequate volumes of water from some of these new wells because of limited ***aquifer*** productivity (less than the required productivity for that location based on the water demand at the associated construction location), it would obtain the additional water required at those locations from other new wells proposed for installation either within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way or from one or more of the proposed new wells simulated outside of that right-of-way. In these cases, the water would either be transported by truck or pumped through a temporary above-ground pipe within the construction right-of-way. Wells installed outside of the construction right-of-way would be installed as near as reasonably possible, based on hydrogeologic criteria, to the right-of-way, except for wells installed at the proposed quarry sites, which might or might not be at more remote locations.

DOE considered a number of factors to evaluate potential adverse impacts to groundwater resources. There could be an adverse impact if construction and operation of the Mina rail line and railroad construction and operations support facilities would cause any of the conditions listed in Table 4-205.

Table 4-205. Impact assessment considerations for groundwater resources.

Resource criteria	Basis for assessing adverse impact
Groundwater availability and uses	• Adversely affect an existing aquifer. Adverse effects would include substantial depletion of groundwater supplies on a scale that would affect available capacity of a groundwater source for use by existing water-rights holders within the hydrographic area where groundwater withdrawal would occur or in any downgradient hydrographic area, interfere with groundwater recharge, or reduce discharge rates to existing springs or seeps. • Conflict with established water rights, allotments, or regulations protecting groundwater resources.
Ground subsidence	• Cause subsidence of the ground surface (as a result of groundwater withdrawals).
Groundwater quality	• Contaminate a public water-supply aquifer and exceed federal, state, or local water-quality criteria.

To evaluate potential impacts to groundwater resources DOE considered:

- Potential changes to infiltration rates, with consequent changes to percolation rates of surface water to the groundwater system that could be caused by the same disturbances evaluated in the surface-water impact analysis (also see Section 4.3.5, Surface-Water Resources).
- Potential changes to groundwater quality due to groundwater withdrawals or from accidental spills or releases.

- Potential impacts to aquifer users and uses resulting from withdrawal of groundwater from new wells to support water needs for construction and operation of the Mina rail line and railroad construction and operations support facilities. DOE focused the impact analysis on aquifers and the existing groundwater users who withdraw water from the groundwater hydrographic areas that would serve as sources of water for construction and operation of the rail line. DOE compared the amount of water that would be required for construction and operation of a railroad along the Mina rail alignment and existing uses of groundwater in those groundwater hydrographic areas. Existing groundwater resources addressed in these evaluations include existing wells, springs, and groundwater seeps. DOE considered potential impacts resulting from the following actions: (1) pumping from new wells to obtain water needed for rail roadbed construction (including water needed for earthwork, dust control, and construction camps), and (2) pumping from new wells installed to support quarry operations, rail sidings, and other railroad facilities.
- Potential for damage to existing wells from construction activities or potential ground subsidence as a result of the proposed groundwater withdrawals.

4.3.6.2 Construction Impacts

4.3.6.2.1 Construction Impacts Common to the Entire Rail Alignment

Impacts to groundwater or the land surface during construction of the Mina rail line could include: (1) potential changes in infiltration rates in disturbed areas with resulting changes in rates of percolation to groundwater (addressed in Section 4.3.5, Surface-Water Resources); (2) reduced flow to springs or seeps or a reduction in available flow rates to one or more existing wells within the ***radius of influence*** of, or the radius of the ***cone of depression*** surrounding, purposed new wells; (3) possible damage to, or loss of, use of existing wells within the construction right-of-way; (4) degradation of groundwater quality resulting from groundwater withdrawals; or (5) potential ground subsidence.

As described in Section 4.3.5, construction of the rail line and railroad construction and operations support facilities would result in land-surface disturbance, such as grading, excavating, or stockpiling, that would alter the rate at which water could infiltrate the disturbed areas. Construction activities would disturb and temporarily loosen the ground, which could produce temporarily higher near-surface infiltration rates (see Section 4.3.5). This situation would typically be short-lived; rail roadbed materials and disturbed areas associated with railroad facilities and ballast areas would become compacted and less porous, with most of the land disturbance during railroad and facilities construction likely resulting in surfaces with lower infiltration rates causing an increase in runoff. Even in the short term, localized changes in infiltration would likely cause no large-scale change in the amount of groundwater percolation (***recharge***) because the disturbed areas would be a very small percentage of the overall surface area of a hydrographic area (see Section 4.3.5). Therefore, changes to infiltration rates in the regions where construction would take place would be small, and adverse impacts associated with changes in stormwater infiltration rates would be small.

Most recharge to aquifers in the region is derived from precipitation falling in the higher parts of the inter-basin mountain ranges (see, for example, DIRS 103136-Prudic, Harrill, and Burbey 1993, pp. 2, 58, 84, and 88; DIRS 180759-Van Denburgh and Rush 1970, Table 6). The climate in the region through which DOE would construct a railroad along the Mina rail alignment is generally arid. These factors combine to produce a deficit of shallow groundwater beneath many parts of the rail alignment, such as several valley floors it would cross. Estimated depths to groundwater beneath most of the hydrographic areas the rail line would cross range from approximately 15 to 150 meters (50 to 490 feet) or more below ground, with some localized areas where shallower groundwater occurs, at depths ranging between 3 and less than 15 meters (10 and less than 50 feet) below ground. Areas of such shallower groundwater occurrence include portions of the Mason Valley, Walker Lake Valley (Schurz Subarea), Rhodes Salt

Marsh, Columbus Salt Marsh, Clayton Valley, and Oasis Valley hydrographic areas (DIRS 180887-Converse Consultants 2007, Plates 4-1 to 4-10; DIRS 180888-Converse Consultants 2007, Appendix B). However, with the exception of one portion of one alternative segment (Montezuma alternative segment 1) in the Clayton Valley hydrographic area (area 143) and a portion of Department of Defense Branchline North in the Mason Valley hydrographic area (area 108), areas of known shallower groundwater occurrence lie outside of the proposed rail alignment construction right-of-way (DIRS 180887-Converse Consultants 2007, Plates 4-1 to 4-10). Available hydrogeologic information suggests that shallow groundwater would occur infrequently, and on a localized basis, beneath the Mina rail alignment.

Other potential impacts include degradation of groundwater quality due to new sources of contamination that could come into direct contact with, or migrate to, groundwater. Construction-related materials that would be used in this arid environment, that could contaminate groundwater if spilled, include petroleum products (such as fuels and lubricants) and coolants (such as antifreeze) necessary to operate construction equipment. The infrequent occurrence of shallow groundwater beneath the Mina rail alignment (see Section 3.3.6) beneath the vast majority of the proposed Mina rail alignment indicates that the probability of contaminants reaching underlying groundwater would be low; therefore, DOE would not expect impacts to groundwater quality resulting from spills of hazardous or nonhazardous materials.

As discussed in Section 4.3.11, Utilities, Energy, and Materials, ***sanitary wastes*** from the construction camps would be disposed of in accordance with all applicable regulatory requirements. By complying with regulatory requirements, it is expected that wastewater-related impacts to groundwater resources in these areas would be minimized.

Railroad construction activities might occur near one or more existing wells. However, based on the available data, DOE does not anticipate that construction would disturb any existing wells. In the unlikely event that wells are identified prior to rail roadbed construction that could be disturbed by construction activities, DOE would take steps to minimize impacts to those wells, such as advising well owners of planned activities and discussing with the owners measures needed to protect the well head (the portion of the well above the ground surface) during construction. An estimated total of approximately 7.34 million cubic meters (5,950 ***acre-feet***) of water could be required to construct a railroad along the Mina rail alignment (DIRS 180875-Nevada Rail Partners 2007, p. 4-4). The actual amount of water required would depend on the specific combination of alternative rail segments that would be selected for construction (see Table 3-114). DOE would use water for earthwork compaction, control of excavation dust, workforce needs, and ballast production (DIRS 180875-Nevada Rail Partners 2007, p. 4-4). DOE has assumed that it would obtain all water from new wells. Over 87 percent of the total required project water demand is needed to support rail roadbed construction (DIRS 180875-Nevada Rail Partners 2007, Section 4.4.2). These construction water wells would be temporary wells and DOE assumes they would be used for up to a year (DIRS 180888-Converse Consultants 2007, Section 2.1 and Table 2-2). As discussed in Chapter 2, Proposed Action and Alternatives, DOE is considering a 4- to 10-year rail construction schedule. The typical groundwater pumping scenario for rail roadbed construction wells assumes a 9-month effective pumping period with 3 months of lost production for each construction well because of adverse weather conditions or other factors such as equipment repairs. This provides for a conservative scenario, or upper bound estimate of groundwater withdrawal rates that would result in the largest potential impacts (greatest amounts of drawdown) to groundwater resources (and existing groundwater users potentially situated within the region of influence of the proposed water wells). If the construction schedule were lengthened (for example, up to 10 years), less water would be required to support construction activities in any given year, thereby resulting in the same or reduced groundwater withdrawal rates and the same or reducing impacts to groundwater resources and existing groundwater users. Section 4.3.6.2.2 further describes the approach and methods DOE used to quantitatively evaluate potential site-specific impacts to groundwater resources. Table 4-206 lists the proposed Mina rail alignment alternative segments and common segments and summarizes the estimated total construction-related water requirements (demands) within each hydrographic area. The table lists a range of water demand values for hydrographic areas associated with more than one alternative segment or common segments. The range of values consists of the minimum water demand and the maximum water demands based on the various possible combinations of alternative rail segments that could be constructed, for the 18 hydrographic areas that would be crossed by the Mina rail alignment. Figure 4-30 depicts the proposed Mina rail alignment, hydrographic areas the alignment would cross, and the range of estimated total water demand associated with railroad construction within each hydrographic area.

As described in Section 3.3.6, Table 3-113 identifies hydrographic areas that are considered to be ***designated groundwater basins***, and lists information about total annual committed resources and ***pending annual duty*** amounts in the listed hydrographic areas. Seven of the 18 hydrographic areas that could be crossed by the alignment are designated groundwater basins.

Comparison of the information presented in Tables 4-206 indicates that, depending on the specific combination of alternative segments selected for construction, where applicable, total water withdrawals could exceed annual ***perennial yield*** values for hydrographic areas 123, 144, and 229, and could be as high as 48 percent, 57 percent, 82 percent, 87 percent, and 99 percent of the annual perennial yield in hydrographic areas 145, 228, 110A, 121B, 227A, respectively. Water withdrawals would typically range from less than 1 percent to as high as approximately 28 percent of the annual perennial yield value for the remaining areas for the various possible theoretical combinations of alignment segments. It should be noted that, for all hydrographic areas crossed, approximately 87 percent of the groundwater withdrawals would be temporary withdrawals, occurring within 1 year or less, rather than long-term withdrawals. For evaluating potential impacts from the proposed groundwater withdrawals, it is also noteworthy that although available groundwater resources in some hydrographic areas might be deemed to be currently "overcommitted" as a whole (hydrographic areas 146, 228, and 229), one or more particular aquifers within a hydrographic area might not be overcommitted. Additionally, all water-rights appropriations might not be in service simultaneously.

The information in Tables 3-113 and 4-206 suggests that the selection of one alternative segment over another or different possible combinations of alignment segments over others would make no notable difference in the amount of water needed to support construction when compared to the annual committed resources for each hydrographic area, with the following exceptions:

- Construction of the Schurz alternative segment 1/Department of Defense Branchline South combination for construction through hydrographic area 110A (Walker Lake-Schurz Subarea) would result in the lowest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area, representing approximately 32 percent, and 75 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area. By comparison, construction of the Schurz alternative segment 4/Department of Defense Branchline South combination through hydrographic area 110A would result in the highest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area (approximately 82 percent, and 190 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area). Construction of either the Schurz alternative segment 5/Department of Defense Branchline South or the Schurz alternative segment 6/Department of Defense Branchline South alternative segment combinations through area 110A would represent ratios of groundwater demand to perennial yield and groundwater demand to committed resources that are intermediate between those for these two options.

Table 4-206. Estimated water requirements for railroad construction by hydrographic area – Mina rail alignment (page 1 of 3).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or possible range of water demand values within hydrographic area (acre-feet)[f]
108 – Mason Valley*	25,000	179,696/ 25,269	Department of Defense Branchline North	22
110A – Walker Lake (Schurz Subarea)	1,500	637/ 2	Schurz alternative segment 1/Department of Defense Branchline South	475
			Schurz alternative segment 4/Department of Defense Branchline South	1,182
			Schurz alternative segment 5/Department of Defense Branchline South	706
			Schurz alternative segment 6/Department of Defense Branchline South	718
123 – Rawhide Flats	500	116/ 0	Schurz alternative segment 5	243
			Schurz alternative segment 6	913
110B – Walker Lake (Lake Subarea)	700	2,093/ 0	Department of Defense Branchline South	46
110C – Walker Lake (Hawthorne Subarea)	5,000	12,709/ 0	Department of Defense Branchline South/Mina common segment 1	143
121A – Soda Spring Valley (Eastern Part)*	6,000	3,168/ 0	Mina common segment 1	485
121B – Soda Spring Valley (Western Part)*	200	354/ 0	Mina common segment 1	174
119 – Rhodes Salt Marsh Valley	1,000	49/ 0	Mina common segment 1	276
118 – Columbus Salt Marsh Valley	4,000	1,764/ 0	Mina common segment 1	346
137A – Big Smoky Valley (Tonopah Flat)*	6,000	19,638/ 0	Mina common segment 1/Montezuma alternative segment 1	171
			Mina common segment 1/Montezuma alternative segment 2	413

Table 4-206. Estimated water requirements for railroad construction by hydrographic area – Mina rail alignment (page 2 of 3).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
143 – Clayton Valley	20,000	23,882/ 0	Montezuma alternative segment 1	1,080
142 – Alkali Spring Valley	3,000	2,596/ 0	Montezuma alternative segment 1	573
			Montezuma alternative segments 1/3/2	356
			Montezuma alternative segment 2/Mina common segment 2	632
144 – Lida Valley	350	72/ 0	Montezuma alternative segment 1/Mina common segment 2/Bonnie Claire alternative segment 2	570
			Montezuma alternative segment 1/Mina common segment 2/Bonnie Claire alternative segment 3	467
			Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 2	376
			Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 3	273
145 – Stonewall Flats	100	12/ 0	Montezuma alternative segment 2	48
146 – Sarcobatus Flat*	3,000	3,591/ 0	Bonnie Claire alternative segment 2/common segment 5	377
			Bonnie Claire alternative segment 3/common segment 5	460
228 – Oasis Valley	1,000	1,299/ 0	Common segment 5/Oasis Valley alternative segment 1/common segment 6	401
			Common segment 5/Oasis Valley alternative segment 3/common segment 6	574

Table 4-206. Estimated water requirements for railroad construction by hydrographic area – Mina rail alignment (page 3 of 3).

Hydrographic area[a] number and name	Perennial yield for hydrographic area (acre-feet)[b,c]	Total annual committed resources/pending annual duties for hydrographic area (acre-feet)[c,d]	Rail line segment or rail line segment combination[e]	Estimated water demand or range of water demand values within hydrographic area (acre-feet)[f]
229 – Crater Flat	220	1,147/ 82	Common segment 6	256
227A – Fortymile Canyon, Jackass Flats	580[g]	58[g] / 5	Common segment 6	572
Estimated lowest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 5,750
Estimated highest total water demand value (acre-feet) based on possible combinations of rail line segments				Approximately 8,200
Current estimate of total water demand (acre-feet) – current best estimate (see text)				Approximately 5,950

a. Source: DIRS 106094-Harrill, Gates, and Thomas et al. 1988, Summary, Figure 3, with the proposed rail alignment map overlay. An asterisk (*) indicates that the State of Nevada considers the hydrographic area a designated groundwater basin (DIRS 177741-State of Nevada 2005, all).

b. Source: DIRS 103406-Nevada Division of Water Planning 1992, Regions 10, 13, and 14, except hydrographic areas 227A, 228, and 229, for which the source is DIRS 147766-Thiel Engineering Consultants 1999, pp. 6 to 12. The perennial yield value shown for area 228 is the lowest value in range of estimated values (1,000 to 2,000 acre-feet per year) presented by Thiel Engineering Consultants 1999.

c. To convert acre-feet to cubic meters, multiply by 1,233.49. To convert acre-feet to gallons, multiply by 3.259×10^5.

d. Data for committed groundwater resources and pending annual duties are current as of the dates described in Section 3.3.6. Pending duties include underground duties but do not include duties for streams or springs. All values have been rounded to the nearest acre-foot.

e. Figures 3.3.6-4 through 3.3.6-10 show the locations of the Mina rail alignment alternative segments and common segments.

f. Water demand estimates are from DIRS 180888-Converse Consultants 2007, Table 2-3 and DIRS 180875-Nevada Rail Partners 2007, Table 4-3. All demand values rounded to the nearest acre-foot.

g. Based on a 1979 Designation Order by the State Engineer; there are no committed resources in area 227A. However, water-rights information from the NDWR indicates there are 58 acre-feet in committed resources for this area. The discrepancy appears to be related to the location of the boundary between areas 227A and 230 (Amargosa Desert) (DIRS 176600-Converse Consultants 2005, page 29 and Table 4-45). The perennial-yield value shown for area 227A is the lowest estimated value presented in *Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin* (DIRS 147766-Thiel Engineering Consultants 1999, p. 8), for the entirety of hydrographic area 227A. The perennial yield estimate for area 277A is broken down into 300 acre-feet for the eastern third of the area and 580 acre-feet for the western two-thirds of the area.

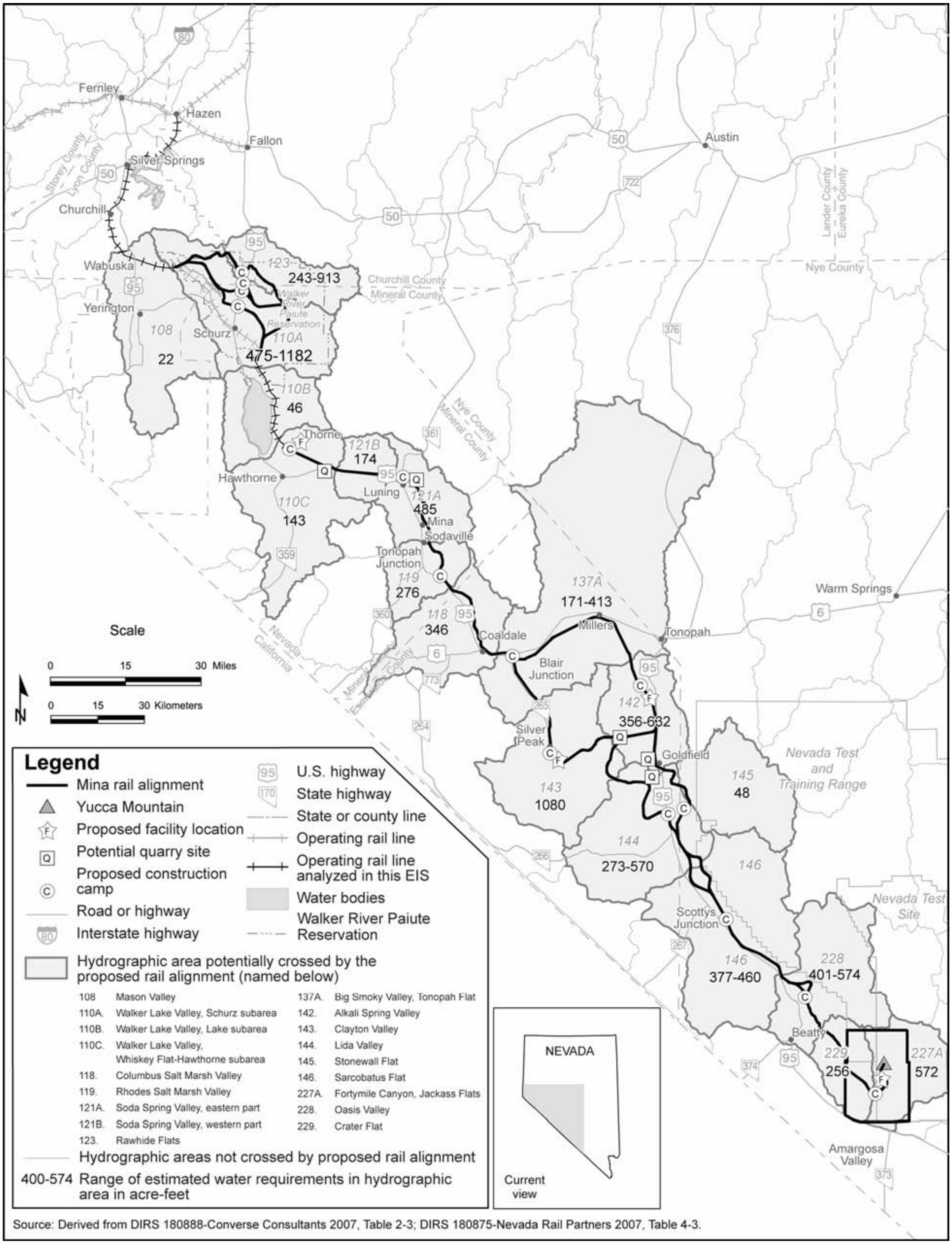


Figure 4-30. Estimated water requirements along the Mina rail alignment.

- Construction of Schurz alternative segment 5 within hydrographic area 123 (Rawhide Flats) would result in a groundwater demand representing approximately 49 percent of the estimated annual perennial yield and approximately 210 percent the total committed resources of the hydrographic area, whereas constructing the Schurz alternative segment 6 within hydrographic area 123 would result in a groundwater demand representing approximately 183 percent of the estimated annual perennial yield and approximately 790 percent of the total committed resources of the hydrographic area.

- Construction of the Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 3 combination for construction through hydrographic area 144 (Lida Valley) would result in the lowest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area, representing approximately 78 percent, and 380 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area. By comparison, construction of the Montezuma alternative segment 1/Mina common segment 2/Bonnie Claire alternative segment 2 combination through hydrographic area 144 would result in the highest ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area (approximately 160 percent, and 790 percent, respectively, of the estimated annual perennial yield and the total annual committed resources of the hydrographic area). Construction of either the Montezuma alternative segment 2/Mina common segment 1/Bonnie Claire alternative segment 2 combination or the Montezuma alternative segment 2/Mina common segment 2/Bonnie Claire alternative segment 3 combination through area 144 would represent ratios of groundwater demand to perennial yield and groundwater demand to committed resources that are intermediate between those for these two options.

- Construction of the Mina common segment 1/Montezuma alternative segment 2 combination within hydrographic area 137A (Big Smoky Valley-Tonopah Flat) would result in a groundwater demand representing approximately 7 percent of the estimated annual perennial yield and approximately 3 percent of the total committed resources of the hydrographic area, whereas constructing the Mina common segment 1/Montezuma alternative segment 2 combination within hydrographic area 137A would result in somewhat lower ratios of groundwater demand to perennial yield and groundwater demand to committed resources for this area (approximately 21 percent of the estimated annual perennial yield and approximately 9 percent of the total committed resources of the hydrographic area).

As described previously in Section 4.2.6, construction of Oasis Valley alternative segment 1 and common segments 5 and 6 within hydrographic area 128 (Oasis Valley) would result in a groundwater demand equaling approximately 41 percent of the estimated annual perennial yield and approximately 31 percent of the total annual committed resources of the hydrographic area. Construction of Oasis Valley alternative segment 3 and common segments 5 and 6 through hydrographic area 128 would result in a groundwater demand equaling approximately 57 percent of the estimated annual perennial yield and approximately 44 percent of the total annual committed resources of this hydrographic area.

DOE evaluated potential impacts to existing groundwater resources assuming that it would apply for permits to appropriate water from 77 to 110 new water wells, including from 3 to 5 new quarry water wells, to furnish all the water required to support rail construction, construction camps, quarry operations, and operation of railroad operations support facilities, including sidings (DIRS 180888-Converse Consultants 2007, Table 2-1; DIRS 180875-Nevada Rail Partners 2007, Table 4-5). Each construction camp would need one new well.

Depending on location along the rail alignment, each well serving a construction camp would furnish water to just that camp, furnish water for construction of the rail roadbed, or furnish water for both construction of the rail line roadbed and operation of a proposed facility (DIRS 180888-Converse Consultants 2007, Appendixes A and C). The actual total number of wells required would depend on the specific alternative segments selected and flow rates achieved in completed wells.

New multiple-use wells would be installed in each hydrographic area along the Mina rail alignment, with the exception of area 227A, and used as sources of water supply. DOE assumed that each of the wells used to support rail roadbed construction would be pumped for a period not to exceed 1 year (for purposes of quantitative analysis, DOE assumed 9 months) (DIRS 180888-Converse Consultants 2007, Section 2.1). These wells would have the highest required water withdrawal rates. DOE could use quarry water wells, which would have lower production rates of approximately 91 liters (24 gallons) per minute, for up to 2 years. Wells to supply water for construction camps would be temporary and would have average production rates less than 76 liters (20 gallons) per minute. Wells supplying water for railroad operations support facilities and sidings would have the lowest average withdrawal rates (less than 3.8 liters [1 gallon] per minute to approximately 16 liters [4.2 gallons] per minute); these would be permanent wells (DIRS 180873-Nevada Rail Partners 2007, Table 2-2; DIRS 180888-Converse Consultants 2007, Section 2.1).

DOE would construct, and plans to subsequently decommission, all new water wells in accordance with applicable State of Nevada well-construction standards. After DOE completed construction of the rail line, some wells would remain in operation to supply water to railroad operations support facilities located near sidings, rail yards, or other locations along the rail line during the operations phase. As was the case for wells that could be installed to support the Caliente rail alignment construction, DOE currently plans that wells not needed for operation of the Mina rail line or for quarries would be properly abandoned in compliance with State of Nevada regulations, and the well sites and temporary access roads would be reclaimed (DIRS 180875-Nevada Rail Partners 2007, Section 4.4.4; DIRS 180922-Nevada Rail Partners 2007, Section 4.4.4) in accordance with applicable requirements.

DOE assumed that proposed new well sites outside the typical maximum 300-meter (1,000-foot)-wide rail alignment construction right-of-way would consist of a drilling pad approximately 5,700-square-meter (1.4-acre) or smaller in area (DIRS 180888-Converse Consultants 2007, Section 3.4). On the basis of analysis of available data on hydrogeologic characteristics along the proposed alignment, DOE assumed that one new well would be installed at each drilling pad (DIRS 180888-Converse Consultants 2007, Appendix A). Areas identified as potential locations for such well sites would be adjacent to documented existing land disturbances, including existing improved or unimproved roadways. If necessary, DOE would construct temporary access roads to accommodate 0.10- to 0.15-meter (4- to 6-inch)-diameter temporary aboveground pipelines that would transport water from these wells to the area of the construction right-of-way. Impacts that might result from the construction and temporary use of such water transfer pipelines are evaluated in the sections of this Rail Alignment EIS that address applicable resources or media (such as Biological Resources, Cultural Resources, and Land Use and Ownership). After construction of the rail line was complete, some wells would remain in operation to supply water to railroad operations support facilities near sidings, rail yards, or other locations along the rail alignment during the operations phase.

Well water would be piped through the temporary aboveground pipelines to temporary in-ground storage basins (reservoirs), inflatable bladders (“pillow tanks”), or rigid storage tanks within the construction right-of-way to provide storage capacity to meet daily construction needs. For planning purposes, DOE assumed that temporary water-storage reservoirs, if used, would be approximately 30 by 30 meters (100 feet by 100 feet) wide and approximately 3 meters (10 feet) deep, and would be used to store the daily water production from wells. Storage tanks or inflatable bladders, if used, could vary in their storage capacity up to approximately 190,000 liters (50,000 gallons) or more, depending on water demands and water withdrawal rates required for specific locations along the construction right-of-way. Open storage basins or reservoirs, if used, would be surrounded by a fence to mitigate the potential to attract wildlife (Section 4.3.7).

In determining the quantity of water that can be appropriated from a specific hydrographic area, requirements contained in the applicable State of Nevada statutes are considered. This authority includes the ability to grant appropriation requests in hydrographic areas that are designated groundwater basins or in cases where such appropriations would cause an exceedance of an area's estimated perennial yield.

DOE evaluated the potential impacts to groundwater resources as a result of withdrawal of groundwater from the proposed new water wells. For analysis purposes, each new well was assumed to be pumped, with one exception, at an average withdrawal rate of up to approximately 850 liters (225 gallons) per minute, or approximately 0.5 cubic foot per second (DIRS 180888-Converse Consultants 2007, Appendix A). Actual groundwater withdrawal rates at several of the proposed new wells could likely be less than 0.5 cubic foot per second, based on hydrogeologic limitations associated with the specific aquifers involved; however, DOE considered the effects of groundwater withdrawals at this production rate in order to help assess the degree of flexibility available for possibly utilizing some proposed new wells at the 0.5-cubic-foot-per-second withdrawal rate more than, or in lieu of, other proposed wells, based on potential differences in well productivity that might occur between the new wells. At one proposed new well location, due to existing groundwater quality conditions in areas surrounding the proposed well location, it is assumed that the average withdrawal rate could be as high as 1,300 liters (350 gallons) per minute, or approximately 0.78 cubic foot per second. An analysis of potential impacts due to groundwater withdrawal at this well location is described in Section 4.3.6.2.2).

Any groundwater withdrawal would decrease the availability of water in a portion of the aquifer within the cone of depression induced within the aquifer surrounding a groundwater-production well. However, as described previously, DOE would obtain approximately 87 percent of all the water required for construction of the proposed rail line along the Mina rail alignment from new temporary rail roadbed construction wells. The withdrawal of groundwater from new wells to support railroad construction would not be likely to result in long-term adverse impacts to the groundwater aquifers that are targeted for meeting project water demands for the following reasons:

- For the proposed new groundwater withdrawals, hydrogeologic impact analysis results (see Section 4.3.6.2.2 and Appendix G) show that short-term direct impacts on groundwater availability in aquifers resulting from proposed groundwater withdrawals where the new wells would be pumped at the withdrawal rate of 852 liters (225 gallons) per minute, approximately 0.5 cubic foot per second, would be limited in aerial extent. Analytical results indicate that the maximum calculated lateral extent of the drawdown feature (the cone of depression) that would be induced at any location within the host aquifers from the proposed groundwater withdrawals would be approximately 0.8 kilometer (0.5 mile), and in most cases less at the proposed well locations. With the exception of three locations in the Oasis Valley hydrographic area (see Section 4.3.6.2.2.11) and one location in the Clayton Valley hydrographic area (see Section 4.3.6.2.2.5), withdrawals of groundwater from the proposed new water wells at the 0.5-cubic-foot-per-second withdrawal rate would not be expected to impact existing groundwater users (owners of active pumping wells) or impact discharge rates or groundwater quality at nearby springs. Sections 4.3.6.2.2.5 and 4.3.6.2.2.11 describe one or more mitigation approaches that could be implemented to avoid potential impacts at these otherwise affected locations.

- For areas where proposed new water wells would be installed near the boundary between adjacent hydrographic areas, groundwater withdrawals would not be likely to affect downgradient hydrographic areas because: (1) there are no identified existing well users in downgradient groundwater basins that are within 1.6 kilometers (1 mile) of any of these proposed well water withdrawal locations (see Figures 3-190 through 3-196), or (2) available hydrogeologic information indicates either that no significant inter-basin groundwater (under) flow is inferred to be occurring in the areas downgradient of the proposed well locations (see Figure 3-188) or, in three cases (proposed well locations Ssa-3, BSa-4a, and LV7 on Figures 3-192, 3-193, and 3-195, respectively) where the proposed well locations are located near such a boundary and in the general vicinity of such inferred underflow areas, the wells are located at least 2.3 to 4 kilometers (1.4 to 2.5 miles) upgradient of the hydrographic area boundary. Because the distances of these well locations from the hydrographic area boundary in these two cases are significantly greater than the maximum range (0.8 kilometer to 1 kilometer [0.5 to 0.6 mile]) of pumping-induced radii of influence surrounding the proposed well locations, pumping at these locations should have a negligible effect on existing inter-basin underflow patterns or flow rates and thus would have a very small effect on groundwater resources in downgradient hydrographic areas.
- Long-term direct impacts to groundwater resources would not be likely because most of the total project water demand would be used over a short period to support railroad construction. Most water demands within any given hydrographic area would occur over approximately 9 months under an assumed 4-year railroad construction schedule; therefore, long-term impacts resulting from their use would be small.
- Direct impacts to downgradient groundwater resources would be unlikely for the reasons stated above; indirect impacts to groundwater resources in adjacent downgradient hydrographic areas also would not be likely.

New wells that are proposed to be installed outside of the construction of right-of-way of some alignment segments to support railroad construction or quarries would be located on either grazing land, on Walker River Paiute Reservation land, or, for one proposed quarry, partly on BLM-managed grazing land and partly on Hawthorne Army Depot property (see Section 4.3.2). Direct or indirect impacts to private property owners from construction and use of such wells are expected to be small and capable of being minimized through the use of appropriate planning and mitigation measures as required (Section 4.3.2).

Several of the proposed railroad operations support facilities and sidings would overlie hydrographic areas that are designated by the Nevada State Engineer as designated groundwater basins. Construction-water demand for these facilities would be low compared to the amount of water required for railroad construction. These facilities include the Staging Yard at Hawthorne in hydrographic area 110C, the Maintenance-of-Way Facility at either Silver Peak in hydrographic area 143 or Klondike in hydrographic area 142, the Rail Equipment Maintenance Yard in hydrographic area 227A, and proposed sidings in several hydrographic areas (Figures 3-191, 3-193, 3-194, and 3-196). DOE assumed that water demand for constructing these railroad facilities and sidings would be met by installing new wells.

Details on the water requirements activity and groundwater impacts at the railroad operations facilities and sidings are provided in the *Facilities Design Analysis Report Mina Rail Corridor, Task 10: Facilities, Rev. 00* (DIRS 180873-Nevada Rail Partners 2007, Sections 2.1.5 and 3.6) and in the *Repository Surface Design Engineering Files Report* (DIRS 104508-CRWMS M&O 1999, Tables III-1 and II-2). The Staging Yard at Hawthorne, Maintenance-of-Way Facility, and Rail Equipment Maintenance Yard would require only limited amounts of water, with water required for operations estimated to range from approximately 11,000 to 23,000 liters (3,000 to 6,000 gallons) per day at the facilities, which is equivalent to 7.9 to 16 liters (2.1 to 4.2 gallons) per minute. Sidings would require less than 625 liters (165 gallons) per day, which is equivalent to less than 3.8 liters (1 gallon) per minute

(DIRS 180873-Nevada Rail Partners 2007, Table 2-2). DOE derived operations water requirements from estimated staffing and shift projections, a 190-liter (50-gallon) per day per capita use ratio, estimated shop process needs, and a multiplier of 1.5 to account for miscellaneous water needs (DIRS 180873-Nevada Rail Partners 2007, Section 2.1.5). Water needed for meeting emergency water storage capacity requirements (for fire safety) are estimated to range from 420,000 to 830,000 liters (110,000 to 220,000 gallons). Water needs for meeting water storage requirements at each facility could be readily met using a new small production-rate well. The water demand for operation of the Cask Maintenance Facility is estimated at approximately 40,000 liters (10,500 gallons) per day, which is equivalent to approximately 26 liters (7 gallons) per minute (DIRS 104508-CRWMS M&O 1999, Table III-1). Owing to the very small required well production rates for wells supporting operations of these facilities and sidings, the magnitude of short-term or long-term impacts on the host aquifer for the individual facility water wells would be small. For this reason, DOE did not perform quantitative impact analyses for water wells that would support facilities operations or sidings.

Water consumption rates during the period of use of construction camps during the peak output year have been estimated at approximately 76 liters (20 gallons) per minute, which is equivalent to approximately 110,000 liters (29,000 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-1). Water consumption rates during the period of use of quarries have been estimated at approximately 91 liters (24 gallons) per minute, which is equivalent to 131,000 liters (34,560 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-4). New wells proposed for supplying water to support construction camp and quarry operations were considered when performing the quantitative impact analyses.

Construction of the Cask Maintenance Facility would require approximately 4,400 cubic meters (approximately 3.6 acre-feet, or 1.176 million gallons) of water, with construction estimated to occur over approximately 2 years (DIRS 104508-CRWMS M&O 1999, Table III-2). The amount of water needed to construct the other railroad facilities (Staging Yard at Hawthorne, Maintenance-of-Way Facility, and Rail Equipment Maintenance Yard) would range from approximately 14,000 to 200,000 cubic meters, which is equivalent to 11.5 to 161.1 acre-feet, or 3.75 to 52.5 million gallons (DIRS 180873-Nevada Rail Partners 2007, Table 2-2). No water is required for constructing the rail sidings (DIRS 180873-Nevada Rail Partners 2007, Table 2-2). When compared to the total annual ***committed groundwater resources*** listed in Table 4-206, the direct short-term impacts to groundwater resources in the respective hydrographic areas due to water withdrawals associated with construction of railroad facilities and sidings would be small, and long-term direct and indirect impacts on groundwater resources also would be small.

DOE also assessed the potential for the proposed groundwater withdrawals to cause ground subsidence in areas of the proposed withdrawals. Groundwater pumping-induced ground subsidence has been observed at some locations in the western United States, including the Las Vegas Valley of Nevada, the Santa Clara Valley and San Joaquin Valley areas of California, and other selected locations in Texas, New Mexico, and Arizona, and selected other locations overseas. The subsidence that has occurred is primarily related to prolonged groundwater withdrawal at rates that exceed the estimated annual recharge to the affected groundwater system. The estimated annual recharge to the aquifer systems in each of these localities is often less than approximately 50 percent of the total average annual groundwater pumped from these aquifers. In the Las Vegas Valley, groundwater withdrawals between 1955 and 1990 ranged from approximately 49.4 to 108.5 million cubic meters (40,080 to over 88,000 acre-feet) per year, with the maximum groundwater withdrawal occurring in 1968 (108.9 million cubic meters [88,290 acre-feet]) (DIRS 181390-Bell et al. 2002, p. 156). Estimates of annual ***recharge*** rate to the Las Vegas Valley aquifer system range from approximately 30.6 to 72.2 million cubic meters (25,000 to 59,000 acre-feet) per year, indicating that groundwater withdrawal rates in the Las Vegas Valley have typically exceeded, sometimes by a factor of more than two, natural recharge rates over a period of decades (DIRS 181390-Bell et al. 2002, p. 156). Groundwater withdrawals of over 12.1 billion cubic meters (9.8 million acre-feet) per year in the San Joaquin Valley resulted in withdrawal overdrafts of at least 4.93 billion cubic meters (4 million acre-feet) per year during the 1950s and 1960s (DIRS 181392-USGS 1984, p. 264). Annual groundwater pumping rates in each of these areas have exceeded their respective annual groundwater recharge rates between the mid-1940s to 1950s and the 1990s.

Interbedded fine- and coarse-grained sediments underlie each of these areas. Where impermeable caliche horizons occur within ***alluvial fan*** deposits or poorly permeable clay horizons occur within fine-grained material, groundwater is under confined or partially confined conditions, frequently exhibiting artesian flow conditions (for example, DIRS 181390-Bell et al. 2002, p. 56). Continued groundwater pumping in excess of the yearly recharge has reduced the artesian pressures in these aquifer systems resulting in an increase in vertical loads, or effective stresses. The increased effective stresses result in the compaction of the underlying sediments and corresponding ground subsidence.

An evaluation of the proposed new groundwater withdrawal wells for the Mina rail alignment indicates that most of the wells would be developed in unconsolidated alluvia sediments, with a few completed in consolidated bedrock aquifers. Subsidence is not expected to be an issue in consolidated bedrock aquifers because these aquifers are not susceptible to compaction during pumping.

Of the wells developed in unconsolidated alluvial sediments, a relatively small percentage would be developed in confined alluvial sediments. In general, subsidence is not expected to be an issue for pumping unconfined alluvial aquifers, because the major reported cases of land subsidence due to groundwater withdrawals involve pumping from confined aquifers.

Groundwater withdrawals from confined alluvial aquifers, at the withdrawal rates expected for this project, and if they exceeded recharge rates, could, in theory, result in some small amount of subsidence within the radius of influence associated with each pumping well. However, no known subsidence effects have been documented for preexisting pumping wells in these hydrographic areas, many of which are being pumped at rates much higher than the range of pumping rates proposed for this project. In addition, the area of disturbance within the radius of influence surrounding each well represents an extremely small percentage of the total area of the host aquifer within hydrographic area. Finally, the duration of pumping for approximately 90 percent of the proposed total groundwater withdrawals would be on the order of 1 year or less within each hydrographic area crossed by the alignment. The pumping rates required, the total volume of groundwater that would be withdrawn from each hydrographic area, and the pumping timeframes involved are much smaller than the pumping rates, water volumes removed, and the prolonged periods of pumping that were involved at locations where ground subsidence has been observed, such as the Las Vegas Valley, Santa Clara Valley, and San Joaquin Valley. For these reasons, the potential for ground subsidence to occur as a result of the construction and operation a railroad along the Mina rail alignment would be small.

4.3.6.2.2 Construction Impacts for Specific Alternative Segments and Common Segments

DOE evaluated potential site-specific impacts to groundwater resources from constructing and operating a rail line along the Mina rail alignment. This section summarizes the approach and methodologies DOE used to quantitatively evaluate the extent of potential hydrogeologic impacts from withdrawing groundwater to support construction of the rail line and railroad construction and operations support facilities. Appendix G provides a more detailed description of the approach and methodology. Section 3.3.6 summarizes the existing groundwater resources along each of the alternative segments and common segments.

To evaluate potential impacts of proposed groundwater withdrawals from new water wells on existing wells and springs, DOE reviewed proposed well locations, well construction details, estimated groundwater depths, and proposed groundwater withdrawal rates and timeframes (DIRS 176189-

Converse Consultants 2006, all; DIRS 180888-Converse Consultants 2007, all). Unless otherwise noted, the sources for all spring and well data in this section are as follows:

- DIRS 176600-Converse Consultants 2006, all; DIRS 180887-Converse Consultants 2007, all
- The Nevada Division of Water Resources (NDWR) water-rights database and water-well log databases, and other datasets (DIRS 182288-NDWR 2007, all ; DIRS 182759-Converse Consultants 2007, all; DIRS 182899-NDWR 2007, all; DIRS 182900-NDWR 2007, all)
- Data from the U.S. Geological Survey (USGS) National Water Information System (NWIS) database (DIRS 176325-USGS 2006, all; DIRS 177294-MO0607USGSWNVD.000, all)
- The U.S. Geological Survey (USGS) National Hydrographic Datasets (DIRS 177712-MO0607NHDPOINT.000, all; DIRS 177710-MO0607NHDWBDYD.000, all)
- Geographic Names Information Systems databases on springs in Nevada (DIRS 176979-MO0605GISGNISN.000, all)

For initial screening purposes, if DOE identified an existing well or a spring within a 1.6-kilometer (1-mile) radius (buffer distance) of a proposed new water well, DOE selected that proposed well location as a candidate for conducting a groundwater hydrogeologic impacts evaluation. When DOE found no spring or existing well in this initial search radius, it extended the search distance outward from the proposed well location to identify the nearest spring or existing well within a 2.4-kilometer (1.5-mile) radius (buffer distance) of the proposed new well and determined its hydrogeologic and construction characteristics. In addition to the above screening processes, and before completing impacts analyses, for a selected set of new groundwater withdrawal well locations where the well was specifically targeted for installation within a fault zone or an extensive ***fracture*** zone, the locations of existing wells and springs up to 9.7 kilometers (6 miles) away from each such proposed well were identified. These larger search distances were considered to: (1) allow evaluation of potential simultaneous drawdown effects involving individual private wells having higher pumping rates that might be located in the general vicinity; and (2) assess the potential for a fault zone or extensive fracture zone present at the proposed new well location to act as a conduit for groundwater flow (possibly resulting in a groundwater drawdown effect over a larger distance).

DOE then searched the NDWR water-rights database and well-log databases to confirm the identity, use, water-rights status, and appropriated annual ***duty*** and diversion rate, if any, associated with each existing well located within these buffer distances. DOE included domestic wells and considered the appropriated annual duty and diversion rate for each well with a water right in hydrogeologic impacts analyses to estimate potential hydrogeologic impacts from groundwater withdrawals at the proposed well location. In some cases, using the available information, DOE could not positively correlate wells listed in the USGS NWIS database to any well listed in the NDWR water-rights database or the NDWR well-log database. For such wells, DOE did not perform quantitative impacts analyses for these wells. For impacts analysis purposes, DOE considered the locations of known domestic wells with respect to the proposed alignment and relative to proposed new well locations. Figures 3-190 through 3-196 show the approximate locations of existing wells, including domestic wells, and springs within the 1.6-kilometer (1-mile) screening level region of influence.

DOE reviewed available geologic and hydrogeologic information to confirm the hydrogeologic characteristics of known and potential aquifers in areas near proposed wells. Appendix G provides a detailed list of published geologic and hydrogeologic reports and maps and water resource appraisal reports that were reviewed prior to completing the groundwater resource impacts analysis calculations. Where applicable, for the closest existing well having a water right, DOE identified water appropriations information (annual appropriated groundwater duty, well use period, and authorized groundwater diversion rate) and documented the information for subsequent use in analysis.

DOE used the information obtained from the geologic and hydrogeologic data reviews to identify an appropriate analytical method or methods to determine the magnitude of drawdown that would be created in the aquifer as a result of the proposed groundwater withdrawals and determine the amount of simultaneous drawdown created, where applicable, due to groundwater pumping from the nearest existing pumping well. For purposes of analysis, fractured consolidated rock aquifers were treated as homogeneous, ***isotropic***, equivalent porous media. For a selected set of new groundwater withdrawal well locations where the well was determined to be located in the vicinity of faults or extensive fracture systems or specifically targeted for installation within a major fault zone or an extensive fracture zone (DIRS 180888-Converse Consultants 2007, Appendix B), additional evaluations of hydrogeologic data and/or additional analyses were performed.

In cases where a proposed well was determined to be oriented lateral to a mapped fault or fracture zone, the fault or fracture zone was treated as a potential no-flow ***barrier*** if it was located sufficiently close to the proposed new well to be within the region of influence from pumping at that well location. In such cases, the calculations included a specific method (image well method) to simulate the potential effects of the fault or fracture zone on groundwater flow behavior.

Hydraulic tests performed in faulted and fractured consolidated rock aquifers at a few wells in the region of the Nevada Test Site indicate that when a pumping well pumps groundwater from a high-***permeability*** zone associated with a fault that fault zone might act as a conduit for transmitting hydraulic responses from the pumping well over larger-scale (on the order of kilometers) distances. Results from pump tests conducted at these wells often indicate that very complex hydrogeologic conditions, including heterogeneous hydraulic rock properties, the presence of complex structural systems controlling flow, and other non-isotropic conditions, exist at these test sites. For these reasons, where a proposed new well was identified as targeting a specific fault or fracture system that could act as a high-permeability conduit, DOE identified the locations of existing wells and springs up to 9.7 kilometers (6 miles) away from each such proposed well. In these cases, DOE reviewed available data on existing wells and springs and locations of known (mapped) faults and fracture zones within the 9.7-kilometer radius surrounding each new well location and compared these with the locations of the proposed well to estimate the likelihood of a hydraulic connection occurring between the proposed well and existing wells and springs beyond a distance of 2.4 km (1.5 miles) but within the approximately 10-kilometer (6-mile) distance. Additional details regarding the treatment of faults and extensive fracture systems as conduits (or barriers) to flow in the impacts analyses are described in Appendix G.

DOE calculated a region of influence for each well and determined how far from the well the aquifer would be affected by the drawdown. For analysis purposes, DOE assumed that (1) it would obtain all water for railroad construction from new groundwater wells, and (2) groundwater might be pumped at the nearest existing well with a water right simultaneously to groundwater withdrawal at the new well or wells. If existing wells were found to be farther away from the proposed new well than the sum of the radii of influence associated with both wells, DOE concluded that there would be no impacts to the nearest existing well. If the nearest spring was found to beyond the calculated radius of influence of the proposed new well, DOE concluded that there would be no impacts to the spring.

For each analysis completed, with the exception of one proposed new well location (Cl-1a in Clayton Valley, as described in Section 4.3.6.2.2.5), DOE assessed the potential impacts to existing wells with water rights from imposing a pumping rate of 852 liters (225 gallons) per minute at each proposed well, considering the possibility of intersecting cones of depression from the simultaneous pumping of the nearest existing well with a water right and the proposed new well. The pumping rate assumed for the nearest well in nearly all cases was the average withdrawal rate required to realize the total appropriated annual or seasonal duty value for that well, if that well had a formal appropriated water right, over the authorized period of use. The exceptions included existing wells for which the average pumping rate calculated based on the total appropriated duty value was very low and much smaller than the authorized (short-term) diversion rate for that well, and those existing wells for which NDWR-issued certificates list only a diversion rate but do not specify an authorized annual duty. In those cases, to conservatively bound impact analysis results, DOE used the diversion rate to calculate the well's radius of influence.

Sections 4.3.6.2.2.1 through 4.3.6.2.2.12 describe potential impacts to existing springs or groundwater wells. Table 4-206 lists information about the hydrographic areas the rail line would cross and the estimated volume of water DOE would need to construct each set of Mina rail alignment alternative and/or common segments across each hydrographic area.

Figures 3-190 through 3-196 show the approximate locations of the proposed new water wells. DOE assumed that appropriation applications for new water wells represent a viable mechanism for obtaining the water required to support construction and operation of the Mina rail line and the Shared-Use Option. This approach does not predispose the final outcome of decisions regarding the approval or denial of such appropriation applications; however, the analysis assumes that such applications would, in theory, be accepted, and that groundwater withdrawal would occur at the proposed new well as designed. This analysis approach provides a conservative framework for estimating potential impacts to groundwater resources resulting from groundwater withdrawals within the respective hydrographic areas crossed by the rail alignment.

4.3.6.2.2.1 Department of Defense Branchline North. Department of Defense Branchline North begins at a new siding to be installed along the Union Pacific Hazen Branchline near Wabuska. Most of Department of Defense Branchline North segment overlies hydrographic area 108.

One new well is proposed within hydrographic area 108 to support water needs associated with operation of a new rail siding. Due to the anticipated small required withdrawal rate for this well (likely to be less than 3.8 liters [1 gallon] per minute), impacts to existing groundwater resources from this well would be small. Therefore, the new well proposed to support construction of the new siding at the beginning of Department of Defense Branchline North is not likely to have an adverse impact on the local groundwater uses or users.

4.3.6.2.2.2 Schurz Alternative Segments (Walker River Paiute Reservation). The Schurz alternative segments would cross hydrographic areas 110A (Walker Lake Valley-Schurz Subarea) and/or 123 (Rawhide Flats). New wells in these hydrographic areas could be between 15 and 230 meters (50 and 750 feet) deep (DIRS 180888-Converse Consultants 2007, Appendix A). The target aquifer for proposed wells would be alluvial valley-fill or alluvial fan deposits (DIRS 180888-Converse Consultants 2007, Appendix B).

Figures 3-190 and 3-191 show the approximate locations of USGS NWIS wells and known existing NDWR wells, existing springs, and proposed new wells along the Schurz alternative segments. Assuming that a proposed average groundwater withdrawal rate of 852 liters (225 gallons) per minute could be applied at each proposed new right-of-way well location and each well location outside of the construction right-of-way that would be used within the Walker River Paiute Reservation, analysis results (Table 4-207) indicate that there would be no impacts to existing wells and springs near the proposed Schurz alternative segments from pumping at the proposed well locations. Where the closest existing well or spring to a proposed new well was found to be located more than 2.4 kilometers (1.5 miles) away from that proposed new well location, no quantitative impacts analysis calculations were completed.

As noted in Sections 3.3.6.3.1 and 3.3.6.3.2, land the Schurz alternative segments would cross includes lands occupied by the Walker River Paiute Reservation. As described in Sections 3.3.6.3.1 and 3.3.6.3.2, the Nevada Division of Water Resources Well Log and Water Rights Databases are incomplete with respect to existing wells present in hydrographic areas 110A and 123.

Table 4-207. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Schurz alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
WLa-3a	> 1.60 (spring)	Not applicable [d]	0.38

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. No calculation was completed for reasons stated in text.

Therefore, DOE does not have a complete record of the total groundwater usage on the reservation. In accordance with Council on Environmental Quality NEPA implementing regulations (Section 1502.22), DOE has used the resources that are available to evaluate potential adverse impacts to groundwater usage on the Walker River Paiute Reservation.

A new well (see Figure 3-190) might be installed in area 110A (Well Wla-1c) in the same general area where several mapped faults exist. Several northeast-striking faults are mapped on the south edge of the Desert Mountains and might pass through the general area of this proposed well location (DIRS 180888-Converse Consultants 2007, Appendix B). There are no known existing wells or springs within approximately 9.7 kilometers (6 miles) of this proposed well location that are known to be associated with the same fault system or potentially related major fault zones.

4.3.6.2.2.3 Department of Defense Branchline South Segment (Walker Lake Valley Area). Department of Defense Branchline South would overlie the southern part of hydrographic area 110A and would continue southward across area 110B (Walker Lake Valley-Lake Subarea). One new well (at location WLa-5a) is proposed within hydrographic area 110A for supplying water to support water needs associated with railroad construction and operation of a new rail siding. Figures 3-191 and 3-192 show the approximate location of this proposed new water well. The target aquifer for this proposed well would be an alluvial fan deposit (DIRS 180888-Converse Consultants 2007, Appendix B).

There are no existing springs, no existing USGS NWIS wells, and no existing NDWR water wells within 1.6 kilometers (1 mile) of proposed well location WLa-5a. Withdrawal of groundwater from proposed well location WLa-5a would therefore not be expected to impact existing springs or existing water wells in area 110A. Additionally, the proposed well at WLa-5a is located approximately 1.6 kilometers north of the southern boundary of hydrographic area 110A, which is significantly greater than the maximum 0.8 kilometer (0.5 mile) radius of the pumping-induced cone of depression that would surround this proposed well location. For this reason, and because the area south of location WLa-5a is also not an area where inter-basin groundwater flow is inferred to be occurring (Figure 3-188), pumping at this location should have a very small effect on existing groundwater resources in area 110A and on groundwater resources in the adjacent hydrographic area (area 110B).

4.3.6.2.2.4 Mina Common Segment 1. Mina common segment 1 would overlie most of hydrographic area 110C (Walker Lake Valley-Whiskey Flat-Hawthorne Subarea), would continue southeastward across hydrographic areas 121B (Soda Spring Valley-Western Part), 121A (Soda Spring Valley-Eastern Part), 119 (Rhodes Salt Marsh Valley), and 118 (Columbus Salt Marsh Valley), and continue into the western portion of hydrographic area 137A (Big Smoky Valley-Tonopah Flat). Beginning at a point northeast of Luning, Mina common segment 1 would change its direction from eastward-to-southeastward to more southward-to-southeastward. Figures 3-191 through 3-193 show Mina common segment 1 and the approximate locations of new wells DOE could install to meet construction-water demands and locations of existing wells and existing springs in the vicinity of Mina common segment 1.

Assuming that a proposed average groundwater withdrawal rate of 852 liters (225 gallons) per minute was to be applied at each proposed new right-of-way well location and well location outside of the nominal 300-meter (1,000-foot)-wide construction right-of-way, analysis results (Table 4-208) indicate that, with one possible exception (CSM-2a, described below), no impacts would be expected to occur to existing wells or springs near Mina common segment 1 from pumping at the proposed new well locations along Mina common segment 1.

Table 4-208. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Mina common segment 1.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
WLa-3a	> 1.60 (spring)	Not applicable[d]	0.38
WLc-2a	1.42 (well)	Not applicable[d]	0.72
SSb-2	0.73 (spring)	Not applicable[d]	0.48
SSa-4	> 1.60 (well)	Not applicable[d]	0.80
SSa-2	> 1.60 (well)	Not applicable[d]	0.80
SSa-3	> 1.60 (well)	Not applicable[d]	0.80
CSM-3a	1.24 (well)	Not applicable[d]	0.48
CSM-2a	0.37 (spring)[e]	Not applicable[d]	0.89
CMS-2a	> 1.60 (well)	Not applicable[d]	0.89

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. No calculation was completed for reasons stated in text.
e. Spring might no longer be discharging (see text).

One new well is proposed at location CSM-2a in the Columbus Salt Marsh Valley (hydrographic area [area 118]), as shown on Figure 3-193. North-trending faults lie along the western front of the Monte Cristo Range in this area. The presence of a nearby spring might be related to the Eastern Columbus fault zone (DIRS 180888-Converse Consultants 2007, Appendix B). Based on the best available information, it cannot be conclusively demonstrated that the proposed well at location CSM-2a would be installed in a fault zone. Therefore, it is not possible to infer a direct hydraulic connection between any existing wells and springs located within 10 kilometers of the proposed well at location CSM-2a.

The proposed withdrawal rate in this new well is approximately 852 liters (225 gallons) per minute or less. The closest spring, or existing well, appears to be a spring. This spring is described in a water resources appraisal report published in 1970 (DIRS 180759-Van Denburgh and Glancy, 1970, Plate 1 and Table 16) as “Spring 8aaa,” located approximately 370 meters (1,230 feet) north-northwest of the site (see Figure 3-193). It should be noted that this spring is not part of the GNIS Nevada springs database (DIRS 176979- DTNMO0605GISGNIS.000, all), nor is it included in the USGS National Hydrologic Point Data Database (DIRS 177712-DTNMO0607NHDPOINT.000, all), or the NDWR water-rights database (DIRS 182759-Converse Consultants 2007, all). Analysis results indicate that, for a scenario where the spring is assumed to be present and be in direct hydraulic connection with the water-producing zone in the proposed well at location CSM-2a, the spring would not be affected by groundwater withdrawal at site CSM-2a if the average withdrawal rate at site CSM-2a is limited to approximately 150 liters (40 gallons) per minute or less. This potential spring was included as a possible existing hydrogeologic feature in the impact analysis calculations to represent a very conservative scenario. The spring was reported to have a very low rate of discharge of 1.9 liters (0.5 gallon) per minute in the 1970 report, and, given that this spring is not included in the other springs databases described above, it is considered likely that the spring no longer exists today (that is, there is no groundwater discharge occurring at this location). In the unlikely event that this spring might still exist, impacts to that spring could be eliminated by reducing the average withdrawal rate at location CSM-2a to approximately 150 liters per minute or less. In this case, the remaining balance of make-up water required could be obtained at another proposed well location, provided that well was sufficiently far away from known existing springs and active pumping wells. Alternatively, additional water could be obtained from an existing water-rights holder or proposed well CSM-2a could be moved to a point sufficiently distant from the spring, if present, to preclude the cone of depression from the well from reaching the spring.

If Spring 8aaa no longer exists, the potential impact on the next closest existing groundwater resource, a Nevada Division of Water Resources (NDWR) well was also evaluated. Analysis results indicate that this well would not be impacted by the proposed groundwater withdrawal activity at location CSM-2a.

4.3.6.2.2.5 Montezuma Alternative Segment 1. Montezuma alternative segment 1 would cross a portion of hydrographic area 137A (Big Smoky Valley-Tonopah Flat), and then cross hydrographic area 143 (Clayton Valley), then proceed into and then exit hydrographic area 142 (Alkali Spring Valley), after which it would re-enter hydrographic area 143, then cross hydrographic area 144 (Lida Valley). Figures 3-193 and 3-194 show the approximate locations of existing wells, existing springs, and proposed new wells within the typical maximum 300-meter (1,000-foot)-wide rail line construction right-of-way to meet water demands along Montezuma alternative segment 1. As of March 31, 2007, there were no pending annual duties assigned to hydrographic areas 137A, 142, 143, or 144 (see Table 4-206).

DOE could install one new well at proposed well location Cl-1a southwest of the community of Silver Peak in the hydrographic area 143 (Clayton Valley). This well location (see Figure 3-194) would be southwest of an existing well field that services Silver Peak. The proposed production rate in the new well installed at this location is approximately 1,300 liters (350 gallons) per minute or less. This withdrawal rate is higher than the anticipated withdrawal rate for other proposed new wells along the Mina alternative ***rail route*** because groundwater underlying much of Clayton Valley is too brackish for human consumption (DIRS 180760-Albers and Stewart 1981, p. 2). Therefore sources of better-quality groundwater for use in the rail roadbed construction and for supplying water for a proposed construction camp are very limited in this area.

The nearest existing spring, domestic well, or well with a known water right is a municipal well (DIRS 182759-Converse Consultants 2007, all; DIRS 182899-NDWR Water Rights Data 2007, all) approximately 980 meters (3,206 feet) northwest of location Cl-1a (see Figure 3-194). Under a scenario where both wells are assumed to be pumped simultaneously, the cones of depression from the two wells would likely intersect each other, and as a result, groundwater pumping at location Cl-1a at the 1,300 liters (350 gallons) per minute production rate would be expected to impact pumping at the existing municipal well. Analysis results (see Table 4-209) indicate that if the average pumping rate in the proposed well at location Cl-1a does not exceed approximately 1,000 liters (266 gallons) per minute, the cones of depression from the two wells would therefore not be expected to intersect each other, and groundwater pumping at either of the two wells would not be expected to impact the availability of groundwater for pumping at the other well. Alternatively, the location of proposed well Cl-1a could be moved to a point sufficiently distant from the existing well with the water right to preclude the cones of depression from the two wells from intersecting each other.

With the exception of proposed well location Cl-1a, there are no known existing wells or springs within 1.6 kilometers (1 mile) or within the potential radius of influence of these proposed alternative well locations.

Table 4-209. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Montezuma alternative 1 segment.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
CL-1a	0.98 (well)	Not applicable[d]	0.87 (1,325 liters [350 gallons] per minute)
CL-8a	> 1.60 (well)	Not applicable[d]	0.50
Cl-9a	> 1.60 (well)	Not applicable[d]	0.50
Li-3a	> 1.60 (well)	Not applicable[d]	1.0

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. No calculation was completed for reasons stated in text.

A proposed alternate well location (Li-5a) in Lida Valley, if used in lieu of proposed well location Li-1a (see Figure 3-194), could require construction of a separate access road whereas no separate access road would be required for a well at location Li-1a (DIRS 180875-Nevada Rail Partners 2007, Figure G-14). There are no existing wells or existing springs within 1.6 kilometers of the proposed Li-5a well location. The potential for impacts to occur to groundwater resources from such an access road would be small, for the reasons previously described in Section 4.3.6.2.1.

Two proposed new locations (As-2a and As-3a) are situated in an area (Figure 3-195) where several northeast-striking faults exist in bedrock to the southwest of these well locations. The possibility exists that these faults might project through the general vicinity of these proposed well locations (DIRS 180888-Converse Consultants 2007, Appendix B). However, based on the best available information, it cannot be conclusively demonstrated that the proposed well at locations As-2a and As-3a would be installed in a fault zone. Therefore, it is not possible to infer a direct hydraulic connection between any existing wells and springs located within 9.7 kilometers (6 miles) of the proposed wells at the As-2a and As-3a locations.

4.3.6.2.2.6 Montezuma Alternative Segment 2. Montezuma alternative segment 2 would cross a portion of hydrographic area 137A (Big Smoky Valley-Tonopah Flat Valley), then continue on through Area 142 (Alkali Spring Valley), and finally end in hydrographic area 144 (Lida Valley). Figures 3-193 and 3-194 show the approximate locations of existing wells, existing springs, and proposed new wells within the rail line construction right-of-way to meet water demands along Montezuma alternative segment 2.

DOE proposes to install up to 15 new wells to support the construction of Montezuma alternative segment 2. Groundwater impacts analyses were conducted for the proposed new wells for which existing wells or existing springs are present within the potential region of influence. Results of the analyses (Table 4-210) indicate that application of the withdrawal rate of approximately 852 liters (225 gallons) per minute at these proposed new well locations would not impact existing users and uses of groundwater resources in any of the hydrographic areas Montezuma alternative segment 2 would cross.

A new well (BSa-3a) might be installed in area 137A (see Figure 3-193) between prominent fault zones. Both north-south fault zones might promote enhanced groundwater flow within stratified ***colluvium***/alluvium in this general area (DIRS 180888-Converse Consultants 2007, Appendix B). Based on the best available information, it cannot be conclusively demonstrated that the proposed well at location BSa-3a would be installed in a fault zone. Therefore, it is not possible to infer a direct hydraulic connection between any existing wells and springs located within 9.7 kilometers (6 miles) of the proposed well at location BSa-3a.

Table 4-210. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Montezuma alternative segment 2.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
Bsa-1a	1.10 (well)	Not applicable[d]	0.80
Bsa-2a	1.40 (spring)	Not applicable[d]	0.54
Bsa-3a	> 1.60 (well)	Not applicable[d]	0.86
As-1b	> 1.60 (well)	Not applicable[d]	0.84
As-2b	> 1.60 (well)	Not applicable[d]	0.83

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. No calculation was completed for reasons stated in text.

4.3.6.2.2.7 Montezuma Alternative Segment 3. Montezuma alternative segment 3 would begin in the western part of hydrographic area 137A, then travel south through the middle of hydrographic area 142, then proceed westward to briefly enter hydrographic area 143, then proceed in an eastward direction where it would end in the southeastern portion of hydrographic area 144. Figures 3-193 and 3-194 show the approximate locations of existing wells, existing springs, and proposed new wells within the rail line construction right-of-way to meet water demands along Montezuma alternative segment 3. DOE proposes to install a total of up to 14 new wells to support the construction of Montezuma alternative segment 3. Groundwater impacts analyses were conducted for the proposed new wells for which existing wells or existing springs are present within the potential region of influence. Results of the groundwater impacts evaluation show that imposing an average pumping rate of 852 liters (225 gallons) per minute at these 14 proposed new wells would not impact the local groundwater users and uses in any of the hydrographic areas that Montezuma alternative segment 3 would cross.

Assuming proposed base-case average and sensitivity analysis groundwater production rates at each new well location, the impacts assessment results indicate that existing wells and springs near Montezuma alternative segment 3 would be outside the radius of influence of the proposed new water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Mina rail alignment.

4.3.6.2.2.8 Mina Common Segment 2. Mina common segment 2 would be entirely in hydrographic area 144 and would be approximately 5 kilometers (3.1 miles) long, proceeding from the northwest to the southeast. Figures 3-194 and 3-195 show a map view of Mina common segment 2.

There are no proposed wells, no existing USGS NWIS wells, no existing NDWR wells and no existing springs within 1.6 kilometers (1 mile) of the centerline of Mina common segment 2. Proposed wells from Montezuma alternative segments 1, 2, or 3 would be used for obtaining water needed to support the construction of Mina common segment 2. Therefore, groundwater impacts resulting from construction of Mina common segment 2 are presented in Sections 4.3.6.2.2.5, 4.3.6.2.2.6, and 4.3.6.2.2.7.

4.3.6.2.2.9 Bonnie Claire Alternative Segments. Figures 3-194 and 3-195 show the approximate locations of proposed new water wells DOE could use to support construction of these alternative segments. Evaluation of proposed new wells and information regarding existing groundwater wells and springs in the area where the Bonnie Claire alternative segments would cross indicate, for cases where groundwater pumping is assumed at the projected base-case average required withdrawal rates and where the hypothetical maximum withdrawal rate of 852 liters (225 gallons) per minute is assumed at each location, that known existing wells and springs along Bonnie Claire alternative segments 2 and 3 would be outside the radius of influence of proposed water wells along this portion of the Mina rail alignment. There are no existing USGS NWIS wells, no existing NDWR wells, and no springs within 1.6 kilometers (1 mile) of the centerlines of Bonnie Claire alternative segment 2 or 3 (see Figure 3-195). For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Mina rail alignment.

4.3.6.2.2.10 Common Segment 5 (Sarcobatus Flat Area). Figures 3-195 and 3-81 show the approximate locations of proposed new wells that DOE could use to support construction of common segment 5.

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results (Table 4-211) indicate that existing wells and springs near common segment 5 would be outside the radius of influence of the proposed new water wells. Where the closest existing well or spring to a proposed new well was found to be located more than 2.4 kilometers (1.5 miles) away from that proposed new well location, no quantitative impacts analysis calculations were completed.

Table 4-211. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – common segment 5.

Well number	Distance to nearest well or nearest spring (kilometers)[a,b]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[c] per minute pumping rate (kilometers)
SaF1/2/3	0.14 (well)	0.35	0.56
SaF4	> 1.60 (well)	0.48	0.81
SaF5/9	> 1.60 (well)	Not applicable[d]	0.68
SaF7/11	1.21 (well)	0.36	0.63
OV24/25/26	> 1.60 (well)	0.31	0.38

a. To convert kilometers to miles, multiply by 0.62137.
b. > = greater than.
c. To convert liters to gallons, multiply by 0.26418.
d. No calculation was completed for reasons stated in text.

4.3.6.2.2.11 Oasis Valley Alternative Segments. A potential concern in this area is that shallow groundwater, if used for meeting ***potable water*** needs at a rail siding, construction camp, or quarry, could have elevated fluoride levels. However, deeper groundwater northeast of Beatty could be of higher quality.

Figure 3-195 shows the approximate locations of proposed new water wells within the Oasis Valley alternative segments 1 and 3 construction right-of-way. Specific siting and use considerations for new wells that would be installed along this portion of the rail alignment are summarized below. Impacts to existing springs in this area (Section 3.3.6.3.11) could be eliminated by employing the following mitigation strategies:

- For Oasis Valley alternative segment 1, up to three proposed new wells at locations OV3 and OV4, and up to two new wells at location OV5, sited within valley-fill alluvial materials, could be used to obtain water needed to support rail line construction. Alternatively, or in combination with these wells, a series of alternate wells approximately 7.2 kilometers (4.5 miles) northwest of proposed well location OV4 (at locations OV24, OV25, and OV26 on Figure 3-196), would also be used to supply water, for the same purpose, to a rail alignment water-demand location in the vicinity of proposed well locations OV3, OV4, and OV5. Locations OV24 through OV26 would be within the proposed rail alignment construction right-of-way, and in valley-fill alluvium. A series of springs on the Upper Oasis Valley Ranch (DIRS 169384-Reiner et al. 2002, Figure 7; DIRS 181909-Fridrich et al. 2007, all) are within approximately 1 kilometer (0.6 mile) of proposed well locations OV3, OV4, and OV5. Section 3.3.5, Surface-Water Resources, discusses other springs in this area. Wells at locations OV3, OV4, and OV5 would be between approximately 15 and 30 meters (50 and 100 feet) deep, while wells at locations OV24, OV25, and OV26 would be between approximately 30 and 46 meters (100 and 150 feet) deep (DIRS 176189-Converse Consultants 2006, Appendix B). For a 4-year construction schedule, the total combined average withdrawal rate for wells at locations OV3 and OV4, taken together with that for alternative wells at locations OV24 and OV25, would be approximately 410 liters (approximately 109 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). For the same schedule, the total combined withdrawal rate for wells at locations OV5, together with that for alternative wells at location OV26, would be approximately 150 liters (approximately 40 gallons) per minute. The total required water withdrawal would be divided between these well locations (Figure 3-195).

- For Oasis Valley alternative segment 3, up to two proposed new wells at locations OV13, sited at the same location as OV5 under Oasis Valley alternative segment 1, could be used to obtain water needed to support railroad construction. Alternatively, or in combination with these wells, up to two alternate wells at location OV24, sited at the same location as OV24 under the Oasis Valley alternative segment 1 (see Figure 3-195), would also be used to supply water to a rail alignment water-demand location in the vicinity of proposed well location OV13. Wells at these locations would have the same depth as the corresponding wells at these locations under Oasis Valley alternative segment 1. For a 4-year construction schedule, the total combined withdrawal rate for wells at location OV13, taken together with that for alternative wells at location OV24, would be approximately 340 liters (approximately 89 gallons) per minute ([DIRS 176189-Converse Consultants 2006, Appendix A). The total required water withdrawal would be divided between these well locations (see Figure 3-196).

- Analysis results (Table 4-212) indicate that pumping groundwater from wells at locations OV3, OV4, and OV5, under Oasis Valley alternative segment 1, and pumping from wells at location OV13, under the Oasis Valley alternative segment 3, would need to be limited to a total of approximately 76 liters (approximately 20 gallons) per minute or less at each location, under each alternative segment, to preclude possible reductions in discharge rates and water quality at the Upper Oasis Valley Ranch springs. The remaining water needed to support construction activities in this portion of the rail alignment would be obtained from proposed alternate well locations OV24, OV25, and/or OV26. For Oasis Valley alternative segment 1, the total combined net withdrawal that would be met through the use of wells at alternate well locations would be approximately 340 liters (89 [109 + 40 − 20 − 20 − 20] gallons) per minute. For Oasis Valley alternative segment 3, the total combined net production from wells at location OV24 would be approximately 261 liters (69 [89 – 20]) gallons) per minute.

Table 4-212. Summary of calculated radii of influence for proposed new wells for the Mina rail alignment – Oasis Valley alternative segments.

Well number	Distance to nearest well or nearest spring (kilometers)[a]	Radius of influence at base-case pumping rate (kilometers)	Radius of influence at 852 liters[b] per minute pumping rate (kilometers)
OV3/4/5	0.64 (spring)	0.28	Not applicable[c]
OV9	1.50 (spring)	0.18	0.64
OV12/18/19/20/21	0.96 (spring)	0.56	0.61
OV6/8/14/16	1.32 (spring)	0.49	0.64

a. To convert kilometers to miles, multiply by 0.62137.
b. To convert liters to gallons, multiply by 0.26418.
c. No calculation was completed for reasons stated in text.

Evaluation of the effects of proposed groundwater withdrawals from proposed wells at locations OV9, OV12, OV17, OV18, OV19, and OV20 for Oasis Valley alternative segment 3 indicate that there would be no expected impact to known existing springs or wells in the Oasis Valley area.

Existing USGS NWIS wells (OVU-Dune Well, OVU-Middle ET Well, OVU-Lower ET Well, and Well ER-OV2) within approximately 0.32 to 0.48 kilometer (0.2 to 0.3 mile) of the proposed new wells at locations OV3, OV4, and OV5 on Oasis Valley alternative segment 1 (see Section 3.3.6.3.11) are shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. All of these wells have no current or projected beneficial use and are used solely for monitoring purposes. An existing well cluster of USGS NWIS wells (ER-OV-01, ER-OV-06a, and ER-OV-6a2) is approximately 1.9 kilometers (1.2 miles) northeast of the proposed new wells at location OV20/OV21 on Oasis Valley alternative segment 3. These are also shallow groundwater monitoring wells owned and installed by the U.S. Geological Survey. These wells have no current or projected beneficial use and are used solely for monitoring purposes.

Alternatively, for Oasis Valley alternative segment 1, up to four proposed new wells could be installed at proposed alternative well locations OV6 and OV8 west of the Amargosa River in the Oasis Valley area (see Section 3.3.6.3.11 and Figure 3-195). For Oasis Valley alternative segment 3, these alternate well locations are designated OV14 and OV16 but the wells would have the same characteristics and same required production rates. These alternate wells would support earthwork construction and would be between 30 and 46 meters (100 and 150 feet) deep. The total combined required withdrawal rate for this set of wells would be approximately 510 liters (136 gallons) per minute (DIRS 176189-Converse Consultants 2006, Appendix A). Analysis results (Table 4-212) indicate that pumping groundwater from these wells at the required base-case withdrawal rates would not be expected to impact discharge rates and/or water quality at a group of springs (identified in records as Ute Springs and Manley Springs) approximately 0.64 kilometer (0.4 mile) to 0.97 kilometer (0.6 mile) east of the OV14 and OV16 locations.

For two proposed new well locations associated with the Oasis Valley alternative segments, the targeted water zone is a possibly water-bearing detachment fault system (DIRS 176189-Converse Consultants 2006, Appendixes A and B and Maps 14a and 14b). A proposed well location (well location OV5 or OV15, depending on alternative segment) could be installed in the southern portion of hydrographic area 228, within the typical maximum 300-meter (1,000-foot)-wide construction right-of-way of common segment 6 (see Figure 3-195). A new well (see Section 3.3.6.3.11 and Figure 3-195) might be installed in the southern part of the Oasis Valley hydrographic area near the area boundary, approximately 0.8 kilometer (0.5 mile) west of common segment 6 (well location OV22 or OV23, depending on alternative segment). The target water source at this location would be a possibly water-bearing detachment fault system (DIRS 176189-Converse Consultants 2006, Appendix B). There are no known existing wells or springs within approximately 9.7 kilometers (6 miles) of either of these proposed well locations that are known to be associated with the same fault system as, or with potentially related major fault zones in either of these proposed well locations, should these wells be used for obtaining water required at corresponding rail alignment water-demand stations.

4.3.6.2.2.12 Common Segment 6 (Yucca Mountain Approach). Figure 3-195 shows the approximate locations of proposed new wells along this common segment. There are 1.41 million cubic meters (1,147 acre-feet) and 72,000 cubic meters (58 acre-feet) of annual committed groundwater resources in hydrographic areas 229 and 227A, respectively. There are 101,000 cubic meters (82 acre-feet) of documented pending annual duties in area 229 and approximately 6,170 cubic meters (5 acre-feet) of documented pending annual duties in area 227A. Tables 3-113 and 4-206 indicate that water withdrawal required within hydrographic area 229 for construction of common segment 6 would exceed the estimated annual perennial yield for that hydrographic area. However, except for smaller-magnitude water requirements (on the order of 3.8 liters [1 gallon] per minute) associated with a proposed rail siding

(DIRS 176189-Converse Consultants 2006, Table 2-1) and a proposed construction camp (approximately 76 liters [20 gallons] per minute), water requirements for common segment 6 would be required for only 9 months (DIRS 176189-Converse Consultants 2006, Appendix A).

There are 14 existing USGS NWIS wells, no NDWR wells with water rights, no NDWR domestic wells, and no springs located within approximately 1.6 kilometers (1 mile) of the centerline of common segment 6. Up to two new water wells are proposed at location CF4. These wells would furnish water for earthwork compaction and would be between approximately 370 and 460 meters (1,200 and 1,500 feet) deep. Although there is one USGS NWIS well approximately 1.5 kilometers (0.9 mile) northeast of this location, that well is a groundwater test/monitoring well (NC-EWDP-18P) installed to test subsurface characteristics and monitor groundwater conditions downgradient of the Yucca Mountain repository site. This well has no current or projected beneficial use, and is used only for monitoring purposes (DIRS 176600-Converse Consultants 2005, Plate 4-2 and Appendix A; DIRS 176808-Nye County Nuclear Waste Repository Project Office 2002, all).

As shown in Table 3-113, the perennial yield for the western two-thirds of hydrographic area 227A is approximately 720,000 cubic meters (580 acre-feet) and committed groundwater resources are very low. Appropriations for new wells could be pursued in this area to meet railroad construction-water needs and water demands for rail line construction and for the railroad operations support facilities near the end of the rail line at Yucca Mountain.

Water required for railroad construction and operations through area 227A would be acquired as part of the water inventory of approximately 530,000 cubic meters (430 acre-feet) per year proposed for appropriation in area 227A to support construction and operation of a repository at Yucca Mountain. The total estimated water demand for construction of the portion of common segment 6 within area 227A is approximately 710,000 cubic meters (572 acre-feet). Water requirements associated with the construction and operation of proposed rail facilities in area 227A are described in Section 4.3.6.2.1. If the amount of water required to support rail construction and operations exceeds the current amount proposed for appropriation, the schedule for railroad construction or for water acquisition could be modified to reduce peak water demands or an additional temporary water appropriation for rail construction could be sought (DIRS 176189-Converse Consultants 2006, p. 15).

Assuming proposed base-case average and sensitivity analysis groundwater withdrawal rates at each new well location, the impacts assessment results indicate that existing wells and springs near common segment 6 would be outside the radius of influence of the proposed water wells. For this reason, no quantitative impacts analysis calculations were completed for new well locations proposed for this portion of the Mina rail alignment.

4.3.6.3 Operations Impacts

Overall, potential impacts to groundwater resources from operating the proposed railroad along the Mina rail alignment under the Proposed Action or under the Shared-Use Option would be small.

Rail line operations facilities would need water for daily operation. However, other than relatively limited water quantities required for maintaining fire-protection water-tank reserves at rail sidings and meeting relatively low water needs for operations personnel at selected facility locations along the rail line, there would be no continued need for any large-scale pumping wells once construction of the railroad is completed. Possible changes to recharge characteristics, and resulting changes in percolation rates to groundwater, if any, in the areas of railroad operations facilities would be the same as those at the completion of construction of the rail line.

By complying with applicable regulations, it is expected that impacts to groundwater resources from disposal of wastewater would be minimized (see Section 4.3.11, Utilities, Energy, and Materials).

4.3.6.4 Impacts under the Shared-Use Option

Impacts to groundwater under the Shared-Use Option would be similar to those identified for the Proposed Action without shared use. Under the Shared-Use Option, additional commercial rail sidings would be constructed as a third track alongside passing sidings (see Figure 2-55). The total length of commercial rail sidings would be relatively small compared to the total length of the rail line. Under the Shared-Use Option, water needs for construction of the rail line would increase only by approximately 150,000 cubic meters (119 acre-feet).

For purposes of analysis, DOE assumed that the commercial sidings would be in the same hydrographic areas as analyzed for the Proposed Action without shared use. Impacts would be similar to those described for the Proposed Action without shared use; additional impacts to groundwater resources in these areas would be small.

The commercial-only facilities that would be constructed under the Shared-Use Option would likely be close to DOE-owned and -operated rail facilities and would likely overlie the same hydrographic areas identified for the Proposed Action without shared use. Overall, the impacts would be similar to those described for the Proposed Action without shared use and would be small.

Impacts to groundwater under Shared-Use Option operations would be similar to those identified for operations under the Proposed Action without shared use (Section 4.2.6.2). Use of the completed rail line from Wabuska to Yucca Mountain, including any additional sidings, would have a small impact on groundwater resources. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

The commercial-only facilities would require water for daily operation. Water demand to operate these facilities has not been determined, but DOE assumes this demand would be small. Therefore, the additional impacts to groundwater resources would likely be small and overall would be similar to those described for the Proposed Action without shared use.

4.3.6.5 Summary

This section summarizes and characterizes potential impacts to groundwater resources from constructing and operating the proposed rail line and railroad construction and operations support facilities along the Mina rail alignment. The potential for impacts to groundwater resources resulting from physical disturbance of the ground surface during the construction phase would be small. Proposed groundwater withdrawals would locally affect groundwater flow patterns and groundwater availability. Impacts on downgradient groundwater basins (hydrographic areas) due to the proposed groundwater withdrawals would be very small. Impacts on groundwater resources due to groundwater withdrawals at proposed quarry locations and rail facility locations would also be very small. As discussed in Section 4.1, DOE would implement best management practices as part of the Proposed Action to avoid, minimize, or otherwise reduce impacts to groundwater resources. Chapter 7 describes best management practices and mitigation measures.

For the case of groundwater withdrawals from proposed wells to support a 4-year rail construction schedule, analysis results indicate that, based on anticipated hydrogeologic conditions, existing known wells or springs are not expected to fall within the radius of influence of the proposed new wells, except for location Cl-1a in Clayton valley, possibly location CSM-2a in Columbus Salt Marsh Valley, and selected proposed new well locations in the Oasis Valley area (if the restrictions and use limitations discussed for these well locations as described below were not followed). The proposed groundwater withdrawal at each new production well would create a drawdown feature in the portion of the ***saturated zone*** immediately surrounding that well, locally affecting groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding the well. The effects in each case where projected average production rates are assumed to occur at the proposed well locations would be limited in extent to a maximum horizontal distance of approximately 0.8 to 1 kilometer (approximately 0.5 to 0.6 mile) or less in a few instances and generally a much smaller distance.

As noted above, impacts analysis results indicate at two proposed well locations along the portion of the proposed Mina rail alignment that would be unique to the alignment (that is, distinct from the rail line segments that would be common to both the Mina and Caliente rail alignments as described in Section 4.2.6), proposed groundwater withdrawals, if unmitigated, could impact existing groundwater resources and/or an existing groundwater user. The following is a summary of these potential impacts:

- Location CSM-2a – There is potentially a spring located within the calculated region of influence of this pumping location. It should be noted that available information suggests that this spring, noted in a report from 1970 as having a very small flow rate, might no longer exist (that is, no longer discharge). If this potential spring location was excluded from consideration in the impact analysis calculations, there would be no impact to nearby groundwater uses or users due to the pumping at location CSM-2a. In the unlikely event that this spring might still exist, impacts to that spring could be eliminated by reducing the average withdrawal rate at location CSM-2a to approximately 150 liters (40 gallons) per minute or less. In this case, the remaining balance of make-up water required could be obtained at another proposed well location provided that well is sufficiently far away from known existing springs and active pumping wells. Alternatively, the location of proposed well CSM-2a could be moved to a point located sufficiently distant from the spring, if present, to preclude the cone of depression from the well from reaching the spring.

- Location Cl-1a – This well location would be southwest of an existing groundwater well field that services the community of Silver Peak. The proposed production rate in the new well installed at this location would be approximately 1,300 liters (350 gallons) per minute (gpm) or less. This withdrawal rate is higher than the anticipated production rate for other proposed new wells along the Mina rail alignment because groundwater underlying much of Clayton Valley is very brackish in nature. Therefore, possible target areas for obtaining better-quality groundwater for use in the rail line roadbed construction and for supplying water for a proposed construction camp are very limited in this area. Analysis indicates that if the average pumping rate in the proposed well at location Cl-1A were maintained at approximately 1,000 liters (265 gallons) per minute or less, the cone of depression developed around this proposed well would not be expected to intersect the cone of depression surrounding the nearest existing well with a known water right (a municipal water well), under the scenario where both wells are assumed to be pumped simultaneously. In this case, the remaining balance of make-up water required could be obtained at another proposed well location provided that well is sufficiently far away from known existing springs and active pumping wells. Alternatively, the location of proposed well Cl-1a could be moved to a point sufficiently distant from the existing well with the water right to preclude the cones of depression from the two wells from intersecting each other.

Analysis results (see Tables 4-207 through 4-212) for the rail line segments that would be common to both the Mina and Caliente rail alignments indicate that certain restrictions or use prohibitions would need to be factored into the final siting and use of some specific proposed new groundwater well locations (mostly with respect to potential higher well-productivity scenarios) at selected locations in the Oasis Valley hydrographic area (proposed well locations OV3, OV4, OV5/OV13 in order to preclude impacts on existing groundwater resources. The resources that could be affected if such restriction for use prohibitions were not followed include springs (locations OV3, OV4, and OV5/13) or existing wells (location Cl-1a).

Wells having the largest withdrawal rates would be expected to be those that are designed for use as supply wells for earthwork compaction; groundwater withdrawals from these wells would occur over a period of less than 1 year (typically over a 9-month pumping period). For a longer rail construction schedule (up to 10 years), groundwater withdrawal rates from new wells could be the same or reduced for most well locations compared to those described in this section. For this longer schedule, the magnitude of potential impacts to existing groundwater users from groundwater withdrawals would be equal to or less than that determined for the 4-year railroad construction schedule.

Collectively, the impacts analysis results indicate that the effects of groundwater withdrawals from the proposed new wells at the range of production rates that may be required for this project would be localized in nature and extent. The impacts caused by the majority of water withdrawals and the wells having the highest production rates (those associated with construction of the rail line roadbed) would be short term in duration. Additionally, for those areas where proposed new water wells would be near a boundary between adjacent hydrographic areas, downgradient hydrographic areas would not be likely to be affected by the proposed groundwater withdrawals because (1) there are no identified existing groundwater users associated with the downgradient groundwater basins within 1.6 kilometers (1 mile) of any of these proposed well-water withdrawal locations, and (2) available hydrogeologic information indicates that significant inter-basin groundwater (under) flow is not occurring in the areas downgradient of the proposed well locations.

DOE compared hydrogeologic conditions occurring at the proposed withdrawal well locations and required groundwater withdrawal durations and proposed groundwater withdrawal rates for new wells to hydrogeologic conditions and groundwater withdrawal rates and pumping durations that have occurred at certain locations in the western United States where ground subsidence has been observed as a result of prolonged, large-scale groundwater withdrawals. Comparison results indicate that the potential for ground subsidence to occur as a result of proposed groundwater withdrawals in the hydrographic areas crossed by the Mina rail alignment is small, both during the construction and operations phases.

Table 4-213 summarizes potential impacts to groundwater resources from constructing and operating the proposed railroad along the entire Mina rail alignment.

Table 4-213. Summary of potential impacts to groundwater resources – Mina rail alignment.

Resource	Proposed Action
Groundwater availability and uses	*Construction* - Analysis results indicate that proposed groundwater withdrawals would locally affect groundwater flow patterns and water availability in the portion of the aquifer immediately surrounding each new withdrawal well. The effects resulting from application of assumed withdrawal rates of 852 liters (225 gallons) per minute at proposed well locations, and an initially proposed withdrawal rate of 1,300 liters (350 gallons) per minute at one proposed well location (Cl-1a), would be limited in extent. Analysis results indicate that the radius of influence of the cone of depression created in the aquifer in each case averages approximately 0.64 kilometer (0.4 mile) for the proposed new well locations, with a maximum horizontal distance of approximately 0.97 kilometer (0.6 mile) indicated at one proposed well location. Hydrogeologic effects resulting from use of the proposed new wells for supporting rail line roadbed construction would be temporary in nature. Proposed groundwater withdrawals at a proposed well location Cl-1a in the Clayton Valley hydrographic area (Cl-1a) and at selected proposed well locations in the Oasis Valley hydrographic areas (OV3, OV4, and OV5/13), could, if unmitigated, likely impact existing groundwater users or existing groundwater resources during the construction of a railroad along the Mina rail alignment. Proposed groundwater withdrawals from proposed well CSM-2a in the Columbus Salt Marsh Valley hydrographic area, could, depending on whether a small-discharge rate spring might still exist in the nearby vicinity, impact discharge rates at that spring. One or more specific mitigation measures described earlier in this section, as needed, and if implemented at these locations, would effectively avoid such potential impacts. *Construction and Operations* - Physical impacts to existing groundwater resource features such as existing wells or springs resulting from rail line construction and operations would be small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, potential impacts to groundwater resources from operating the rail line from Wabuska to Yucca Mountain under the Proposed Action would be small.
Ground subsidence	*Construction* - The temporary duration of the vast majority (approximately 87 percent) of the total groundwater withdrawals required for railroad construction indicates that the potential for the proposed groundwater withdrawals to cause subsidence of the ground surface is small. *Operations* - Owing to the very small groundwater withdrawal rates needed to support railroad operations, the potential for the groundwater withdrawals needed to support railroad operations to cause subsidence of the ground surface is small.
Groundwater quality	*Construction and Operations* - The impact to groundwater resources of contaminants that might be released by construction equipment during rail line construction or during rail system operation would be small because of generally deep groundwater depths beneath most of the alignment. *Construction and Operations* - The impact of proposed groundwater withdrawals on groundwater quality would be small to negligible. The proposed withdrawals would not conflict with water-quality standards protecting groundwater resources.

4.3.7 BIOLOGICAL RESOURCES

This section describes potential impacts to biological resources (vegetation, wildlife, special-status species, State of Nevada game species, and wild horses and burros) from constructing and operating the proposed railroad along the Mina rail alignment. Potential impacts are reported and described as either direct or indirect, and either long-term or short-term.

There could be short-term impacts to biological resources in the rail line construction right-of-way during the construction phase. These impacts would be short term because DOE would restore disturbed lands not required for railroad operations with appropriate vegetation immediately after construction was complete.

There would be long-term impacts to biological resources in areas where there would be unavoidable impacts that would result in a change in the natural setting that could last beyond the 50-year operations phase. These areas would include the rail roadbed, along access roads, and in facility and quarry footprints. For biological resources, such impacts are identified for areas of the maximum edge of cut and toe of slope for fill (see Section 2.2.2.5).

Section 4.3.7.1 describes the methods DOE used to assess potential impacts to biological resources; Section 4.3.7.2 describes impacts under the Proposed Action; Section 4.3.7.3 describes impacts under the Shared-Use Option; and Section 4.3.7.4 summarizes impacts. Section 6.2.7 summarizes laws and regulations governing the protection of biological resources. Appendix H provides more detail on the methods DOE used to assess potential impacts to biological resources.

4.3.7.1 Impact Assessment Methodology

For this analysis, DOE calculated potential direct long-term impacts to biological resources based on the footprint of the rail roadbed. The footprint would be within the nominal width of the construction right-of-way, and is the area that would involve clearing of vegetation, excavation, and filling to support the rail line. The width of the footprint would fluctuate along the alignment due to topography, cut and fill requirements, land use, and to avoid or minimize impacts to other resources (such as water and structures). This area would experience direct, long-term impacts.

DOE coordinated with personnel from pertinent federal, state, and local agencies to identify potential impacts to biological resources. Where possible, the Department has quantified potential impacts (such as habitat loss due to construction and operations activities).

Although the Department would minimize the use of the area between the edge of the construction footprint and the outside edge of the construction right-of-way, DOE took a conservative approach and analyzed the short-term impacts to biological resources within this area. This approach overstates impacts as DOE would likely not disturb a large portion of this area.

For facilities that would be outside the nominal width of the construction right-of-way (such as quarries and railroad operations support facilities), the area DOE assessed for potential impacts was the maximum construction footprint of each facility. In order to assess potential impacts, the Department performed a spatial Geographical Information System analysis to compare the footprints of these facilities with biological resources information.

Where possible, this section reports potential impacts to biological resources quantitatively. Potential species-specific impacts are reported qualitatively as either small, moderate, or large, as defined in Section 4.1. DOE estimated impacts based on the amount of change to or loss of the resource from the baseline conditions described in Section 3.3.7, and considered the following criteria for determining the level of change in conditions:

- Direct effects would be-
  - Long-term loss of vegetation (land-cover types)
  - Short-term disturbance to habitat and vegetation
  - Long-term and short-term species displacement or alteration of access to important year-round or seasonal habitat during the construction and operations phases (including watering areas and other key areas)
  - Long-term loss of potential habitat (species-specific land-cover types)
  - Short-term disturbance to habitat and vegetation
  - The risk of trains colliding with wildlife
- Indirect effects would be-
  - Changes in land use that could effect movement patterns and migratory patterns
  - Displacement of species after construction that could add additional stress to other areas and habitat

The assessment of impacts to biological resources considers the potential for continued engineering and site evaluation and planning efforts (see Chapter 2), compliance with applicable requirements (see Chapter 6), and implementation of best management practices (see Chapter 7) to minimize or avoid impacts. This section reports potential direct impacts for the entire rail alignment and specific rail line segments.

DOE expects that there would be small indirect impacts, if any, to biological resources from changes in land use and post-construction displacement, because of the large expanses of land in the area and the types of current uses that tend to be less intrusive than normal development and rural or urban expansion.

DOE concluded from the groundwater impact analysis that project-related groundwater withdrawals would not result in changes to water levels at springs; therefore, there would be no impacts to vegetation, wildlife, special status species, state of Nevada game species, wild horses or burros associated with those springs (see Section 4.2.5, Surface-Water Resources).

4.3.7.1.1 Vegetation

DOE began the assessment of impacts to vegetation resources quantitatively and qualitatively by reviewing available resource data and field surveys. The Department considered the potential direct impacts to land-cover types from railroad construction and operations activities. To assess potential direct impacts from the loss or disturbance of most land-cover types, DOE compared the area of a land-cover type that could be disturbed during the construction and operations phase to the land-cover types present within the affected mapping zones. For ecologically important and relatively uncommon land-cover types within the entire mapping zone, such as ***riparian*** and marsh habitats, DOE compared the area of a land-cover type that would be disturbed (within the construction right-of-way and facilities footprints) to the land-cover type present within the study area, as defined in Section 3.3.7.1.2. The Department used this information to quantitatively estimate the potential loss of habitat and to determine qualitatively whether the loss of habitat would result in a small, moderate, or large impact.

DOE also evaluated potential impacts from noxious or invasive plant species based on the potential for railroad construction or operations activities to introduce or spread noxious or ***invasive species***.

4.3.7.1.2 Wildlife

DOE assessed potential impacts to wildlife communities qualitatively by reviewing the land-cover types that could be affected during railroad construction and operations and identifying the wildlife species likely to be present within those areas. Habitat loss with these communities would be the primary driver of impacts to wildlife and is the focus of this analysis. The Department also evaluated potential impacts from railroad operations on wildlife.

4.3.7.1.3 Special Status Species

DOE assessed potential impacts to special status species (threatened and endangered species; BLM-designated sensitive species; and State of Nevada-designated sensitive and protected species) qualitatively by reviewing the potential for a species to occur within the study area and the region of influence; species habitat that would be affected; and the potential mechanisms for impact. The primary impact would be from the loss of habitat, which is the focus of this analysis. DOE also evaluated impacts from railroad operations on special status species.

4.3.7.1.4 State of Nevada Game Species

DOE assessed potential impacts to State of Nevada Game Species, as defined in Section 3.3.7.2.4, based on the potential for loss of important foraging habitat, the potential for loss of important water sources, the potential displacement of game, and the potential disruption of movement patterns.

4.3.7.1.5 Wild Horses and Burros

DOE assessed potential adverse impacts to wild horses and burros based on the potential for loss of important foraging habitat, the potential for loss of important watering areas, and the potential for impacts to individual ***herd management areas***.

4.3.7.2 Environmental Impacts

This section describes potential impacts to biological resources from construction and operation of a railroad along the Mina rail alignment under the Proposed Action. To minimize redundancy and provide clear and concise reporting of potential impacts, Section 4.3.7.2.1 describes impacts common to all rail line segments and construction and operations support facilities and how each biological resource could be affected. Section 4.3.7.2.2 describes rail line segment- and facility-specific impacts. Tables list the amount of departure from baseline conditions (see Section 3.3.7) based on the indicators described above.

4.3.7.2.1 Environmental Impacts Common to the Entire Mina Rail Alignment

This section describes potential short-term and long-term impacts to each biological resource that could result from rail line construction along the Mina rail alignment.

4.3.7.2.1.1 Vegetation Construction of the rail line and facilities along the Mina rail alignment would directly impact a diverse mix of vegetation communities and land-cover types. Tables 4-214, 4-215, 4-216, and 4-217 list the land-cover types associated with the Mina rail alignment common segments, alternative segments, quarries, and operations support facilities that would be affected during the construction phase. The primary construction-related impacts to vegetation communities during the construction phase would be the physical short-term or long-term removal of vegetation and compaction of the soil.

Table 4-214. Short-term and long-term impacts to land-cover types[a] by common segments (CS).

	Area covered by common segment (square kilometers[b])							
	MCS1		MCS2		CS5		CS6	
Land-cover type[c]	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-specific	0.07	<0.01	0	0	0	0	0	0
Great Basin Pinyon-Juniper Woodland	0	0	0	0	0.01	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0.10	<0.01	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0	0	<0.01	<0.01	0	0
Inter-Mountain Basins Cliff and Canyon	<0.01	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	0.58	0.05	0	0	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	29.11	2.45	0.93	0.06	0	0	0	0
Inter-Mountain Basins Playa	0.60	0.05	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0.56	0.05	0.06	<0.01	0.85	0.04	1.78	0.24
Invasive Annual and Biennial Forbland	0.02	<0.01	0	0	0	0	0	0
Invasive Annual Grassland	<0.01	<0.01	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	1.39	0.09	3.18	0.38
North American Warm Desert Bedrock Cliff and Outcrop	0	0	0	0	0	0	0.05	<0.01
North American Warm Desert Playa	0	0	0	0	<0.01	0	0.02	<0.01
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	2.92	0.23	8.13	1.00
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	5.93	0.44	0.08	<0.01
Totals[d]	31.04	2.61	0.99	0.06	11.10	0.82	13.20	1.63

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.1.
c. The following land-cover types occur within the study area but are not listed above due to no impact on the construct right-of-way: Developed, Open Space - Low Intensity, Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland, Inter-Mountain Basins Montane Sagebrush Steppe, Inter-Mountain Basins Wash, North American Arid West Emergent Marsh.
d. Totals might differ from the sums of values due to rounding.

Table 4-215. Short-term and long-term impacts to land-cover types[a] by alternative segments (page 1 of 2).

Land-cover type	Area covered by alternative segment (square kilometers[b])													
	Schurz alternative segments								Montezuma alternative segments					
	S1		S4		S5		S6		MN1		MN2		MN3	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Barren Lands, Non-specific	0	0	0	0	0	0	0	0	0.19	0.02	<0.01	<0.01	0	0
Developed, Medium - High Intensity	0	0	0	0	0	0	0	0	0	0	0.01	<0.01	0	0
Developed, Open Space - Low Intensity	0	0	0	0	0	0	0	0	0	0	0.03	<0.01	0	0
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	0.01	0	0.01	<0.01	0.02	<0.01	0.02	0	0	0	0	0	0.07	<0.01
Great Basin Pinyon-Juniper Woodland	0	0	0	0	0	0	0	0	0.07	<0.01	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0	0	0	0	1.28	0.18	0.21	0.01	1.17	0.14
Inter-Mountain Basins Active and Stabilized Dune	0.05	0.03	0.03	0.02	0.01	0.01	0.02	0.01	<0.01	0	0.04	0	0.04	0
Inter-Mountain Basins Big Sagebrush Shrubland	0	0	0	0	<0.01	0	<0.01	0	2.71	0.30	1.40	0.16	2.93	0.30
Inter-Mountain Basins Cliff and Canyon	0	0	0	0	0	0	<0.01	0	0	0	0	0	0	0
Inter-Mountain Basins Greasewood Flat	0.42	0.18	0.22	0.08	0.22	0.07	0.21	0.07	0.87	0.06	5.74	0.33	5.74	0.33
Inter-Mountain Basins Mixed Salt Desert Scrub	2.20	1.03	3.02	1.82	4.36	2.17	4.48	2.34	23.28	2.42	1.78	2.29	27.84	2.08
Inter-Mountain Basins Playa	0.02	<0.01	0	0	0	0	<0.01	<0.01	2.86	0.21	0.94	0.07	0.94	0.07
Inter-Mountain Basins Semi-Desert Grassland	0	0	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	0	0	0.03	0.02	0.04	0.02	0.34	0.04	0.46	0.02	0.40	0.03
Invasive Annual and Biennial Forbland	0	0	0	0	<0.01	0	<0.01	0	0	0	0	0	0	0
Invasive Annual Grassland	0	0	0	0	0.03	0	0.03	0	0	0	0	0	0	0
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0	0	0	0	<0.01	<0.01	<0.01	<0.01
Totals[c]	2.70	1.24	3.28	1.93	4.67	2.27	4.80	2.45	31.61	3.33	32.44	2.40	38.93	2.96

Table 4-215. Short-term and long-term impacts to land-cover types[a] by alternative segments (page 2 of 2).

Land-cover type	Area covered by alternative segment (square kilometers[b])							
	Bonnie Claire alternative segments				Oasis Valley alternative segments			
	BC2		BC3		OV1		OV3	
	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Great Basin Pinyon-Juniper Woodland	0	0	0	0	0	0	0	0
Great Basin Xeric Mixed Sagebrush Shrubland	<0.01	0	0	0	0	0	0	0
Inter-Mountain Basins Big Sagebrush Shrubland	0.29	0.02	0.05	<0.01	0	0	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	1.87	0.20	1.70	0.14	0	0	0	0
Inter-Mountain Basins Playa	0	0	<0.01	<0.01	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0.60	0.06	0.94	0.07	0.12	0.02	0.11	0.02
Mojave Mid-Elevation Mixed Desert Scrub	1.79	0.15	1.30	0.13	0.09	0.01	0.02	<0.01
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	0	0	0	0	0	0	0.02	0
North American Warm Desert Playa	0	0	0	0	0.14	0.02	0.04	<0.01
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0.80	0.05	1.51	0.13	2.05	0.22	2.87	0.31
Sonora-Mojave Mixed Salt Desert Scrub	0.30	0.02	0.10	<0.01	0.22	0.03	0.89	0.09
Totals[c]	5.65	0.51	5.59	0.49	2.62	0.31	3.95	0.43

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.1.
c. Totals might differ from sum of values due to rounding.

Table 4-216. Short-term and long-term impacts to land-cover types[a] by quarry.

	Area covered by quarry (square kilometers[b])									
	Garfield Hills		Gabbs Range		North Clayton		ES-7		Malpais Mesa	
Land-cover type	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0.03	0.10	0.13	0.34	0.16	0.14
Inter-Mountain Basins Big Sagebrush Shrubland	<0.01	<0.01	0	0	0.04	0.28	0.14	0.55	0.26	1.16
Inter-Mountain Basins Mixed Salt Desert Scrub	0.39	0.99	0.30	0.66	0.30	0.95	0.04	0.24	0.12	0.73
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	<0.01	<0.01	0.02	0.06	0	0.02	<0.01	0.06
Totals[c]	0.39	0.99	0.30	0.66	0.39	1.39	0.31	1.14	0.54	2.09

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.1.
c. Totals might differ from sum of values due to rounding.

Table 4-217. Short-term and long-term impacts to land-cover types[a] by facility.

	Area covered by facility (square kilometers[b])							
	Hawthorne Staging Yard		Klondike Option Maintenance of Way Facility		Silver Peak Option Maintenance of Way Facility		Rail Equipment Maintenance Yard	
Land-cover Type	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts	Short-term impacts	Long-term impacts
Great Basin Xeric Mixed Sagebrush Shrubland	0	0	0	0	0	0	0	0
Inter-Mountain Basins Active and Stabilized Dune	0	0.03	0	0	<0.01	0	0	0
Inter-Mountain Basins Greasewood Flat	0.01	0.18	0.27	0.03	0.02	<0.01	0	0
Inter-Mountain Basins Mixed Salt Desert Scrub	1.06	1.03	0.34	0.01	0.06	<0.01	0	0
Inter-Mountain Basins Playa	0	<0.01	0	0	0.59	0.05	0	0
Inter-Mountain Basins Semi-Desert Grassland	0	0	0	0	0	0	0	0
Inter-Mountain Basins Semi-Desert Shrub Steppe	0	0	<0.01	0	0	0	0.09	0.04
Mojave Mid-Elevation Mixed Desert Scrub	0	0	0	0	0	0	0.06	0.01
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	0	0	0	0	0	0	0.44	0.24
Sonora-Mojave Mixed Salt Desert Scrub	0	0	0	0	0	0	<0.01	0.01
Totals[c]	1.07	1.24	0.62	0.04	0.68	0.05	0.61	0.30

a. Source: DIRS 174324-NatureServe 2004.
b. To convert square kilometers to acres, multiply by 247.1.
c. Totals might differ from sum of values due to rounding.

Areas where there could be short-term impacts to vegetation include the area from the outer edge of the construction right-of-way to the toe of slope of the rail roadbed, construction camps, and material lay-down areas. Disturbance to vegetation associated with these areas would result in relatively small impacts compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. Impacts in the area between the outer edge of the roadbed footprint and the outer edge of the construction right-of-way would be short-term because DOE would implement best management practices. These practices would minimize disturbance and promote effective restoration efforts, including stockpiling and replacing topsoil, reseeding of native species, monitoring for success, and in most cases the eventual return of a native vegetation community.

Areas where there could be long-term impacts include the rail line construction right-of-way and the footprints of facilities. The amount of vegetation loss under the rail line and facility footprints would be relatively small compared to the amount of available specific land-cover types within the Great Basin and Mojave Deserts. The removal of vegetation for the rail line would be linear and for part of its length, would be adjacent to an existing state highway and other roadways. Therefore, impacts related to fragmentation of vegetation communities would be relatively small and would not be expected to disrupt the dispersal of seeds across the rail bed.

Clearing vegetation and disturbing soil during construction activities could create habitat suitable for potential colonization by ***noxious weeds*** and invasive plant species. In addition, linear disturbances such as the rail line and access roads that cross relatively undisturbed regions have the potential to increase the spread of noxious weeds and invasive plant species, with the increase in traffic or human activity. If noxious weeds and invasive species were to become established along the rail alignment, they could spread to adjacent areas and affect intact plant communities beyond the initial area of disturbance.

DOE would implement best management practices during and after the construction phase to prevent the establishment of noxious weeds and invasive species. Such practices would include limiting the grading of surfaces and surface disturbance to the immediate area of construction; planting stockpiles of topsoil retained for more than a year; establishing staging areas in previously disturbed areas when practicable; applying approved herbicides; and revegetating disturbed areas not needed for the operations phase (see Chapter 7). As a result, potential impacts from the spread of noxious weeds and invasive species would be minimized or avoided, and would be small.

Additionally, the watering of land surfaces during construction activities for such purposes as soil stabilization, ballast cleaning, vehicle washing, and dust suppression could encourage the growth of noxious weeds and invasive species. However, watering would primarily occur on road surfaces where weeds would not become established. DOE would implement best management practices to limit the watering of land surfaces to the extent practicable (see Chapter 7). Short-term impacts from introduction and spread of noxious weeds and invasive species would be very small during the construction phase; long-term impacts would be small over the entire length of the rail alignment.

4.3.7.2.1.2 Wildlife. Potential impacts to wildlife during the construction phase would consist of the loss of suitable habitat (land-cover types), disturbance to habitat, displacement of or limited access to important year-round or seasonal habitat during the construction phase, change in movement patterns, and the potential increase in the risk of wildlife collisions with vehicles along access roads. Reduced vegetation could limit forage for wildlife, such as big game or bird species, and could reduce or limit habitat for ground dwelling mammals in the area. These impacts are reported as direct short- or long-term losses of land-cover types or habitat. To reduce redundancy, direct impacts from habitat disturbance and displacement and changes in wildlife movement and potential collisions with trains and automobiles are described in segment- and facility-specific sections. Wildlife collisions with trains would be minimal over most of the alignment due to the amount of sight distance, low speeds of trains, and area for escape beside the tracks.

Wildlife species that use underground habitats and were present within the construction right-of-way could be crushed or smothered during rail line construction. However, DOE would implement best management practices (such as conducting clearance surveys for the presence of sensitive species and their habitat) before and during the construction phase to minimize adverse impacts to wildlife. The more mobile wildlife species, such as kit fox, badgers, mountain lions, and rabbits would be less likely to incur mortality, as they would be able to avoid the construction area, resulting in a short-term impact to these species due displacement or avoidance of the area.

Cuts into steep hillsides, depending on design, could encourage wildlife to congregate in the cut areas, resulting in a potential increase of collision with trains and possible fatalities. Access roads adjacent to the rail line would allow animals to move off the tracks to avoid oncoming trains. Therefore, the potential for mortality of animals congregating in cut areas would be small. Additionally, sight distance and the slow speeds of the trains would help minimize potential collisions. Cuts would also have the potential to slightly disrupt movement patterns of some wildlife species. However, this impact would be small because animals would be able to travel around cuts to move up or down the hillsides.

Construction of additional access roads and the improvement of existing access roads could increase traffic during the construction phase and in the short term could increase wildlife fatality from vehicle collisions and potentially disturb wildlife habitat from the increase in off-road vehicle traffic. However, the degree and magnitude of impacts would be species-specific and would depend on the existing habitat range of the species.

The generation of solid waste at construction camps could increase the occurrence of coyotes and ravens, indirectly increasing the death rate of the prey of these two species. As part of the worker education program, all personnel would be trained on the proper way to dispose of waste. Therefore, this potential indirect impact would be small.

Draw-down of ground-fed springs and seeps and the consequent reduction in associated riparian habitat due to the use of groundwater during construction activities, could indirectly impact wildlife species that depend on riparian habitat. However, DOE has proposed the placement of wells such that there should be no impact to groundwater from the use of the wells during the construction phase. (See Sections 3.3.6 and 4.3.6, Groundwater Resources, for the analysis of wells and groundwater use.) There could be impacts to aquatic species in streams and springs in the construction area due to sedimentation and erosion, but such impacts would be small because DOE would implement best management practices to prevent sedimentation and erosion throughout the construction phase (see Chapter 7).

The Migratory Bird Treaty Act (16 U.S.C. 703 through 712) protects migratory birds, their eggs, and occupied nests, but it does not protect their habitat. Therefore, long-term impacts to migratory bird species as a result of the proposed project could result from loss of suitable nesting and foraging habitat where large amounts of vegetation (for example, junipers and pinyon pines) are removed or where rock outcrops or cliffs are disturbed for construction purposes (see Appendix H, Table H-4 for a list of all bird species that could occur in construction right-of-way). Short-term impacts could include birds avoiding the area during construction activities. However, to avoid or minimize adverse impacts to migratory birds during the construction phase, DOE would implement best management practices, including minimizing groundbreaking activities in nesting habitat during the critical nesting period, which the BLM defines as May 1 through July 15 (see Chapter 7). If groundbreaking or land-clearing activities had to be conducted during the bird nesting season, DOE would conduct surveys for the nests of migratory bird before beginning those activities. All activities that would harm nesting birds or result in nest abandonment would be prohibited.

4.3.7.2.1.3 Special Status Species. A review of the Nevada Natural Heritage Program database for the 16-kilometer (10-mile)-wide study area, which extends 8 kilometers (5 miles) on either side of the centerline of the rail alignment (see Section 3.3.7.1.2), documented 54 special status species that have the potential to occur within the study area. Potential impacts to special status wildlife species would include loss of and disturbance to potential foraging and nesting habitat, avoidance of the area that could change movement patterns, and disturbance from the increase of noise.

The loggerhead shrike is known to occur along the entire Mina rail alignment where suitable habitat is present. There could be small, short-term impacts this species from increased human activity and noise during construction of sidings along existing rail line and construction of new rail line. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

The western burrowing owl potentially occurs along the entire Mina rail alignment where suitable habitat is present. There could be small, short-term impacts to this species from increased human activity and noise during construction of sidings along existing rail line and construction of new rail line. Burrowing owls occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

It is possible that some individual cacti and yucca plants would be removed during the construction phase, resulting in a small impact to individual plants. However, construction activities would not threaten cacti or yucca populations.

4.3.7.2.1.4 State of Nevada Game Species. The rail line would cross areas recognized by the BLM and the Nevada Department of Wildlife as habitat for game species (see Figures 3-215 through 3-218). Direct impacts to game species during rail line construction would include loss of foraging habitat, disturbance from noise, potential fatality from collisions with trains, and a short-term avoidance of year-round or seasonal habitat, migratory corridors and water sources during construction activities. Because of the relatively low density of game animals in the study area, their mobility, and the presence of humans and machines, such impacts would be small. Potential impacts to game species would be greatest in the areas under active construction. After sections of the rail line were completed, potential impacts would be related to trains crossing the area to move workers and materials to active construction locations. It is possible that individual game animals could collide with moving trains and be injured or killed. However, the likelihood of such collisions would be low, because most game animals would likely avoid oncoming trains whenever possible.

During rail line construction there would be a potential for short-term impacts from the potential for disruption of movement patterns of game species within an area or along migratory corridors, which could disturb individuals or groups of animals and cause animals to avoid the construction areas. Game species are large, mobile animals and would be able to avoid contact with humans at construction sites and would likely move temporarily to other areas during construction activities. These changes in movement or habitat-use patterns would affect relatively low numbers of individuals at any one time; therefore, changes in utilization of the water or forage resources in the region would be small.

There could be direct impacts to the various game populations if animals avoid water sources close to construction activities. Water sources are found only along certain portions of the Mina rail alignment and there could be small, short-term impacts to individuals and groups of animals if they are unable to reach those water sources. There would be no impact on the overall populations of State of Nevada game species due to avoidance of adjacent water resources during construction. Other potential impacts to State of Nevada game species would be similar to those described for wildlife, and would be small.

4.3.7.2.1.5 Wild Horses and Burros. This section identifies the magnitude of potential adverse impacts to wild horses and burros due to potential displacement and loss of their habitat or vegetation for grazing.

Construction activities within herd management areas would result in a long-term loss of forage, potential for collisions with trains, the short-term loss of year-round or seasonal habitat, and the potential to disrupt wild horse and burro movement patterns. Appendix H describes specific herd management areas that could be affected during the construction phase.

The removal of vegetation during the construction phase would result in a long-term loss of potential forage for wild horses and burros. However, the amount of vegetation permanently removed in the rail line, facility, and quarry footprints would be relatively small compared to the available forage within the affected herd management area. Vegetation removal would likely result in an overall small impact to the associated herd management area. Tables in segment- and facility-specific sections list the potential loss of forage due to construction of the proposed railroad.

The potential changes in movement or habitat-use patterns would affect relatively low numbers of individuals at any one time due to the localized nature of the construction; therefore, changes in utilization of the water or forage resources in the region would be small. Generally, wild horses and burros avoid contact with humans and therefore would likely move temporarily to other areas during construction activities. DOE would also minimize impacts to herd management areas by fencing off temporary ponds or reservoirs that are used during construction activities to prevent herds from utilizing those water sources, which could otherwise change herd movement patterns. The loss of potential forage and habitat and the temporary short-term loss of access due to construction activities and noise would be similar for each affected herd management area.

4.3.7.2.2 Segment-Specific Construction Impacts

Sections 4.3.7.2.2.1 through 4.3.7.2.2.18 describe potential short- and long-term direct impacts to biological resources from the construction of specific alternative segments and common segments, quarries, and facilities along the Mina rail alignment. The discussion in Section 4.3.7.2.1 for the impacts to biological resources common to all of the segments is not repeated. Rather, tables provide information necessary to report direct impacts to the specific biological resources associated with each alternative segment, common segment, quarry, and facility. Where DOE would utilize existing rail lines, a brief discussion of the impacts is provided; any operations impacts are reported in Section 4.3.7.2.3.

4.3.7.2.2.1 Union Pacific Hazen Branchline (Hazen to Wabuska), Existing Rail. DOE would not perform any ground-disturbing activities along this portion of the Mina rail alignment. Therefore, there would be no construction-related impacts to biological resources along this existing rail line. (See Section 4.3.7.2.3 for a description of potential impacts during the operations phase.)

4**.3.7.2.2.2 Department of Defense Branchline North (Wabuska to the Boundary of the Walker River Paiute Reservation), Existing Rail Line.** This segment is an existing rail line that connects to the Union Pacific Railroad Hazen Branchline just east of Wabuska and would connect to one of the Schurz alternative segments near the Walker River. DOE would construct a siding within the construction right-of-way of this existing rail line, which would result in some small short-term construction-related impacts.

<u>Special Status Species</u>

Threatened and Endangered Species: There are no federally threatened, endangered, candidate or proposed species known to occur within the study area of the Department of Defense Branchline North, therefore there would be no impact.

BLM- and State of Nevada-designated Sensitive/Protected Species: There are no species that are known to occur within the study area of the Department of Defense Branchline South, except the loggerhead shrike and western burrowing owl which potentially occur within the study area of the entire Mina rail alignment. These potential impacts would be small and short-term due to avoidance of the area during construction of the siding; however, the area has been previously disturbed and these species do not likely nest within the footprint of the siding, therefore there would be no loss of habitat.

State of Nevada Game Species The existing rail line occurs within designated yearlong habitat for both mule deer and pronghorn antelope. Potential impacts would be small and short-term due to temporary avoidance of the area during the construction of the siding. Any potential impacts from operation of the rail line are discussed in Section 4.3.7.2.3.

Wild Horses and Burros There are no designated herd management areas that occur within the study area of the Department of Defense Branchline North. Therefore, there would be no impacts on wild horse and burros as a result of construction of the siding.

Table 4-218 summarizes potential impacts to biological resources that have the potential to occur within or near the existing Department of Defense Branchline North. Section 4.3.7.2.3 describes potential impacts during the operations phase.

Table 4-218. Summary of potential impacts to biological resources from constructing a siding along Department of Defense Branchline North.

Resource/impact type	Extent of impact
Wildlife	
Noise and human activity	Small impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact due to avoidance
Western burrowing owl (*Athenes cunicularia*)	Small impact due to avoidance
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	No impact

4.3.7.2.2.3 Schurz Alternative Segments, Rail Line Construction.

Vegetation The Schurz alternative segments, located primarily on the Walker River Paiute Reservation, would pass through several land-cover types. The dominant land-cover type that would be affected along all the Schurz alternative segments would be Inter-Mountain Basins Mixed Salt Desert Scrub, followed by Inter-Mountain Basins Greasewood Flat. Playas and sand dunes are common in this area, and some would likely be affected by the Schurz alternative segments. Sites of this type, depending on annual precipitation levels, support special status plants such as the Dune sunflower, oryctes, and Wassuk beardtongue. However, the areas through which the alternative segments would pass are disturbed and occupied (in some areas dominated) by noxious and invasive weeds such as halogeton *(Halogeton glomeratus),* Russian thistle *(Salsola kali),* and cheatgrass *(Bromus tectorum*). The extent of noxious and invasive weed colonizations in these areas makes it unlikely that special plant species would be present.

However, potential suitable habitat for special status plant species could be affected during construction along any of the Schurz alternative segments.

Schurz alternative segment 1 would result in a long-term impact to 1.03 square kilometers (254 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.18 square kilometer (44 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). The overall impact from the loss of this vegetation would be small because these are the predominant land-cover types and are abundant in the region.

Schurz alternative segment 4 would result in a long-term impact to 1.82 square kilometer (450 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.08 square kilometer (20 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). The impact from the loss of this vegetation would be small because these are the predominant land-cover types and are abundant in the region.

Schurz alternative segment 5 would pass on the south side of the Terrill Mountains and to the north of the Calico Hills through a narrow valley. There would be a long-term impact to 2.17 square kilometers (536 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.07 square kilometer (17 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). This would result in an overall small impact, if any, to the land-cover types given the current condition of the affected vegetative communities and the relatively small percentage of these land-cover types that would be affected within the Nellis mapping zone.

Schurz alternative segment 6 would result in a long-term impact to 2.34 square kilometers (578 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.07 square kilometer (17 acres) of Inter-Mountain Basins Greasewood Flat (see Table 4-215). This alternative segment would pass on the northwest side of the Terrill Mountains, which also supports some scattered patches of winterfat communities. Potential impact from the loss of this vegetation would be small to moderate due to the quality and value of the plant communities in that area.

Schurz alternative segments 1, 4, 5, 6, and a bridge over the Walker River could affect riparian and wetland vegetation communities. Schurz alternative segments 1 and 4 would run parallel to the Walker River for about 10 kilometers (6 miles) and would cause a long-term impact to less than 0.01 square kilometer (about 0.31 acre) of Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland and would temporarily impact another 0.03 kilometers (6.4 acres [see Table 4-215]). DOE would use best management practices, comply with the requirements of the Clean Water Act, and reduce the construction footprint to as little as 8 to 20 meters (6 to 65 feet) within identified wetlands to minimize adverse impacts to riparian habitat. Rail line construction would not alter the natural flow or stream channel of the Walker River.

Wildlife Because of the potential impacts to riparian and wetland habitats described above, Schurz alternative segments 1 and 4 could result in direct impacts to various wildlife populations if wildlife avoided riparian or aquatic habitats close to construction activities. Most of the impact would be short-term (see Table 4-215) because construction would not alter the natural flow or stream channel characteristics of the Walker River. These potential impacts would be small. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2.

Special Status Species

Threatened and Endangered Species: The Lahontan cutthroat trout has been documented in the Walker River downstream of the Weber Dam and in areas outside the rail line construction right-of-way. The species has been absent from areas upstream from the dam because it obstructs their seasonal migration. There is suitable habitat for Lahontan cutthroat trout upstream of the Weber Dam, which would be within the construction right-of-way for all of the Schurz alternative segments where they would cross the

Walker River. However, the species has been absent from this area for years because the dam obstructs upstream seasonal migration. Weber Dam is currently being renovated and will include a fish ladder that will enable Lahontan cutthroat trout to migrate north of the dam. Should this species return to the area upstream of the Weber Dam, there would be direct impacts to this threatened fish as a result of bridge construction across the Walker River. Short-term impacts would include pile-driving, the presence of timber mats in parts of the stream, and in-water work. This would cause turbidity and sedimentation downstream where potential Lahontan trout would migrate if the new fish ladder was in operation. DOE would apply appropriate best management practices and timing restrictions to minimize impacts to any Lahontan trout during bridge construction. These impacts would be small and short-term, and Lahontan cutthroat trout would be expected to recover within 3 years after the end of construction activities.

There is potential marginal foraging and roosting habitat for the southwestern willow flycatcher within the construction right-of-way along Schurz alternative segments 1 and 4 where they would parallel the Walker River. No occurrences of this species have been documented within the study area for these segments, but there is marginal habitat within the construction right-of-way. There would be direct impacts to the willow flycatcher due to the restriction of the habitat. There could be direct impacts in the form of noise disturbances to transient southwestern willow flycatchers during construction activities if the birds used habitat within the vicinity of active construction areas. Any noise disturbance impacts would be small given that there are no recorded occurrences for the southwestern willow flycatcher within the construction right-of-way for any of the Schurz alternative segments.

Habitat for the western yellow-billed cuckoo, a ***candidate species***, is similar to the habitat of the southwestern willow flycatcher. Potentially suitable habitat for this species is present along Schurz alternative segments 1 and 4 where they would parallel the Walker River. However, there are no documented occurrences of the western yellow-billed cuckoo within the construction right-of-way for any of the Schurz alternative segments. Therefore, there would be no direct impacts to the western yellow-billed cuckoo due to the destruction of habitat. There could be direct impacts in the form of noise disturbances to migratory western yellow-billed cuckoos during construction activities if the birds used habitat in the vicinity of active construction areas. However, these impacts would be small given that there are no recorded occurrences of the western yellow-billed cuckoo within the construction right-of-way for any of the Schurz alternative segments.

Potentially suitable nesting or winter roosting habitat for the bald eagle is present within the study area for Schurz alternative segments 1 and 4 where they would parallel the Walker River. However, there are no documented nest sites within the construction right-of-way of the Schurz alternative segments. Areas up and down river of Weber Dam, which is approximately 0.8 kilometer (0.5 mile) west of the Schurz alternative segments, have been reported to provide winter habitat for this species (DIRS 182302-Miller Ecological Consultants 2005, p. 3-35). If wintering or migrating eagles were in the area during construction activities, increased noise and human activity would likely deter them from using the area or would cause them to leave the area of disturbance. Any noise impacts are expected to be small and short-term, and would not affect the population of bald eagles in Nevada because this species does not nest or roost in the study area.

BLM- and State of Nevada-designated Sensitive/Protected Species: The western burrowing owl potentially occurs along the entire Mina rail alignment where suitable habitat is present. However, no burrowing owl nests have been documented within the study area. Potential impacts to this species from construction of the Schurz alternative segments would result from burrows used by nesting owls being covered over or collapsing during rail line construction. Burrowing owls occupy a wide range of habitat; therefore, any potential impact would be small and short-term.

White-faced ibis have been observed in the study area of Schurz alternative segments 1 and 4 below the Weber Dam on the Walker River. There could be direct impacts in the form of noise disturbances to white-faced ibis during construction activities if the birds used habitat in the vicinity during these activities. However, these impacts would be small given that there are no recorded occurrences of the ibis within the construction right-of-way for any of the Schurz alternative segments.

Swainson's hawks have been reported flying and roosting in the area around Weber Reservoir and Weber Dam (DIRS 182302-Miller Ecological Consultants 2005, p. 3-31) outside of the construction right-of-way of the Schurz alternative segments. No evidence of nesting was reported. There could be direct impacts in the form of noise disturbances to Swainson's hawks during construction activities if the birds used habitat in the vicinity of active construction areas. However, these impacts would be small and short-term given that this species would only be present as a transient and there are no recorded occurrences of the Swainson's hawk within the construction right-of-way for any of the Schurz alternative segments.

The loggerhead shrike is known to occur along the entire Mina rail alignment where suitable habitat is present. However, nest sites for this species have not been documented within the study area or construction right-of-way of the Schurz alternative segments. There could be direct impacts to this species as a result of increased noise and human activity or long-term removal of suitable habitat during construction of the Schurz alternative segments. These impacts would be small and short-term. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

The river otter might occur in the Walker River or Weber Reservoir. There could be direct impacts to this species as a result of increased noise and human activity during rail line construction. These impacts would be small and short-term given that there are no reported occurrences of this species in the construction right-of-way and DOE does not expect to alter aquatic habitats.

There could be potential impacts to several bat species, listed in Table 3-133, during rail line construction as a result of a temporary increase of noise and human activity. However, these impacts would be small and short-term. No bats have been documented roosting within the construction right-of-way of the Schurz alternative segments.

Wassuk beardtongue has been observed on the east side of the Wassuk Range; but the Walker River and U.S. Highway 95 would be between the rail line and this population; thus, there would be no impact on this species population.

The nearest population of Orcytes is approximately 1.4 kilometers (0.8 mile) east of the southern terminus of Department of Defense Branchline South; there would be a small impact, if any, to this species population due to the potential loss of individual plants and suitable habitat during construction.

The dune sunflower has been observed 1.8 kilometers (1.1 miles) north of Schurz alternative segment 6, near U.S. Highway 95. However, impacts to suitable habitat would not be likely; therefore, there would be no impact on this species as result of construction of Schurz alternative segment 6. There is a documented occurrence of the dune sunflower about 0.8 kilometer (0.5 mile) from Schurz alternative segment 1. Potential habitat could be adversely affected, resulting in a small impact from construction of Schurz alternative segment 1; however, there would likely be no impact to occupied habitat.

There is potential habitat for Cima milkvetch in the Calico Hills and Terrill Mountains. This species typically occurs on slopes. Because the rail line would be constructed in the valley, impacts to this species would not be likely.

State of Nevada Game Species The Schurz alternative segments would not cross any documented game habitat.

Wild Horses and Burros The Horse Mountain Herd Management Area would be north of and adjacent to Schurz alternative segment 6. There are currently no wild horses or burros within this Herd Management Area due to recent modifications in the primary water source once used by herds (DIRS 181843-Axtell 2007, all). Therefore, there would be no impacts to wild horse and burros.

Table 4-219 summarizes potential impacts to biological resources that have the potential to occur within or near the Schurz alternative segments. Section 4.3.7.2 describes impacts during the railroad operations phase.

4.3.7.2.2.4 Department of Defense Branchline South (end of Schurz Alternative Segments to Mina Common Segment 1). This existing rail line would connect the Schurz alternative segments with Mina common segment 1. DOE would construct a siding along this existing branchline within the existing right-of-way, which would result in some small short-term construction-related impacts. However, most impacts would be a result of railroad operations and are described in Section 4.3.7.2.3.

Vegetation There would be no construction impacts to vegetation associated with this existing rail line. Operations impacts are described in Section 4.3.7.2.3.1.

Wildlife There would be direct impacts to various wildlife populations if wildlife avoided the area close to construction activities. These potential impacts would be small and short-term, because the area has been previously disturbed and the surrounding habitat provides habitat primarily for a suite of disturbance-tolerant species. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2. Operations impacts are described in Section 4.3.7.2.3.2.

Special Status Species There would be no construction impacts to special status plants, because none are documented to occur in the construction right-of-way.

Threatened and Endangered Species There are no documented occurrences of federally listed plants or wildlife within the construction right-of-way; therefore, there would be no impacts to listed species within or near Department of Defense Branchline South.

BLM- and State of Nevada-Designated Sensitive and Protected Species The loggerhead shrike is known to occur along the entire Mina rail alignment where suitable habitat is present. Potential impacts to this species from the construction of a siding along this branchline would be small and short-term due to noise and the increase in human activity during construction. However, loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impacts to the population or viability of this species.

The western burrowing owl potentially occurs along the entire Mina rail alignment where suitable habitat is present. Potential impacts to this species from the construction of a siding along this branchline would be small and short-term due to noise and the increase in human activity during construction. However, burrowing owls occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

Oryctes has previously been found 1.39 kilometers (0.86 mile) from the existing rail line; however, there were no observations of this species during the 2006 survey. No other BLM- or State of Nevada-designated species are documented to occur within the area. There would be no impact to this species as a result of construction of the siding. Any potential impacts to oryctes along Department of Defense Branchline South would occur from operation of the rail line (see Section 4.3.7.2.3.1).

Table 4-219. Summary of potential impacts to biological resources from rail line construction along the Schurz alternative segments.

Resource/impact type	Extent of impact, Schurz 1	Extent of impact, Schurz 4	Extent of impact, Schurz 5	Extent of impact, Schurz 6
Wildlife				
Loss of vegetation or land-cover type (long-term)	1.24 square kilometers[a]	1.92 square kilometers	2.27 square kilometers	2.45 square kilometers
Construction related disturbance vegetation or land cover type (short-term)	2.41	4.84 square kilometers	4.10 square kilometers	4.52 square kilometers
Loss of riparian and water related habitats (long-term)[b]	<0.01 square kilometer	<0.01 square kilometer	0	0
Construction related disturbance to riparian habitats (short-term)[b]	0.01 square kilometer	0.01 square kilometer	0.02 square kilometer	0.01 square kilometer
Wildlife water resources	Small impact	No impact	Small impact	No impact
Special status species				
Threatened and endangered species and habitat				
Lahontan cutthroat trout *(Onchorhynchus clarki henshawi)*	Potential for a small impact	Potential for a small impact	Potential for a small impact	Potential for a small impact
Southwestern willow flycatcher (*Empidonax traillii extimus*)	Small impact	Small impact	Small impact	Small impact
Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*)	Small impact	Small impact	Small impact	Small impact
BLM- and State of Nevada-designated sensitive/protected				
Bald eagle	No impact	No impact	No impact	No impact
River otter *(Lontra canadensis)*	No impact	No impact	No impact	No impact
Bat species (see Table 3-133)	Small impact	Small impact	Small impact	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact	Small impact	Small impact	Small impact
Swainson's hawk (Buteo swainsoni)	Small impact	Small impact	Small impact	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact	Small impact	Small impact	Small impact
Cima milkvetch *(Astragalus cimae* var. *cimae)*	No impact	No impact	No impact	No impact
Dune sunflower *(Helianthus deserticola)*	Small impact	No impact	No impact	No impact
Oryctes *(Oryctes nevadensis)*	Small impact	Small impact	Small impact	No impact
Wassuk beardtongue *(Penstemon rubicundus)*	No impact	No Impact	No Impact	No Impact
State of Nevada game species	No designated game habitat within study area.			
Wild horses and burros	No impact	No impact	No impact	No impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined; < = less than.

State of Nevada Game Species There would be direct impacts to pronghorn antelope and mule deer if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short-term. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros There are no designated herd management areas adjacent to or intersecting Department of Defense Branchline South. Therefore, there would be no impacts to wild horses and burros associated with construction of a siding along this existing rail line.

Table 4-220 summarizes potential impacts to biological resources that have the potential to occur within or near the existing Department of Defense Branchline North.

4.3.7.2.2.5 Hawthorne Staging Yard, Facility Construction.

Vegetation Construction of the Staging Yard at Hawthorne would not result in any long-term impacts to vegetation. There would be a short-term impact to 2.2 square kilometers (544 acres) of Inter Mountain Basins Mixed Salt Desert Scrub and a long-term loss of 1.0 square kilometer (254 acres) of Inter Mountain Basins Mixed Salt Desert Scrub. The overall impact would be small because most of the land where DOE would construct the Staging Yard is currently disturbed.

Wildlife There would be direct impacts to various wildlife populations if wildlife avoided the area close to construction activities due to temporarily increased noise and human activity or the long-term loss of 1.0 square kilometer (254 acres) of salt desert scrub habitat. These potential impacts would be small and short-term, because the area has been previously disturbed and likely supports a disturbance-tolerant wildlife community. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2. Operations impacts are described in Section 4.3.7.2.3.2.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no impacts to listed species within or near the Hawthorne Staging Yard.

Table 4-220. Summary of potential impacts to biological resources from constructing a siding along Department of Defense Branchline South.

Resource/impact type	Extent of impact
Wildlife	
Noise and human activity	Small impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact due to avoidance
Western burrowing owl (*Athenes cunicularia*)	Small impact due to avoidance
Oryctes *(Oryctes nevadensis)*	No impact
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	No impact

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potential impacts to loggerhead shrike and the western burrowing owl would be small and short-term due to the loss of potential habitat and potential displacement. Potential occupied and suitable habitat for oryctes could be affected as a result of constructing the Staging Yard. There are no other documented occurrences of BLM- or State of Nevada-designated sensitive or protected species.

State of Nevada Game Species There would be direct impacts to pronghorn antelope if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short-term. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros There are no designated herd management areas at or near the proposed Staging Yard location; therefore, there would be no impact to wild horses and burros.

Table 4-221 summarizes potential impacts to biological resources that have the potential to occur within or near the proposed Staging Yard location at Hawthorne.

4.3.7.2.2.6 Mina Common Segment 1, Rail Line Construction.

Vegetation Mina common segment 1 would result in a long-term impact to 2.45 square kilometers (605 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. This land-cover type is typical of sandy and alkaline soils and is common throughout the Nellis mapping zone. A small amount of Inter-Mountain Basins Greasewood Flat (0.05 square kilometer [12 acres]) and Inter-Mountain Basins Semi-Desert Shrub Steppe vegetation (0.05 square kilometer) would also be affected in the long term. The proposed rail line would parallel U.S. Highway 95 and would be constructed on top of an historic rail roadbed in some areas. Overall impacts to the existing land-cover types would be small because the highway corridor currently fragments the vegetation, and DOE would reduce impacts to vegetation by utilizing the existing historic rail roadbed.

Mina common segment 1 would pass through Soda Spring Valley, which supports wetlands identified by the National Wetlands Inventory dataset, including the Alkali Flat and Soda Spring Valley playas. However, DOE field surveys did not identify these as wetlands. This area supports three separate locations of the Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland land-cover type. It is highly unlikely that these land-cover types would be affected by rail line construction along Mina common segment 1, because they are not present within the construction right-of-way. Any potential impact to the associated playas would be short-term and occur within the ephemeral washes. DOE would minimize such impacts by incorporating appropriate drainage structures into the engineering design.

Wildlife Construction of Mina common segment 1 would create a long-term impact to 2.61 square kilometers (645 acres) of potential wildlife habitat, predominantly Inter-Mountain Basins Mixed Salt Desert Scrub land-cover type. However, much of the vegetation within this area is already disturbed. The disturbed habitat is of relatively low value to wildlife because it parallels U.S. 95 and lies adjacent to the Hawthorne Army Depot. Because species that use this habitat are likely disturbance-tolerant, impacts to wildlife from construction of Mina common segment 1 would be small, but long-term. The aquatic habitat at Soda Spring is of relatively high value because water is scarce in this part of the study area. Impacts to this habitat are expected to be moderate and long-term.

Special Status Species

Threatened and Endangered Species: The Railroad Valley spring fish, a ***threatened species***, has been documented to occur within the springs near Sodaville (Figure 3-213). However, the spring does not

Table 4-221. Summary of potential impacts to biological resources from construction of the Staging Yard at Hawthorne.

Resource/impact type	Extent of impacts
Wildlife	
Loss of vegetation or land cover type (long-term)	0.27 square kilometers[a]
Construction related disturbance vegetation or land cover type (short-term)	1.07 square kilometers
Loss of riparian and water related habitats (long-term)[b]	0
Construction related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Oryctes *(Oryctes nevadensis)*	Small impact to suitable habitat
State of Nevada game species	
Pronghorn antelope	Small impact
Wild horses and burros	No impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands/seeps/streams/and riparian combined.

occur within the construction right-of-way, therefore, there would be no impact on this species as a result of construction of Mina common segment 1.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Common loons have been documented to occur on Walker Lake (DIRS 182302-Miller Ecological Consultants 2005 p. 3-32). Large numbers of loons stop at Walker Lake during the spring and fall migration (DIRS 182895-Boise State University 2007). Construction activities would not impact Walker Lake; therefore, there would be no impacts to common loons.

The Western snowy plover has been documented to occur within the study area near Walker Lake and the Hawthorne Army Depot. Because of the lack of specificity of some Nevada Natural Heritage Program data, it is not clear how close this observation was to the Mina common segment 1 construction right-of-way, but it might have been in the construction right-of-way or as far away as 2.8 kilometers (1.75 miles). This species is not federally listed in this part of its range. There could be direct impacts to the western snowy plover due to the destruction of habitat or the short-term increase of noise and human activity during construction if the birds used habitat in the vicinity during these activities. These impacts could be small and short-term to long-term depending on the level of use by this species in the construction right-of-way.

The western burrowing owl potentially occurs throughout the entire Mina rail alignment where suitable habitat is present. However, no burrowing owl nests have been documented within the study area. Potential impacts to this species from construction of Mina common segment 1 would result from burrows used by nesting owls being covered over or collapsing during rail line construction. Burrowing owls occupy a wide range of habitat. Therefore, there would be no long-term impacts to the population or viability of this species.

White-faced ibis likely occur at Walker Lake in Mina common segment 1 study area, although they have not been documented to breed there. There could be direct impacts in the form of noise disturbances to white-faced ibis during construction if the birds used habitat in the vicinity during these activities. However, these impacts would be small given that there are no recorded occurrences of the ibis within the construction right-of-way for Mina common segment 1 and construction would have no effect on Walker Lake.

The loggerhead shrike is known to occur throughout the entire Mina rail alignment where suitable habitat is present. Nest sites for this species have not been documented within the Mina common segment 1 study area or construction right-of-way. There could be direct impacts to this species as a result of increased noise and human activity or long-term removal of suitable habitat during rail line construction along Mina common segment 1. These impacts would be small and short-term; 2.61 square kilometers (645 acres) of potentially suitable habitat for this species would be removed. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

There could be potential impacts to several bat species, listed in Table 3-133, during rail line construction as a result of temporarily increased noise and human activity. However, these impacts would be small and short-term. No bats have been documented nesting or roosting within the Mina common segment construction right-of-way.

Tiehm buckwheat has been found in the vicinity of Mina common segment 1. However, it is highly unlikely individuals or any potential habitat for this species would be affected and there would be no impact.

Sodaville milkvetch is known to occur near Sodaville, 2.5 kilometers (1.5 mile) from Mina common segment 1. It is a wetland-dependent species and is likely associated with Soda Spring, which would not be affected by the rail line construction along Mina common segment 1. Therefore, there would be no impacts to this species.

Oryctes has been observed within the Soda Spring Valley north of Mina, 0.5 kilometer (0.3 mile) from Mina common segment 1. Occupied and suitable habitat could be altered or destroyed as a result of rail line construction along Mina common segment 1, resulting in a small impact to the population of this species. The alignment would impact less than 0.01 square kilometer (0.17 acre) of the Inter-Mountain Basins Active and Stabilized Dune land-cover type and would have a small impact on potential habitat for this species. There would be no impact on the viability of the population of this species.

State of Nevada Game Species There would be direct impacts to pronghorn antelope and mule deer if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short-term. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros Mina common segment 1 would run adjacent to the Pilot Mountain Herd Management Area (Figure 3-214). The rail line would not intersect designated wild horse and burro habitat, but the increased human activity during construction could cause herds to avoid the low-elevation areas associated with the proposed alignment. Given that the Pilot Mountain Herd Management Area encompasses about 1,937 square kilometers (477,985 acres), there would be small, if any, short-term impacts due to potential avoidance of the area during construction.

Table 4-222 summarizes the potential impacts to biological resources that have the potential to occur within or near Mina common segment 1.

Table 4-222. Summary of potential impacts to biological resources from construction of Mina common segment 1.

Resource/impact type	Extent of impact, Mina common segment 1
Wildlife	
Loss of vegetation or land cover type (long-term)	2.60 square kilometers[a]
Construction related disturbance vegetation or land cover type (short-term)	31.05 square kilometers
Loss of riparian and water related habitats (long-term)[b].	0
Construction related disturbance to riparian habitats (short-term)[b].	0
Wildlife water resources	Small
Special status species	
Threatened and endangered species and habitat	
Railroad Valley springfish (*Crenichthys nevadae*)	No impact
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Common loon (*Gavia immer*)	No impact
Western snowy plover *(Charadrius alexandrinus nivosus)*	Small impact
White-faced ibis *(Plegadis chihi)*	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
Sodaville milkvetch *(Astragalus lentiginosus var. sesquimetralis)*	No impact
Tiehm buckwheat *(Eriogonum tiehmii)*	No impact
Oryctes (Oryctes nevadensis)	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact
Mule deer	Small impact
Wild horses and burros	Small to no impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands/seeps/streams/and riparian combined.

4.3.7.2.2.7 Garfield Hills Quarry, Quarry Construction.

Vegetation The proposed Garfield Hills quarry would result in a long-term impact to 0.99 square kilometer (245 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. However, this area is sparsely vegetated and the overall impacts on vegetation would be small.

The quarry pit would be constructed within a series of ephemeral washes. There is no riparian vegetation within the washes. However, any ephemeral flows could be altered as a result of construction.

Wildlife Construction of the Garfield Hills quarry would remove approximately 0.99 square kilometer (245 acres) of potential wildlife habitat in the long-term, primarily Inter-Mountain Basins Mixed Salt Desert Scrub and a small percentage of Inter-Mountain Basins Big Sagebrush Shrubland. This habitat is sparsely vegetated and likely supports a disturbance-tolerant suite of wildlife species. Therefore, impacts from development of the quarry would be small, but long-term.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no construction impacts to listed species within or near the proposed Garfield Hills quarry. Operations impacts are described in Section 4.3.7.2.3.3.

BLM Special Status and State of Nevada Protected Species: The western burrowing owl potentially occurs throughout the entire Mina rail alignment where suitable habitat is present. However, no burrowing owl nests have been documented within the study area. Potential impacts to this species from construction of a quarry at Garfield Hills would result from burrows used by nesting owls being covered over or collapsing during quarry construction. Burrowing owls occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

The loggerhead shrike is known to occur throughout the entire Mina rail alignment where suitable habitat is present. However, nest sites for this species have not been documented within the quarry footprint. There could be direct impacts to this species as a result of increased noise and human activity or long-term removal of suitable habitat during construction of a quarry at Garfield Hills. These impacts would be small and short-term because 0.99 square kilometer (244 acres) of potentially suitable habitat for this species would be removed. Loggerhead shrikes occupy a wide range of habitat; therefore, there would be no long-term impact to the population or viability of this species.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of the proposed quarry as a result of temporarily increased noise and human activity, and long-term removal or modification of potential roosting habitat. However, these impacts would be small and short-term. No bats have been documented roosting within the quarry footprint.

There is good potential habitat for Wassuk beardtongue within the series of washes at the potential quarry site. However, the closest recorded occurrence of this species is outside the quarry study area. Therefore, it is unlikely that any individual plants would be affected, and this species has a wide distribution range. Thus there would be no impacts on this species population.

State of Nevada Game Species There would be no impacts to State of Nevada game species, as the Garfield Hills quarry would not cross any documented game habitat.

Wild Horses and Burros The proposed Garfield Hills quarry does not occur within any designated wild horse and burro management area. The closest Herd Management Area is the Garfield Herd Management Area to the south approximately 11 kilometers (7 miles). Therefore there would be no impact to wild horses and burros as a result of the construction and operation of the Garfield Hills Quarry.

Table 4-223 summarizes the potential impacts to biological resources that have the potential to occur within or near the proposed quarry. Operations impacts are discussed in Section 4.3.7.2.3.

Table 4-223. Summary of potential impacts to biological resources from construction of a quarry at Garfield Hills.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long-term)	0.99 square kilometers[a]
Construction-related disturbance vegetation or land-cover type (short-term)	0.39 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
Wassuk beardtongue (*Penstemon rubicundus*)	No impact
State of Nevada Game species	No designated game habitat within study area of quarry
Wild horses and burros	No impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands/seeps/streams/and riparian combined.

4.3.7.2.2.8 Gabbs Range Quarry, Quarry Construction.

Vegetation Construction of the potential Gabbs Range quarry would result in a long-term impact to 0.66 square kilometer (163 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. There are also some scattered patches of winterfat that occur within and surrounding the proposed site. Potential impacts from the loss of a portion of the Inter-Mountain Basins Mixed Salt Desert Scrub land-cover type would be small. However, the loss of any winterfat community could result in a moderate impact because this vegetative cover is uncommon in the Nellis mapping zone and is considered highly valuable for wildlife.

There is no riparian or wetland vegetation present within the study area of the quarry, therefore, there would be no impact on riparian or wetland vegetation as a result of construction of the quarry site.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no construction impacts to listed species within or near the potential Gabbs Range quarry.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potential impacts to loggerhead shrike and western burrowing owl would be the same as those described in previous section for Garfield Hills Quarry.

Potential habitat for the Wassuk beardtongue occurs within and near the proposed quarry site; however, there are no known occurrences in the vicinity. There would be no impact on this species.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of the proposed quarry as a result of a temporary increase of noise and human activity, and long-term removal or modification of potential roosting habitat. However, these impacts would be small and short-term. No bats have been documented roosting within the quarry footprint.

State of Nevada Game Species There would be direct impacts to pronghorn antelope if they avoided the area close to construction activities due to temporarily increased noise and visual disturbances. These potential impacts would be small and short-term because the area has been previously disturbed and provides habitat primarily for a suite of disturbance-tolerant species. Operations impacts are described in Section 4.3.7.2.3.4.

Wild Horses and Burros The potential Gabbs Range quarry site is within the Pilot Mountain Herd Management Area. Any potential impacts to wild horses and burros would be short-term as a result of the increase in human activity in the area, which could cause herds to avoid the area during construction and operations activities. The loss of vegetation from the quarry construction would not be likely affect available forage for herds, given that the Pilot Mountain Herd Management Area is relatively large, encompassing 1,937 square kilometers (477,985 acres) of higher-elevation shrub-steppe. There are several ***wildlife guzzlers*** in the area, but most occur northeast to east of the quarry site. The quarry would not interfere with any potential conduits to and from guzzlers within the herd management area.

Table 4-224 summarizes the impacts to biological resources that have the potential to occur within or near the potential quarry site. Operations impacts are described in Section 4.3.7.2.3.

4.3.7.2.2.9 Montezuma Alternative Segments, Rail Line Construction.

Vegetation Several different land-cover types would be affected as a result of the Montezuma alternative segments (Table 4-215).

Construction of Montezuma alternative segment 1 could result in long-term impacts to 2.42 square kilometers (598 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 0.21 square kilometer (52 acres) of Inter-Mountain Basins Playa, 0.3 square kilometer (74 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, and 0.28 square kilometer (69 acres) of Great Basin xeric Mixed Sagebrush Shrubland (see Table 4-215); resulting in a small impact. This segment would parallel U.S. Highway 265 to Silver Peak, then parallel an alkali lake and existing road, which is surrounded by disturbed lands. Therefore, there would be minimal fragmentation of vegetation across the landscape, which would result in an overall small impact. There are also some patches of winterfat communities within the Montezuma Range (below the pinyon-juniper zone). Potential loss of this community type would result in a moderate impact given its infrequency and high value to wildlife within the Nellis mapping zone.

Construction of Montezuma alternative segment 2 could result in a long-term impact 2.29 square kilometers (566 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 23.58 square kilometers (350 acres) of Inter-Mountain Basins Greasewood Flat, and 0.33 square kilometer (82 acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-215). The overall impact as a result of construction would be small given the amount of these land-cover types within the Nellis mapping zone. This portion of the rail alignment would parallel U.S. Highway 95 and would leave the highway corridor,

Table 4-224. Summary of potential impacts to biological resources from constructing the potential Gabbs Range quarry.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land cover type (long-term)	0.66 square kilometers[a]
Construction related disturbance vegetation or land cover type (short-term)	0.30 square kilometers
Loss of riparian and water related habitats (long-term)[b]	0
Construction related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
Wassuk beardtongue (*Penstemon rubicundus*)	No impact
Greater sage-grouse	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact
Wild horses and burros	Small impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

intersect the Montezuma Valley, and follow an abandoned rail roadbed, which would minimize potential adverse impacts from fragmentation. However, there is a large winterfat community in the Montezuma Valley; therefore, the overall impact from the construction of this segment in this area would be moderate due to the loss of vegetative community type.

Construction of Montezuma alternative segment 3 would create a long-term impact to 2.29 square kilometers (566 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 0.33 square kilometer (82 acres) of Inter-Mountain Basins Greasewood Flat, 0.90 square kilometer (222 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, 0.14 square kilometer (35 acres) of Great Basin xeric Mixed Sagebrush Shrubland, and 2.08 square kilometers (514 acres) of Inter-Mountain Basins Big Sagebrush Shrubland (see Table 4-215). This portion of the rail alignment would parallel U.S. Highway 95 for 35 kilometers (22 miles) and would leave the highway corridor, intersect the Montezuma Valley, and follow an abandoned rail roadbed, which would minimize potential adverse impacts from fragmentation. However, there is a large winterfat community within the Montezuma Valley; therefore, the overall impact from the construction of this segment in this area would be moderate due to the loss of vegetative community type.

There is no riparian or wetland vegetation present within the study area therefore, there would be no impact on riparian or wetland vegetation as a result of construction of Montezuma alternative segments 1, 2, and 3.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate or proposed species known to occur within the study area of the Montezuma alternative alignments. Therefore, there would be no impact as a result of construction of any of the alternative segments.

BLM- and State of Nevada-Designated Sensitive or Protected Species: There is potentially suitable habitat for the pygmy rabbit within the study area of the Montezuma alternative segments including Inter-Mountain Basins Mixed Salt Desert Scrub and Inter-Mountain Basins Big Sagebrush Shrubland land-cover types. However, there are no known occurrences of this species within the study area. Construction of Montezuma alternative segments 1, 3 and 5 would result in a small, long-term impact due to the loss of potentially suitable habitat.

Potential long-term impacts to the pale kangaroo mouse and the dark kangaroo mouse would be small and due to the loss of potential suitable habitat from the construction of the Montezuma alternative segment 1, 2 and 3. Short-term impacts would result from avoidance of the active construction areas due to the temporary increase in noise and human presence in the area.

The ferruginous hawk has been observed near Montezuma alternative segments 2 and 3. Potential impact to this species would be small and short-term due to the increase in noise and human presence during construction. However, there would be no long-term impact because less than 0.01 square kilometer of pinyon-juniper habitat would be removed for construction of Montezuma alternative segment 1.

Potentially suitable habitat for the northern goshawk is present along Montezuma alternative segments 1 and 3 where they would intersect pinyon-juniper habitat. However, this species has not been documented in the study area. Potential impacts would result from removal of potential nesting or roosting habitat (trees) during rail line construction. However, it is likely that there would be no impact considering the amount of pinyon-juniper that would be removed compared to the amount within the area.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of the Montezuma alternative segment 1, 2 and 3, as a result of a temporary increase of noise and human activity and long-term removal or modification of potential roosting or nesting habitat. However, these impacts would be small and short-term. No bats have been documented nesting or roosting within the construction right-of-way; however, there is ample suitable habitat for bats within the study area of all alternative segments and it is highly likely that bats occupy the area.

The long-term loss of Inter-Mountain Basins Big Sagebrush Shrubland and Great Basin Xeric Mixed Sagebrush Shrubland could adversely affect sagebrush dependant species such as Brewer's sparrow and sage thrasher. Overall impact would be small and short-term due to possible displacement, but potential impacts would also be long-term due to the loss of habitat.

Eastwood milkweed has been historically observed west of Tonopah about 8 kilometers (5 miles) from Montezuma alternative segments 2 and 3. It is possible that rail line construction could impact occupied and suitable Eastwood milkweed habitat. This would result in an overall small impact to this species due to reduced suitable habitat, potential loss of individuals, and the reduced opportunity for this species to expand its range.

There is potential habitat for Cima milkvetch within the southeast facing side of the Montezuma Range where there are multi-colored clay hills. Construction of either Montezuma alternative segment 1 or Montezuma alternative segment 3 could result in the loss of some potential habitat; however, there would likely be no impact on this species.

Pahute Mesa beardtongue has been documented within the Montezuma Range 5.5 kilometers (3.4 miles) from Montezuma alternative segments 2 and 3. It is possible that individual plants and suitable habitat for this species would be adversely affected as a result of rail line construction along Montezuma alternative segments 2 and 3. However, the overall impact would be small and would not affect the viability of this species because there is ample suitable habitat in the area.

There is potential habitat for Nevada dune beardtongue near Montezuma alternative segments 2 and 3 along the portion from Blair Junction to Lone Mountain. There are some patches of vegetated dunes along this route. There would likely be no impact on this species because there are no known occurrences in the construction right-of-way and no occurrences in the study area.

State of Nevada Game Species Short-term direct impacts to pronghorn antelope and mule deer would result due to construction activities and the temporary increased noise and visual disturbance. In addition, there would be a loss of foraging habitat. However, these impacts would be small as a result of constructing all alternative segments considering these land-cover types relative to the amount within the entire Nellis mapping zone. Montezuma alternative segment 1 would cross some greater sage grouse habitat. The impact from construction would be small.

Wild Horses and Burros Montezuma alternative segment 1 would run to the east of and adjacent to the Silver Peak Herd Management Area. The Montezuma alternative segments would be within and adjacent to the Montezuma Peak Herd Management Area. Due to current starvation and genetics issues, all horses were removed from the Silver Peak Herd Management Area. Therefore, impacts to wild horses and burros would be negligible..

Table 4-225 summarizes potential impacts to biological resources that have the potential to occur within or near the alternative segments. Operations impacts are described in Section 4.3.7.2.3.5.

4.3.7.2.2.10 Klondike Option - Maintenance-of-Way Facility, Facility Construction.

Impacts to biological resources associated with development of the Klondike option for the Maintenance-of-Way Facility would be similar to those discussed above for Montezuma alternative segments 2 and 3. Refer to Table 4-217 for short-term and long-term impacts to land-cover types from construction of this facility.

4.3.7.2.2.11 North Clayton Quarry, Quarry Construction.

Vegetation Construction of the potential North Clayton quarry would have a long-term impact on 0.95 square kilometer (235 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub and 0.28 square kilometer (69 acres) of Inter-Mountain Basins Big Sagebrush Shrubland.

This land-cover type and its existing good condition in the area of the potential quarry site support wildlife habitat and wild horse and burro habitat. Therefore, the overall impact would be moderate due to the loss of this vegetative cover and fragmentation.

There is no riparian or wetland vegetation present within the study area of the quarry.

Table 4-225. Summary of potential impacts to biological resources from rail line construction along the Montezuma alternative segments.

Resource/impact type	Extent of impact, Montezuma 1	Extent of impact, Montezuma 2	Extent of impact, Montezuma 3
Wildlife			
Loss of vegetation or land-cover type (long-term)	3.23 square kilometers[a]	2.32 square kilometers	2.96 square kilometers
Construction-related disturbance vegetation or land cover type (short-term)	31.61 square kilometers	31.50 square kilometers	41.57 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0	0
Wildlife water resources	No impact	No impact	No impact
Special status species			
Threatened and endangered species and habitat	No impact	No Impact	No impact
BLM- and State of Nevada-designated sensitive/protected species			
Pygmy rabbit *(Brachylagus idahoensis)*	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Pale kangaroo mouse *(Microdipidops pallidus)*	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Dark kangaroo mouse *(Microdipidops megacephalus albiventer)*	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-133)	Small impact	Small impact	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact	Small impact	Small impact
Northern goshawk (Accipiter gentiles)	No impact	No impact	No impact
Ferruginous hawk *(Buteo regalis)*	Small impact	No impact	Small Impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact	Small impact	Small impact
Sage thrasher *(Oreoscotes montanus)*	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Brewer's sparrow *(Spizella breweri)*	Small impact to potential habitat	Small impact to potential habitat	Small impact to potential habitat
Eastwood milkweed *(Asclepias easwoodiana)*	No impact	Small impact	Small impact
Cima milkvetch *(Astragalus cimae* var. *cimae)*	No impact	No impact	No impact
Nevada dune beardtongue *(Penstemon arenarius)*	No impact	No impact	No impact
Pahute Mesa beardtongue *(Penstemon pahutensis)*	No impact	Small impact	Small impact
State of Nevada game species			
Pronghorn antelope	Small Impact	Small impact	Small impact
Mule deer	Small impact	Small impact	Small impact
Wild horses and burros	No impact	No impact	No impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potentially suitable habitat for the ferruginous hawk may occur within the footprint of the potential quarry. Potential impacts to this species would be small and short-term due to the removal of 1.39 square kilometers (343 acres) of potential foraging habitat.

Potentially suitable habitat for the northern goshawk is present along Montezuma alternative segments 1 and 3 where it intersects with Great Basin Pinyon-Juniper Woodland habitat. However, this species has not been documented in the study area. Potential impacts would result from removal of potential foraging habitat during construction of the quarry. This impact would be small because this species is dependent on woodland habitats, which are not within the footprint of the proposed quarry site.

There could be potential impacts to several bat species, listed in Table 3-133, during construction of the quarry as a result of a temporary increase of noise and human activity and long-term removal or modification of potential roosting habitat. However, these impacts would be small and short-term. No bats have been documented roosting within the quarry footprint; however, there is ample suitable habitat for bats within the study area and it is highly likely that bats occupy the area.

State of Nevada Game Species There would be short-term direct impacts to pronghorn antelope and mule deer if they avoided the area close to construction activities due to the temporary increased noise and visual disturbances. In addition, there would be a long-term impact due to a loss of potential forage habitat. However, these impacts would be small considering the amount of land-cover type affected in relation to the amount within the entire Nellis mapping zone. Operations impacts are addressed in Section 4.3.7.2.3.4.

Wild Horses and Burros The potential North Clayton quarry would be constructed within the Montezuma Peak Herd Management Area. A 2006 BLM census flight located 58 wild horses and 18 burros in the herd management area. Construction of this quarry could result in a small impact due to the small loss of available forage and the short-term avoidance of the area during construction and operations activity.

Table 4-226 summarizes potential impacts to biological resources that have the potential to occur within or near the potential North Clayton quarry. Operations impacts are described in Section 4.3.7.2.3.

4.3.7.2.2.12 Silver Peak Option - Maintenance-of-Way Facility, Facility Construction.

Impacts to biological resources associated with construction of the Maintenance-of-Way Facility at Silver Peak would be similar to those discussed above for Montezuma alternative segment 1. Refer to Table 4-217 for a quantification of short-term and long-term impacts to land-cover types from construction of this facility.

4.3.7.2.2.13 Malpais Mesa Quarry, Quarry Construction.

Vegetation Construction of the potential Malpais Mesa quarry would result in a long-term impact to 1.16 square kilometers (287 acres) of Inter-Mountain Basins Big Sagebrush Shrubland and 0.73 square kilometer (180 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. The overall impact would be moderate due to the loss of this vegetative cover and fragmentation of habitat.

There is no riparian or wetland vegetation present within the study area of the quarry; therefore, there would be no impact on riparian or wetland vegetation as a result of constructing a quarry at this site.

Table 4-226. Summary of potential impacts to biological resources from construction of the North Clayton quarry.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land cover type (long-term)	1.39 square kilometers[a]
Construction related disturbance vegetation or land cover type (short-term)	0.39 square kilometer
Loss of riparian and water related habitats (long-term)[b].	0
Construction related disturbance to riparian habitats (short-term)[b].	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Northern goshawk (*Accipiter gentiles*)	Small impact
Ferruginous hawk *(Buteo regalis)*	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact
Mule deer	Small impact
Wild horses and burros	Small impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences or suitable habitat for any federally listed or candidate species within the study area of the proposed quarry site.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Potential impacts to bat species would result from disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill or quarry operations. The overall impact on bats would be short-term and small due to temporary avoidance during construction activities.

State of Nevada Game Species There is no designated habitat for State of Nevada game species within the proposed quarry footprint. However, designated mule deer yearlong habitat occurs adjacent to the proposed quarry site, and designated pronghorn antelope yearlong habitat occurs to the north approximately 8 kilometers (5 miles) (Figures 3-222 and 3-223). Potential impacts would be due to avoidance of the area because of an increase in noise during construction activity.

Wild Horses and Burros Impacts on wild horses and burros would be the same as described in Section 4.3.7.2.2.11 for the North Clayton Quarry.

Table 4-227 summarizes potential impacts to biological resources that have the potential to occur within or near the potential Malpais Mesa quarry. Operation impacts are discussed in Section 4.3.7.2.3.

Table 4-227. Summary of potential impacts to biological resources from construction of the Malpais Mesa quarry

Resource/impact type	Extent of impacts
Wildlife	
Loss of vegetation or land-cover type (long-term)	2.09 square kilometers[a]
Construction-related disturbance vegetation or land-cover type (short-term)	0.54 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	No impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands/seeps/streams/and riparian combined.

4.3.7.2.2.14 ES-7 Quarry, Quarry Construction.

Vegetation Construction of potential quarry ES-7 would result in a long-term impact to 0.55 square kilometer (136 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, 0.34 square kilometer (84 acres) of Great Basin Xeric Mixed Sagebrush Shrubland, and 0.24 square kilometer (59 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub. Sagebrush communities are highly valuable within the Nellis mapping zone; therefore, the overall impact would be moderate due to the loss of this vegetative cover and fragmentation of habitat.

There is no riparian or wetland vegetation present within the study area of the quarry; therefore, there would be no impact on riparian or wetland vegetation as a result of construction of the quarry site.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences or suitable habitat for any federally listed or candidate species within the study area of the proposed quarry site.

BLM- and State of Nevada-Designated Sensitive or Protected Species: There could be potential impacts to bat species from constructing the proposed Goldfield Quarry which would include the disturbance or alteration of mineshafts, caves, talus slopes with cracks, crevices, and cliff faces during cut and fill or quarry operations. Potential impacts to bat habitats from construction activities would be small.

Potential impacts to the loggerhead shrike would result from the long-term loss of potential suitable habitat. The impact would be small since this species would be temporarily displaced, and there is ample suitable habitat throughout the region.

Potential impacts to the Western burrowing owl would result from loss of potential suitable habitat and possible crushing of burrows. Potential impact would be small since this species occupies various land-cover types throughout the region.

There would be a loss of potential suitable habitat for the dark kangaroo mouse and the pale kangaroo mouse; however, there are no documented occurrences of this species within the construction right-of-way therefore potential impact would be small.

State of Nevada Game Species The proposed quarry ES-7 would cross year-round mule deer habitat (see Figure 3-222). Potential impacts to this species would include long-term loss of habitat and increased noise and human activity. However, these impacts would be expected to be small because year-round mule deer habitat is abundant in the area, and the quarry would affect only a small portion of this habitat.

Wild Horses and Burros Impacts on wild horses and burros would be the same as described in Section 4.3.7.2.2.11 for the North Clayton quarry.

Table 4-228 summarizes potential impacts to biological resources that have the potential to occur within or near potential quarry ES-7.

4.3.7.2.2.15 Mina Common Segment 2 (Stonewall Flat Area), Rail Construction.

Vegetation Mina common segment 2 would pass primarily through Inter-Mountain Basins Mixed Salt Desert Scrub, creating a long-term impact to 0.06 square kilometer (15 acres) of this land-cover type. It would pass through a small portion of Inter-Mountain Basins Big Sagebrush Shrubland (less than 0.01 square kilometer), which is relatively common in the area and could provide habitat for various sagebrush community-obligate species. The amount of vegetation loss in these land-cover types associated with construction of Mina common segment 2 would be small in relation to the amount of these land-cover types that exist within the mapping zone. Therefore, the potential impacts of this loss of vegetative communities would be small. Construction of Mina common segment 2 would not impact any riparian or wetland vegetation.

Wildlife There would be direct impacts to various wildlife populations if wildlife avoided habitats close to construction activities. Any potential impact would be small and short-term. Other impacts to wildlife species would be similar to those described in Section 4.3.7.2.1.2.

Special Status Species

Threatened and Endangered Species: There are no documented occurrences of federally listed plants or wildlife within the study area; therefore, there would be no impacts to listed species within or near Mina common segment 2.

BLM- and State of Nevada-Designated Sensitive or Protected Species: Although there are no documented occurrences of special status species in the common segment 2 study area, there is a potential for some to be present, and thus affected by, rail line construction along Mina common segment 2. These are summarized in Table 4-229.

State of Nevada Game Species There would be no impacts to State of Nevada game species because Mina common segment 2 would not cross any designated game habitat.

Table 4-228. Summary of potential impacts to biological resources from construction of potential quarry ES-7.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long-term)	1.13 square kilometers[a]
Construction-related disturbance vegetation or land-cover type (short-term)	0.32 square kilometers
Loss of riparian and water related habitats (long-term)[b]	0
Construction related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact to potential habitat
Western burrowing owl (*Athenes pallidus*)	Small impact to potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Pale kangaroo mouse *(Microdipidops pallidus)*	Small impact to potential habitat
Dark kangaroo mouse *(Microdipidops megacephalus albiventer)*	Small impact to potential habitat
State of Nevada game species	
Mule deer	Small impact to potential habitat
Pronghorn antelope	Small impact to potential habitat
Wild horses and burros	Small impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Wild Horses and Burros Mina common segment 2 would pass through the Stonewall Herd Management Area. Potential impacts to burros in the Stonewall Herd Management Area would be similar to those described in Section 4.3.7.2.1.5, but would occur in a different area. Burro population estimates indicate that as many as 34 resident burros could be affected.

Table 4-229 summarizes impacts to biological resources along Mina common segment 2.

4.3.7.2.2.16 Bonnie Claire Alternative Segments, Rail Line Construction. Table 4-230 summarizes potential direct impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Vegetation The area of the Bonnie Claire alternative segments represents a transition in vegetative communities. Sagebrush communities occur less frequently as the rail alignment progresses south to southeast into the Mojave mapping zone.

Table 4-229. Summary of potential impacts to biological resources from rail line construction along Mina common segment 2.

Resource/impact type	Extent of impact
Wildlife habitat	
Loss of vegetation or land-cover type (long-term)	0.06 square kilometers[a]
Construction-related disturbance vegetation or land-cover type (short-term)	0.99 square kilometers
Loss of riparian and water related habitats (long-term)[b]	0
Construction related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat present
BLM- and State of Nevada-designated sensitive/protected species	
Bat species (see Table 3-133)	Small impact
Western burrowing owl (*Athenes pallidus*)	Small impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact
State of Nevada game species	No impact
Wild horses and burros	Small impact

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps/streams, and riparian areas combined.

Construction of the Bonnie Claire alternative segment 2 could result in long-term impacts to 0.02 square kilometers (5 acres) of Inter-Mountain Basins Big Sagebrush Shrubland 0.20 square kilometers (49 acres) of Inter-Mountain Basins Mixed Salt Desert Scrub, .06 square kilometers (15 acres) of Inter-Mountain Basins Semi-Desert Shrub Steppe, 0.15 square kilometers (37 acres) of Mojave Mid-Elevation Mixed Desert Scrub, 0.05 square kilometers (12 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and 0.02 square kilometers (5 acres) of Sonora-Mojave Mixed Salt Desert Scrub. Construction of the Bonnie Claire alternative segment 3 could result in long-term impacts to less than 0.01 square kilometers (2 acres) of Inter-Mountain Basins Big Sagebrush Shrubland, 0.14 square kilometers (35 acres) of Inter-Mountain Basin Mixed Salt Desert Scrub, .07 square kilometers (17 acres) of Inter-Mountain Basin Semi-Desert Shrub Steppe, 0.13 square kilometers (32 acres) of Mojave Mid-Elevation Mixed Desert Scrub, 0.13 square kilometers (32 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and less than .01 square kilometers (2 acres) of Sonora-Mojave Mixed Salt Desert Scrub (see Section 3.3.7 and Table 4-215).

Rail line construction along the Bonnie Claire alternative segments would not impact any riparian or wetland vegetation.

Table 4-230. Summary of potential impacts to biological resources from rail line construction along the Bonnie Claire alternative segments.

Resource/impact type	Extent of impact, Bonnie Claire 2	Extent of impact, Bonnie Claire 3
Wildlife		
Loss of vegetation or land-cover type (long-term)	0.51 square kilometers[a]	0.49 square kilometers
Construction-related disturbance to habitat (short-term)	5.65 square kilometers	5.59 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Bat species (see Table 3-133)	Small impact to potential habitat	Small impact to potential habitat
Nevada Game Species		
Mule deer	Small impact	Small impact
Pronghorn antelope	Small impact	Small impact
Wild horses and burros	Small impact to potential habitat	Small impact to potential habitat

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate or proposed species that occur within the study area of the Bonnie Claire alternative segments.

BLM- and State of Nevada-Designated Sensitive or Protected Species: As summarized in Table 4-230, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along the Bonnie Claire alternative segments.

State of Nevada Game Species As summarized in Table 4-230, there would be small potential impacts to game species along the Bonnie Claire alternative segments.

Wild Horses and Burros The Bonnie Claire alternative segments would pass through the Stonewall Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be a small loss of vegetation for foraging.

4.3.7.2.2.17 Common Segment 5 (Sarcobatus Flat Area), Rail Line Construction. Table 4-231 summarizes potential direct impacts to biological resources from rail line construction along common segment 5.

Vegetation As discussed in Section 3.3.7 and shown in Table 4-214, common segment 5 would pass through a small area of Great Basin Juniper Woodland, which would be temporarily affected during rail line construction activities. This land-cover type is relatively common on the lower mountain slopes in the area and likely provides roosting and nesting habitat for some raptors. Construction of common segment 5 could result in long-term impacts to 0.04 square kilometers (10 acres) of Inter-Mountain Basins Semi-Desert Shrub Steppe, 0.09 square kilometers (22 acres) of Mojave Mid-Elevation Mixed Desert Scrub, 0.23 square kilometers (57 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and 0.44 square kilometers (109 acres) of Sonora-Mojave Mixed Salt Desert Scrub. The potential impacts on these land-cover types would be small because the amount of vegetation loss associated with rail line construction along common segment 5 would be small in relation to the amount of these land-cover types within the mapping zone. Common segment 5 would affect a small portion of Inter-Mountain Basins Big Sagebrush Shrubland, which provides habitat for various sagebrush community-obligate species.

Rail line construction along common segment 5 would not impact any riparian or wetland vegetation.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate or proposed species that occur within the study area of common segment 5.

BLM- and State of Nevada-Designated Sensitive or Protected Species: As summarized in Table 4-231, there would be small impacts to BLM- and State of Nevada-designated sensitive and protected species from rail line construction along common segment 5. Habitat for burrowing owl and loggerhead shrike are present along common segment 5 and are discussed in section 4.3.7.2.1, Environmental Impacts Common to the Entire Mina Rail Alignment. Some isolated sand dunes provide habitat for the Nevada dune breadtonge (*Penstemon arenarius*). Rail line construction would create a small impact to the habitat. Occasional stands of pinion juniper provide habitat for the ferruginous hawk (Buteo regalis). Impacts to this species would be small and short-term. Habitat for the Oasis Valley speckled dace is confined to streams in southern Nye County. Impacts to potential habitat for this species would be small and short-term due to the proposed construction of a bridge across Oasis Valley speckled dace is confined to steams in southern Nye County. Impact to potential habitat for this species would be small and short-term due to the proposed construction of a bridge across Oasis Valley that would temporarily increase turbidity in the stream. After construction, the impact would be minimal.

State of Nevada Game Species There is designated pronghorn antelope yearlong habitat to the north of the rail alignment in the Gold Flat area (see Figure 3-223). Potential impacts, if any, to antelope as a result of rail line construction along common segment 5 would be small. Common segment 5 would pass near desert bighorn sheep and mule deer yearlong habitat. It is possible that desert bighorn sheep and mule deer would pass through the area of the rail line, which along common segment 5 would be adjacent to an existing transportation corridor (U.S. Highway 95). Although it is likely that desert bighorn sheep and mule deer use this area during migration, there are no designated game ***movement corridors*** along or near common segment 5. Thus, impacts to these species would be small and short-term, primarily from avoidance of the area during construction activities.

Table 4-231. Summary of potential impacts to biological resources from rail line construction along common segment 5.

Resource/impact type	Extent of impact, common segment 5
Wildlife[a]	
Loss of vegetation or land-cover type (long-term)	0.81 square kilometer[a]
Construction-related disturbance to habitat (short-term)	11.12 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species	
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat
Ferruginous hawk (*Buteo regalis*)	Small impact to potential habitat
Bat species (see Table 3-133)	Small impact to potential habitat
Nevada dune beardtongue (*Penstemon arenarius*)	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* ssp. 6)	Small impact to potential habitat
State of Nevada game species	
Pronghorn antelope	Small impact due to avoidance
Bighorn sheep	Small impact due to avoidance
Mule deer	Small impact due to avoidance
Wild horses and burros	Small impact to potential habitat

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Wild Horses and Burros Common segment 5 would not pass through any wild horse and burro herd management areas. However, burro activity in the region is likely based on local utilization patterns. Potential impacts to wild horses and burros would be small.

4.3.7.2.2.18 Oasis Valley Alternative Segments, Rail Line Construction. Table 4-232 summarizes potential direct impacts to biological resources from rail line construction along the Oasis Valley alternative segments.

Vegetation There is wetland and riparian habitat present within the study area of the Oasis Valley alternative segments. Oasis Valley alternative segments 1 and 3 would cross the Thirsty Canyon/Oasis

Table 4-232. Summary of potential impacts on biological resources from rail line construction along the Oasis Valley alternative segments.

Resource/impact type	Extent of impacts, Oasis Valley 1	Extent of impacts, Oasis Valley 3
Wildlife		
Loss of vegetation or land-cover type (long-term)	0.31 square kilometer[a]	0.43 square kilometer
Construction-related disturbance to habitat (short-term)	2.62 square kilometer	3.95 square kilometer
Loss of riparian and water-related habitats (long-term)[b]	0	0
Construction-related disturbance to riparian habitats (short-term)[b]	0	0.02
Wildlife water resources	No impact	No impact
Special status species		
Threatened and endangered species and habitat	No species or habitat occurrence	No species or habitat occurrence
BLM- and State of Nevada-designated sensitive/protected species		
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat	Small impact to species and potential habitat
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to potential habitat	Small impact to potential habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to potential habitat	Small impact to potential habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact	No impact
Amargosa toad (*Bufo nelsoni*)	No Impact	No impact
Bat species (see Table 3-133)	Small impact to potential habitat	Small impact to potential habitat
State of Nevada game species		
Mule deer	Small impact	Small impact
Desert bighorn sheep	Small impact	Small impact
Wild horses and burros	Small impact to potential habitat	Small impact to potential habitat

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Valley Wash area. Oasis Valley alternative segment 3 would run within 0.7 kilometer (0.4 mile) of Colson Pond and across the Amargosa River drainage (see Section 3.3.5.3.11).

The Amargosa River receives ephemeral flows during high precipitation events; it does not carry water most of the year. There would be no impacts to Colson Pond and engineering design would include appropriate structures (a culvert and bridge) to reduce impacts to the Amargosa River drainage. Within the Oasis Valley alternative segment 3 construction right-of-way, construction activities would temporarily impact 0.02 square kilometer (4.67 acres) of the North American Warm Desert Lower Montane Riparian Woodland and Shrubland land-cover type.

Potential impacts would be short-term from rail line construction along this Oasis Valley alternative segment 3, which would only cross this land-cover type. Given the small amount of this land-cover type within the mapping zone and its high value for wildlife, the impacts on riparian and wetland vegetation would be moderate, but short-term. However, DOE would use drainage structures and best management practices to minimize erosion, runoff, and the subsequent impacts to riparian vegetation along the Oasis Valley alternative segments.

Construction of Oasis Valley alternative segment 1 could result in long-term impacts to 0.02 square kilometers (5 acres) of Inter- Mountain Basis Semi-Desert Shrub Steppe, 0.01 square kilometers (2 acres) of Mojave Mid-Elevation Mixed Desert Scrub, 0.02 square kilometers (5 acres) of North American Warm Desert Playa, 0.22 square kilometers (54 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, 0.22 square kilometers (7 acres) of Sonora-Mojave Mixed Salt Desert Scrub. Construction of Oasis Valley alternative segment 3 could result in long-term impacts to 0.02 square kilometers (5 acres) of Mojave Mid-Elevation Mixed Desert Scrub, less than 0.01 square kilometers (2 acres) of North American Warm Desert Playa, 0.31 square kilometers (22 acres) of Sonora-Mojave Mixed Salt Desert Scrub.

Special Status Species

Threatened and Endangered Species: There are no threatened, endangered, candidate or proposed species that occur within the study area of the Oasis Valley alternative segments.

BLM- and State of Nevada-Designated Sensitive or Protected Species: The black woollypod, a ***BLM-designated sensitive*** plant ***species***, is known to occur along the Beatty Wash section of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Construction of the Oasis Valley alternative segments could result in small impacts due to loss of suitable habitat and possible individuals present during construction.

However, black woollypod appears to adapt well to disturbed areas, thus, anticipated impacts to this species habitat and population would be small from rail line construction along the Oasis Valley alternative segments. The Oasis Valley speckled dace occurs in the Amargosa River drainage and Fleur de Lis Spring near the towns of Springdale and Beatty, less than 1.6 kilometers (1 mile) southwest from Oasis Valley alternative segment 1. This subspecies has a very limited range and is only known from this watershed in Oasis Valley. Specific distribution of this fish varies with available water. Because of the distance of this habitat from construction activities, there should be no impacts to this to the Oasis Valley speckled dace during rail line construction.

The Oasis Valley pyrg is an ***endemic*** snail of the springs found in Oasis Valley. This species has not been documented closer than 4 kilometers (2.5 miles) from the rail alignment and suitable habitat for this species would not occur within the construction right-of-way. Therefore, rail line construction would not impact this species.

The Amargosa toad occurs along the Amargosa River drainage and has been recorded in Oasis Valley, 1.4 kilometers (0.84 mile) from Oasis Valley alternative segment 1 and 1.9 kilometers (1.2 miles) from Oasis Valley alternative segment 3. Typical habitat for this species is near open water, such as springs, seeps and ponds, and the riparian vegetation generally associated with wet areas. In these instances, the presence of moist soil might be sufficient for suitable habitat. There are no open waters that would be within the construction right-of-way, and all seeps and springs within Oasis Valley and Thirsty Canyon would be outside and down gradient of the construction right-of-way. Therefore, it is unlikely that the Amargosa toad would occur within the construction right-of-way.

State of Nevada Game Species The Oasis Valley alternative segments would pass within mule deer limited range (see Figure 3-222) and would be near designated desert bighorn sheep yearlong habitat (see Figure 3-221). Oasis Valley supports riparian vegetation and ephemeral flows that are highly valuable as a potential water source and for forage. Colson Pond, which also provides a potential water source for these species, is 0.7 kilometer (0.4 mile) from Oasis Valley alternative segment 3. However, impacts from rail line construction along the Oasis Valley alternative segments would be very small and very short-term.

Wild Horses and Burros The Oasis Valley alternative segments would pass through northern portions of the Bullfrog Herd Management Area. Potential impacts to the herd management area and the wild horses and burros would be small losses of vegetation for foraging and grazing.

4.3.7.2.2.19 Common Segment 6 (Yucca Mountain Approach), Rail Line Construction.

Table 4-233 summarizes potential direct impacts to biological resources (vegetation, threatened and ***endangered species***, special status species, State of Nevada big game, and wild horses and burros) from rail line construction along common segment 6.

Vegetation As discussed in Section 3.3.7 and shown in Table 4-214, common segment 6 would pass through mostly Sonora-Mojave Creosotebush-White Bursage Desert Scrub and Mojave Mid-Elevation Mixed Desert Scrub. Construction of common segment 5 could result in long-term impacts to 0.24 square kilometers (59 acres) of Inter-Mountain Basin Semi-Desert Shrub Steppe, 0.38 square kilometers (94 acres) of Mojave Mid-Elevation Mixed Desert Scrub, less than .01 square kilometers (2 acres) of North American Warm Desert Bedrock Cliff and Outcrop, less than .01 square kilometer (about 1 acre) of North American Warm Desert Playa, 1 square kilometer (247 acres) of Sonora-Mojave Creosotebush-White Bursage Desert Scrub, and less than 0.01 square kilometers (2 acres) of Sonora-Mojave Mixed Salt Desert Scrub.

Rail line construction along common segment 6 would not impact wetland vegetation.

Special Status Species

Threatened and Endangered Species: Common segment 6 would be in an area of low-density desert tortoise habitat (the northernmost extent of the desert tortoise range), and the extent of habitat loss would result in small impacts.

The potential for desert tortoise to occur or be encountered in the common segment 6 construction right-or-way would be low. The overall impact on the desert tortoise as a result of constructing a rail line and facilities along common segment 6 would be small.

Construction of the proposed rail line, well sites, and construction camps along common segment 6 would result in the potential for species fragmentation, potential species loss, and disturbance of desert tortoise habitat along the southwestern section of common segment 6 from Beatty south to Yucca Mountain (see Figure 3-213). The rail line would not cross any areas of U.S. Fish and Wildlife Service-designated critical habitat. Potential direct impacts to desert tortoises during construction activities could include tortoise injury or mortality from being buried in their burrows or being crushed by construction equipment or other vehicles on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of the rail line, there would be no long-term impacts to the survival of this species. Indirect impacts would result from the fragmentation of habitat. A total of 5.61 square kilometers (1,387 acres) of desert tortoise habitat would be disturbed by rail line and facilities construction along common segment 6 (see Table 4-234).

Table 4-233. Summary of potential impacts on biological resources from rail line construction along common segment 6.

Resource/impact type	Extent of impacts, common segment 6
Wildlife	
Loss of vegetation or land-cover type (long-term)	1.63 square kilometers[a]
Construction-related disturbance to habitat (short-term).	13.24 square kilometers
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-133)	Small impact to habitat
Impacts to State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Moderate, short-term impact to migration corridor
Mule deer	Small impact to habitat
Wild horses and burros	Small impact to forage habitat and avoidance

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

BLM- and State of Nevada-designated Sensitive/Protection Species: The black woollypod, a BLM-designated sensitive plant species, is known to occur along the Beatty Wash portion of common segment 6. The closest known occurrence of this species is 0.3 kilometer (0.2 mile) from common segment 6. Rail line construction along common segment 6 could result in small impacts from the loss of suitable habitat and individual plants. However, black woollypod appears to adapt well to disturbed areas; thus anticipated impacts to this species habitat and population would be small. In addition, DOE would implement best management practices (see Chapter 7) to avoid or minimize plant mortality.

Table 4-234. Amount of desert tortoise habitat that would be disturbed during construction of the rail line and facilities along common segment 6.

Source of disturbance	Amount of habitat disturbed (square kilometers)[a,b]
Rail roadbed and adjacent access roads	4.45
Access road to Beatty Wash bridge and well site 14	0.04
Access road to well site 15	<0.01
Construction camp 12	0.10
Access road to construction camp 12	0.20
Rail Equipment Maintenance Yard	0.81
Total	5.61

a. To convert square kilometers to acres, multiply by 247.10.
b. < = less than.

Rock purpusia has been documented approximately 13 kilometers (8 miles) from common segment 6. The loss of a small percentage (less than 0.01 square kilometer [about 1 acre]) of the North American Warm Desert Bedrock Cliff and Outcrop land-cover type would be a long-term impact as a result of rail line construction along common segment 6. There would be possible loss of suitable habitat (rock crevices and cliffs); however, there would be no impact on this species.

There is suitable habitat for the Amargosa toad in Oasis Valley west of common segment 6. This common segment would not cross any suitable habitat; thus, impacts to this species would be highly unlikely. However, any potential impact to this species would be limited to the northern portion of common segment 6 where it would connect to the Oasis Valley alternative segments (see Section 4.3.7.2.2.16).

Habitat for the Oasis Valley speckled dace is found in the neighboring Oasis Valley. It is unlikely that speckled dace exist in the area that would be crossed by common segment 6 due to lack of persistent streams of ponds. Therefore, no impacts to speckled dace would occur. The Oasis Valley pyrg requires habitat similar to the speckled dace and no impact is expected for this segment.

Chuckwalla have been documented in the southeastern foothills of Yucca Mountain adjacent to common segment 6. This area represents the chuckwalla's northern-most range in southern Nevada. Construction activities in this area could result in the loss of habitat for this species and possible loss of individuals. This would be a small overall impact to this species.

State of Nevada Game Species Common segment 6 would intersect a designated desert bighorn sheep migratory corridor near Beatty Wash (see Figure 3-221). There is also yearlong desert bighorn sheep habitat southwest of common segment 6. Impacts would be moderate, but mostly short-term, due to possible displacement from the designated migratory corridor during construction activities. There is also mule deer habitat along common segment 6 (see Figure 3-222). Impacts to mule deer habitat would be small.

Wild Horses and Burros Common segment 6 would pass through central portions of the Bullfrog Herd Management Area. Impacts to the herd management area and any wild horses and burros in the area would be similar – a small loss of vegetation for grazing. Burro activity south of Beatty Wash and in the Crater Flat area would likely shift temporarily to other locations farther away from the disturbance of human activity. Burro population estimates for this area suggest that 34 burros could be affected. There are no known populations of wild horses along common segment 6.

4.3.7.2.2.20 Common Segment 6 (Yucca Mountain Approach), Facilities Construction. Table 4-235 summarizes potential direct impacts to biological resources (vegetation, threatened and endangered species, special status species, State of Nevada big game, and wild horses and burros) from construction of facilities along common segment 6.

Vegetation The Rail Equipment Maintenance Yard would occupy an area of 0.41 square kilometer (100 acres). There are several different land-cover types in the area, but most of the land cover is Sonora-Mojave Creosotebush-White Bursage Desert Scrub. Construction of the Rail Equipment Maintenance Yard would impact 0.24 square kilometer (60 acres) in the long term and 0.44 square kilometer (108 acres) in the short term.

Special Status Species

Threatened and Endangered Species: Potential impacts to the desert tortoise would be similar to those described in Section 4.3.7.2.2.17. Construction of the Rail Equipment Maintenance Yard would result in a loss of tortoise habitat (see Table 4-234); however, areas of critical habitat would not be affected. The increase in human activity in the area would increase the risk of vehicle collisions with tortoise on access roads. Although these losses would cause a small decrease in the number of individual tortoises in the vicinity of this facility, there would be no impacts to the long-term survival of this species. Therefore, potential impacts to the desert tortoise as a result of the facility would be small.

Potential impacts to special status species would be similar to the impacts described in Section 4.3.7.2.2.17.

State of Nevada Game Species The Rail Equipment Maintenance Yard would be within mule deer limited range (see Figure 3-222). Potential impacts would be similar as those described in Section 4.3.7.2.1.5. Potential impacts would be small due to the infrequent occurrence of mule deer in the area. However, any existing mule deer would likely avoid the area due to increased human activity and noise.

Wild Horses and Burros Potential impacts to wild horses and burros would be similar to the impacts described in Section 4.3.7.2.2.17.

4.3.7.2.3 Operations Impacts Common to the Entire Mina Rail Alignment

4.3.7.2.3.1 Vegetation. DOE would expect activities during the railroad operations to remain within the operations right-of-way or disturbed areas after construction was complete; therefore, there would be no ongoing operations impacts to land-cover types. There could be long-term impacts in the form of a changed use of the land-cover types from construction of the rail roadbed, access roads, and all associated facilities, as described above in Section 4.3.7.2.1.1.

Wetland/Riparian Habitat DOE would not expect railroad operations activities to result in continuing land-disturbing activities outside of areas disturbed and developed during the construction phase. For this reason, DOE would expect no additional direct loss of wetland or riparian habitat during operations activities. However, wetlands and riparian habitat adjacent to the proposed rail line or associated facilities could be affected in the event of a train derailment resulting in the spill of diesel fuel into these habitats. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

Noxious Weeds and Invasive Species DOE would not anticipate additional direct habitat disturbances during railroad operations. However, continued use of the rail line, facilities, and the associated access roads would continue to provide a mechanism for dispersal of seeds and rootable fragments of invasive and noxious plant species.

Table 4-235. Summary of potential impacts on biological resources from constructing facilities along common segment 6.

Resource/impact type	Extent of impact
Wildlife	
Loss of vegetation or land-cover type (long-term)	0.30 square kilometer[a]
Construction-related disturbance to habitat (short-term)	0.61 square kilometer
Loss of riparian and water-related habitats (long-term)[b]	0
Construction-related disturbance to riparian habitats (short-term)[b]	0
Wildlife water resources	No impact
Special status species	
Threatened and endangered species and habitat	
Desert tortoise (*Gopherus agassizii*)	Small impact to species and habitat
BLM- and State of Nevada-designated sensitive/protected species	
Black woollypod (*Astragalus funereus*)	Small impact to species and potential habitat
Rock purpusia (*Ivesia arizonica* var. *saxosa*)	No impact
Loggerhead shrike (*Lanius ludovicianus*)	Small impact to habitat
Western burrowing owl (*Athenes cunicularia*)	Small impact to habitat
Oasis Valley speckled dace (*Rhinichthys osculus* spp. [unnamed])	No impact
Oasis Valley pyrg (*Pyrgulopsis micrococcus*)	No impact
Amargosa toad (*Bufo nelsoni*)	No impact
Chuckwalla (*Sauromalus ater*)	Small impact to habitat
Bat species (see Table 3-133)	Small impact to habitat
State of Nevada game species	
Desert bighorn sheep (*Ovis canadensis*)	Small impact to habitat
Mule deer	Small impact to habitat
Wild horses and burros	Small impact to forage habitat

a. To convert square kilometers to acres, multiply by 247.10.
b. Total includes wetlands, seeps, streams, and riparian areas combined.

Similar to best practices utilized in the construction phase, during the operations phase DOE would implement best management practices and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species (see Chapter 7).

4.3.7.2.3.2 Wildlife. Potential direct impacts to wildlife from railroad operations collisions with trains could occur during the operations phase. DOE estimates that approximately 17 one-way trains per week would utilize the track during the operations phase. While some individual animals could be lost from collisions with trains, the impact on wildlife communities would be small. Because some wildlife species in the area are often more active at night, nighttime collisions with trains would be possible if the trains were to operate during the night. Again, DOE would expect small impacts to the nocturnal wildlife communities.

Construction of communication towers, bridges, or any other structures that would provide raptors, crows (*Corvus brachyrhynchos*), and ravens (*Corvus corax*) with additional perches would increase predation pressure on the local small animal populations such as reptiles, rodents, and small birds. This could result in a potential negative indirect impact on the small animals, but a positive indirect impact on the predatory species. Some long-term structures, such as bridges, if designed to include bat roosting and hibernation sites, could provide additional habitat resulting in positive indirect impact to bat species.

Noise from trains would disturb wildlife species close to the rail line throughout the operations phase of the project. However, this disturbance would diminish with distance from the track and over time because some wildlife species would become acclimated to daily disturbances from passing trains. Noise from the trains and human presence at facilities associated with the rail line could cause wildlife species to move away from the tracks during the period of disturbance (short-term avoidance) and possibly cause changes in migratory patterns (long-term displacement).

Wildlife habitat and associated species adjacent to the proposed rail line or facilities could be affected in the event of a train derailment resulting in the spill of diesel fuel into these habitats. Forage, prey species, nesting and spawning habitat, and sources of drinking water could become contaminated. This potential impact would have greater ramifications for aquatic species. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.3.7.2.3.3 Special Status Species.

Threatened and Endangered Species General impacts to vegetation and wildlife from railroad operations addressed above under Sections 4.3.7.2.3.1 and 4.3.7.2.3.2 also apply to the threatened and endangered species described below.

Railroad operations would result in potential short-term impacts to southwestern willow flycatchers and western yellow-billed cuckoos in the form of noise from passing trains and human activities if these species used habitat within the vicinity during these activities. However, these impacts would be small given that there are no recorded occurrences and only marginal suitable migratory habitat for the flycatcher and cuckoo along the Mina rail alignment. Further, the area where potentially suitable habitat for these species occurs is near the existing Union Pacific Hazen Branchline and existing roads, and therefore, these species would likely already be acclimated to such disturbances.

Railroad operations would result in potential short-term and long-term disturbances to bald eagles. If bald eagles were present in the vicinity of the rail line when a train passed through or in the vicinity of facilities when people were present, the noise and presence of humans could startle the eagles or deter them from using the area for the duration of the disturbance; however, these impacts would be expected to be very small.

No impacts are expected to the Railroad Valley springfish during the operations phase because habitat for this species is far from the operations right-of-way and would not be disturbed.

Potential impacts to desert tortoises from habitat fragmentation would be small. Although there is no available documentation of tortoise behavior related to rail lines, it is possible that desert tortoises could use culverts installed within washes under the rail line to cross from one side of the rail line to the other.

Utility lines, buildings, or communication towers installed to support railroad operations might provide additional nesting and perching sites for the common raven, a frequent predator of juvenile tortoises. Therefore, the presence of these structures could increase juvenile tortoise mortality.

BLM- and State of Nevada-Designated Sensitive and Protected Species Potential impacts to vegetation and special status plants associated with railroad operations would be from the possible introduction of invasive plant species by trains or maintenance vehicles. Invasive species could take hold in disturbed areas and essentially out-compete native species for resources. Potential impacts to vegetation could also result in the event of train derailment and possible associated spill of diesel fuel. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

Any active sage-grouse mating and nesting areas located close to the Mina rail alignment would be adversely affected by noise and vibration from the daily operations and maintenance activities during the breeding season. This could result in reduced nesting success especially during the incubation period when birds would be frightened from their nests, exposing the eggs to predation. However, only one historic sage-grouse lek was identified in the construction right-of-way. DOE surveyed the area on May 13, 2005, for signs of recent use or individual birds, but there was no evidence that sage grouse still occupy the area even though suitable habitat was present at the time. Therefore, there would be no impacts on sage-grouse breeding and nesting areas during the operations phase, unless sage grouse were to occupy this area in the future.

In general, passing trains would initially disturb BLM special status and state protected wildlife close to the rail line. However, this disturbance would diminish with distance from the track and over time as animals became acclimated to daily disturbances. Individual animals could occasionally be killed or injured in collisions with trains. Nevertheless, impacts to animals near the rail line would be small because of the infrequency of trains using the rail line.

Operation of facilities associated with the rail line would create a potential disturbance to BLM special status and state protected wildlife species due to the presence of humans and associated noise. This could result in short-term avoidance of an area or lead to long-term displacement, depending on the degree of disturbance.

Habitat for BLM special status and state protected wildlife species and associated species adjacent to the proposed rail line or associated facilities could be affected in the event of train derailment resulting in the spill of diesel fuel into these habitats. Forage, prey species, nesting and spawning habitat, and sources of drinking water could become contaminated. This potential impact would have greater ramifications for aquatic species. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

Nevada State Protected Cacti, Yucca, and Conifers There would be no impacts to cacti, yucca, or conifers as a result of railroad operations.

Migratory Birds Impacts to migratory bird species during the operations phase would be limited to potential disturbances from passing trains (noise and vibration), facility operations, and maintenance activities. Impacts such as altered behavior and nest abandonment could occur initially. However, noise and vibration disturbances would diminish with distance from the track, and over time, birds could become acclimated to daily disturbances.

In the event of a train derailment resulting in the spill of diesel fuel into surrounding vegetation, foraging habitat, prey species, and water sources for migratory birds could be adversely affected. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.3.7.2.3.4 State of Nevada Protected Game Species. Direct impacts to game species during the operations phase would consist of long-term habitat loss within the construction right-of-way. Game species habitat would be affected in the long-term in areas where DOE would construct the proposed rail line and associated roads and facilities. Direct impacts to game species in the form of collisions with trains would also occur during the operations phase. It is estimated that approximately 17 one-way trains per week would utilize the track during the operations phase. Again, mortality rates from collisions would not be expected to be sizeable because game animals are fairly agile and would usually be able to move out of the way of oncoming trains. While some individual animals could be lost from collisions with trains, the impact on game communities would be small. Noise from trains would disturb game species close to the rail line throughout the operations phase of the project; however, this disturbance would diminish with distance from the track and over time as the game species became acclimated to daily disturbances from passing trains. Noise from the trains could cause game species to move away from the tracks and possibly cause changes in migratory patterns before game species became acclimated to the noise. The rail roadbed itself would represent an attractive nuisance to antelope, because they prefer a vantage point from which to survey the surrounding areas for predators. However, as noted above, antelope are agile and would usually be able to avoid oncoming trains. The finished rail line would bisect game habitat and movement corridors. However, because the rail line would not be fenced, once the animals became acclimated to the presence of the rail line they would be able to move freely across the rail line and impacts to game movements would be small.

Operation of support facilities would create a potential disturbance to game species due to the presence of humans and associated noise. This could result in short-term avoidance or long-term displacement of game species from the area.

In the rare event of a possible train derailment resulting in the spill of diesel fuel into surrounding vegetation, foraging habitat, and sources of drinking water could become contaminated. The likelihood of and the severity of impacts from such spills would be small because DOE would implement best management practices to help prevent such occurrences (see Chapter 7).

4.3.7.2.3.5 Wild Horses and Burros. Direct impacts to wild horses and burros during the operations phase would consist of long-term habitat loss where the footprints of the rail line and associated maintenance roads would intersect herd management areas. There would also be potential direct impacts to wild horses and burros in the form of collisions with trains. DOE estimates that approximately 17 one-way trains per week would utilize the rail line during the operations phase. Again, death rates from collisions are not expected to be sizeable because wild horses and burros are fairly agile and would usually be able to move out of the way of oncoming trains. While some individual animals could be lost from collisions with trains, the impact on wild horse and burro communities would be small. Noise from trains could disturb wild horses and burros close to the rail line throughout the operations phase of the project; however, this disturbance would diminish with distance from the track and over time the wild horses and burros would become acclimated to daily disturbances from passing trains. Noise from the trains could cause wild horses and burros to move away from the tracks and possibly cause changes in migratory patterns. However, because the rail line would not be fenced, once the animals became acclimated to its presence they would be able to move freely across the rail line. Therefore, potential impacts to wild horse and burro movements, as discussed in Section 4.3.7.2.3.5, would be small.

4.3.7.3 Impacts under the Shared-Use Option – Mina Rail Alignment

The Shared-Use Option would require construction of commercial sidings and facilities. All such construction would be immediately adjacent to the rail line and would have impacts similar to those under the Proposed Action without shared use. The Shared-Use Option would mean an increase in train traffic. Therefore, DOE would expect special status species, State of Nevada game species, and wild horse and burro interactions with train traffic (collisions, change in movement patterns, altered behavior, and nest abandonment) to be slightly larger than those interactions with rail traffic under the Proposed Action without shared use. This slight increase in train traffic would result in small impacts to the wildlife communities.

4.3.7.4 Summary

Table 4-236 summarizes potential impacts to biological resources from constructing and operating the proposed rail line along the Mina rail alignment.

Adverse impacts to vegetation communities would be small in relation to the abundance of the vegetation communities in the region, with minimal loss of unique or particularly sensitive communities. There would be impacts to wetlands and riparian habitats from construction of Schurz alternative segments 1 and 6; however, impacts would be mostly short-term during construction of a bridge across the Walker River. There could be impacts to wetlands in the vicinity of Mina common segment 1 and Oasis Valley alternative segment 1 from rail line construction. However, during rail line final design, DOE would make slight adjustments to minimize such impacts. Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species.

Although impacts to wildlife habitats and individual populations could occur as a result of the rail line construction, impacts would be small and would not impact the continued existence of any wildlife species.

There would be the potential for impacts to threatened or endangered species during rail line construction. Potential impacts to desert tortoise would be small. DOE would implement best management practices to protect this species (see Chapter 7).

Localized and minor loss of roosting and foraging habitat for the southwestern willow flycatcher and western yellow-billed cuckoo could occur as a result of the Proposed Action. However, since these species do not nest along the rail alignment, impacts would be small and limited to transient individuals.

Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from the construction and operation of the proposed rail line and associated facilities. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act.

Overall, there would be a loss of conifer habitat and individual conifer trees. There would also likely be a net loss of cacti and yucca along the proposed rail line.

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 1 of 6).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Union Pacific Hazen Branchline	0.00	0.00	No impact	Small	0.00	0.00	No impact	No impact	No impact	No impact	No impact	No impact
Department of Defense Branchline North	0.00	0.00	No impact	Small	0.00	0.00	No impact	No impact	Small impact to loggerhead shrike and burrowing owl	Small impact to loggerhead shrike and burrowing owl	Small impact to pronghorn antelope, mule deer	No impact
Schurz 1	2.42	1.24	Small	Small	0.01	0.00	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, Swainson's hawk, dune sunflower, and oryctes	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact
Schurz 4	4.85	1.92	Small	Small	0.01	0.01	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, Swainson's hawk, white-faced ibis, and oryctes	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact
Schurz 5	4.12	2.27	Small	Small	0.02	0.01	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, Swainson's hawk, and oryctes	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact
Schurz 6	4.53	2.45	Small	Small	0.01	0.00	Small impact to Lahontan cutthroat trout, western yellow-billed cuckoo, and southwestern willow flycatcher	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, and Swainson's hawk	Small impact to bats, loggerhead shrike, and western burrowing owl	No impact	No impact

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 2 of 6).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Department of Defense Branchline South	0.00	0.00	No impact	Small	0.00	0.00	No impact	No impact	Small impact to loggerhead shrike and burrowing owl	Small impact to loggerhead shrike and burrowing owl	Small impact to pronghorn antelope, mule deer	No impact
Hawthorne Staging Yard	1.07	0.27	No impact	Small	0.00	0.00	No impact	No impact	Small impact loggerhead shrike and burrowing owl, and oryctes	No impact	Small impact to pronghorn antelope	Small impact to pronghorn antelope
Mina common segment 1	31.05	2.61	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, white-faced ibis, western burrowing owl, loggerhead shrike, oryctes, and western snowy plover	Small impact to western burrowing owl, loggerhead shrike, and western snowy plover	Small impact to pronghorn antelope, mule deer, and Pilot Mountain Herd Management Area	Small impact to pronghorn antelope, mule deer, and Pilot Mountain Herd Management Area
Garfield Hills quarry	0.39	0.99	No impact	Small	0.00	0.00	No impact	No impact	Small impact to western burrowing owl, loggerhead shrike, and Wassuk beardtongue	Small impact to western burrowing owl and loggerhead shrike	No impact	No impact
Gabbs Range quarry	0.30	0.66	No impact	Small	0.00	0.00	No impact	No impact	Small impact to western burrowing owl and loggerhead shrike	Small impact to western burrowing owl and loggerhead shrike	Small impact to pronghorn antelope and Pilot Mountain Herd Management Area	Small impact to pronghorn antelope and Pilot Mountain Herd Management Area
Montezuma 1	31.61	3.23	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, western burrowing owl, pygmy rabbit, pale kangaroo mouse, dark kangaroo mouse, ferrugious hawk, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to bats, western burrowing owl, pygmy rabbit, pale kangaroo mouse, dark kangaroo mouse, ferrugious hawk, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to mule deer, greater sage-grouse, and Montezuma Peak Herd Management Area	Small impact to mule deer and greater sage-grouse No impact to Montezuma Peak Herd Management Area

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 3 of 6).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Montezuma 2	31.50	2.32	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, western burrowing owl, loggerhead shrike, sage thrasher, Brewer's sparrow, Pahute Mesa beardtongue, Eastwood milkweed, Nevada Dune beardtongue, and ferruginous hawk	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, western burrowing owl, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to mule deer and Montezuma Peak Herd Management Area	Small impact to mule deer No impact to Montezuma Peak Herd Management Area
Montezuma 3	41.57	2.96	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, western burrowing owl, loggerhead shrike, Pahute Mesa beardtongue, Eastwood milkweed, Nevada Dune beardtongue, northern goshawk, sage thrasher, Brewer's sparrow, and ferruginous hawk	Small impact to bats, pale kangaroo mouse, dark kangaroo mouse, pygmy rabbit, sage thrasher, Brewer's sparrow western burrowing owl, and loggerhead shrike	Small impact to bighorn sheep, pronghorn antelope. No impact to Montezuma Peak Herd Management Area	Small impact to bighorn sheep, pronghorn antelope. No impact to Montezuma Peak Herd Management Area
Klondike Option – Maintenance-of-Way Facility	0.62	0.04	No impact	Small	0.00	0.00	No impact	No impact	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, western burrowing owl, sage thrasher, Brewer's sparrow, loggerhead shrike, Eastwood milkweed, and Nevada Dune beardtongue	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, western burrowing owl, sage thrasher, Brewer's sparrow, and loggerhead shrike	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact to mule deer,, pronghorn antelope, and Montezuma Peak Herd Management Area

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 4 of 6).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
North Clayton quarry	0.39	1.39	No impact	Small	0.00	0.00	No impact	No impact	Small impact to bats, western burrowing owl, loggerhead shrike, northern goshawk, and ferruginous hawk	Small impact to bats, western burrowing owl, and loggerhead shrike	Small impact to pronghorn antelope, mule deer and Montezuma Peak Herd Management Area	Small impact to pronghorn antelope, mule deer and Montezuma Peak Herd Management Area
Silver Peak Option Maintenance-of-Way Facility	0.68	0.05	No impact	Small	0.00	0.00	No impact	No impact	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, western burrowing owl, loggerhead shrike, Eastwood milkweed, ferrugious hawk, sage thrasher, Brewer's sparrow, and Nevada Dune beardtongue	Small impact to pale kangaroo mouse, dark kangaroo mouse, bats, ferrugious hawk, sage thrasher, Brewer's sparrow, western burrowing owl, and loggerhead shrike	Small impact to mule deer, greater sage-gourse, and Montezuma Peak Herd Management Area	Small impact to mule deer, greater sage-gourse, and Montezuma Peak Herd Management Area
Malpais Mesa quarry	0.54	2.09	No impact	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike and western burrowing owl	Small impact to bats, loggerhead shrike and western burrowing owl	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area
Goldfield quarry ES-7	0.32	1.13	No impact	Small	0.00	0.00	No impact	No impact	Small impact to bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, western burrowing owl, and Eastwood milkweed	Small impact to bats, dark kangaroo mouse, pale kangaroo mouse, loggerhead shrike, and western burrowing owl	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area	Small impact to mule deer, pronghorn antelope, and Montezuma Peak Herd Management Area

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 5 of 6).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Mina common segment 2	0.99	0.06	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, Western Burrowing Owl, and Loggerhead Shrike	No impact	Small impact to Stonewall Herd Management Area	Small impact to Stonewall Herd Management Area
Bonnie Claire 2	5.65	0.51	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact to bats, loggerhead shrike, and western burrowing owl,	Small impact on Mule deer, pronghorn antelope, bighorn sheep, Stonewall Herd Management Area	Small impact on Mule deer, pronghorn antelope, bighorn sheep, Stonewall Herd Management Area
Bonnie Claire 3	5.59	0.49	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact on Mule deer, pronghorn antelope, bighorn sheep, Stonewall Herd Management Area	Small impact on Mule deer, pronghorn antelope, bighorn sheep, Stonewall Herd Management Area
Common segment 5	11.12	0.82	Small	Small	0.00	0.00	No impact	No impact	Small impact: on bats, loggerhead shrike, western burrowing owl, Oasis Valley speckled dace, ferruginous hawk, and Nevada Dune beardtongue	No to small impact on bats, loggerhead shrike, and western burrowing owl,	Small impact to pronghorn antelope, Bighorn sheep, and mule deer	No impact

Table 4-236. Summary of potential impacts to biological resources from constructing and operating the railroad along the Mina rail alignment (page 6 of 6).

Segment/ facility	Land cover (square kilometers)		Introduction/ proliferation of noxious/ invasive weeds		Wetlands/ riparian habitat (square kilometers)[a]		Threatened and endangered species		Special status species		Herd management areas/ Nevada game species	
	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Oasis Valley 1	2.62	0.31	Small	Small	0.00	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, and black woollypod	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact on Mule deer, desert bighorn sheep, Bullfrog Herd Management Area	Small impact to Bullfrog Herd Management Area
Oasis Valley 3	3.95	0.43	Small	Small	0.03	0.00	No impact	No impact	Small impact to bats, loggerhead shrike, western burrowing owl, and black woollypod	Small impact to bats, loggerhead shrike, and western burrowing owl	Small impact on Mule deer, desert bighorn sheep, Bullfrog Herd Management Area	Small impact to Bullfrog Herd Management Area
Common segment 6	13.24	1.63	Small	Small	0.00	0.00	Small impact to desert tortoise	Small impact to desert tortoise	Small impact to bats, loggerhead shrike, western burrowing owl, chuckwalla, and black woollypod	Small impact to bats, loggerhead shrike, western burrowing owl, and chuckwalla	Moderate impact on desert bighorn sheep. Small impact on mule deer, and Bullfrog Herd Management Area	Small impact to Bullfrog Herd Management Area
Rail Equipment Maintenance Yard	0.61	0.30	No impact	Small	0.00	0.00	Small impact to desert tortoise	Small impact to desert tortoise	Small impact to bats, loggerhead shrike, western burrowing owl, chuckwalla, and black woollypod	Small impact to bats, loggerhead shrike, western burrowing owl, and chuckwalla	Moderate impact on Bighorn Sheep. Small impact to mule deer, and Bullfrog Herd Management Area	Small impact to Bighorn sheep, and Bullfrog Herd Management Area
Totals	147.89	31.63	Small	Small	0.08	0.02	Small	Small	Small	Small	Small	Small

a. To convert square kilometers to acres, multiply by 247.10.

Overall, potential impacts to migratory birds would be short-term noise disturbances during construction and long-term habitat loss during the operations phase. These impacts would not have an adverse impact on migratory birds.

Although there would be impacts to game habitats and potential impacts to individuals or populations from constructing the proposed rail line, impacts would be small and would not significantly impact the continued existence of game species.

Although there would be impacts to herd management areas and potential impacts to individuals or wild horse and burro populations from constructing the proposed rail line along the Mina rail alignment, impacts would be small and would not significantly impact the management strategies utilized within the herd management areas.

Direct impacts to wildlife, wild horses and burros from the operation of the rail line would consist of potential collisions of wildlife with trains and short-term disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and presence of humans at rail facilities. Direct impacts would also include potential contamination of forage, prey species, nesting and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

4.3.8 NOISE AND VIBRATION

This section describes potential noise and vibration impacts from constructing and operating a railroad along the Mina rail alignment. Section 4.3.8.1 describes the methodology DOE used to assess potential impacts; Section 4.3.8.2 describes potential construction impacts. Section 4.3.8.3 describes potential operations impacts; Section 4.3.8.4 describes potential impacts under the Shared-Use Option. Section 4.3.8.5 summarizes potential impacts from noise and vibration.

Section 3.3.8.1 describes the region of influence for the analysis of noise and vibration impacts along the Mina rail alignment. Appendix I, Noise and Vibration Impact Assessment Methodology, provides more information on the fundamentals of analyzing noise.

4.3.8.1 Impact Assessment Methodology

The approach for analyzing potential noise impacts is based on measurements of current ***ambient noise*** levels (see Section 3.3.8.2), noise modeling for future activities (proposed railroad construction and operations), and identification of changes in noise levels that receptors within the region of influence would experience.

To establish a baseline for determining if there would be an increase in noise, DOE measured ambient noise in the study area at five representative locations along the rail alignment: Silver Springs, Schurz, Mina, Silver Peak, and Goldfield (see Section 3.3.8.2). DOE chose these locations because they are representative of the few populated areas near the existing Union Pacific Railroad Hazen Branchline and the Mina rail alignment.

DOE used several criteria to determine the level of potential impacts from noise and vibration along the rail alignment. For noise impacts from construction activities, DOE used U.S. Department of Transportation, Federal Transit Administration, methods (DIRS 177297-Hanson, Towers, and Meister 2006, all) and construction noise guidelines listed in Table 4-237.

Table 4-237. Federal Transit Administration construction noise guidelines.[a,b]

Land use	8-hour L_{eq} (dBA) Day	8-hour L_{eq} (dBA) Night	30-day average DNL (dBA)
Residential	80	70	75[c]
Commercial	85	85	80[d]
Industrial	90	90	85[d]

a. Source: DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-8.
b. dBA = A-weighted decibels; DNL = ***day-night average noise level***; L_{eq} = equivalent sound level.
c. In urban areas with very high ambient noise levels (DNL greater than 65 dBA), DNL from construction projects should not exceed existing ambient + 10 dBA.
d. Twenty-four hour L_{eq}, not DNL.

For operation of trains during the construction and operations phases, DOE analyzed noise impacts under established STB criteria. The STB has environmental review regulations for noise analysis (49 CFR 1105.7e(6)), with the following criteria:

- An increase in noise exposure as measured by DNL of 3 dBA or more
- An increase to a noise level of 65 DNL or greater

If the estimated noise-level increase at a location would exceed either criterion, the STB then estimates the number of affected noise-***sensitive receptors*** (such as schools, libraries, residences, retirement communities, and nursing homes). The two components (3 dBA increase, 65 DNL) of the STB criteria are implemented separately to determine an upper bound of the area of potential noise impact. However, current noise research indicates that both criteria must be met to cause an adverse noise impact (DIRS 173225-STB 2003, p. 4-82). That is, noise levels would have to be greater than or equal to 65 DNL and increase by 3 dBA or more for an adverse noise impact to occur.

The approach for analyzing potential vibration impacts is based on estimates of project-generated vibration and measurements of current ambient vibration conditions (see Section 3.3.8). To evaluate potential vibration impacts from construction and operation activities, DOE used Federal Transit Administration building vibration damage and human annoyance criteria. Under these criteria, if vibration levels exceeded 80 VdB (human annoyance criterion for infrequent events) or if the vibration levels (measured as ***peak particle velocity***) exceeded 0.20 inch per second for fragile buildings or 0.12 inches per second for extremely fragile historic buildings, then there could be a vibration impact (DIRS 177297-Hanson, Towers, and Meister 2006, all). Appendix I provides more information on the vibration metrics used in this study.

Day-night average noise level (DNL): The energy average of A-weighted decibels (dBA) sound level over 24 hours; includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the day.

A-weighted decibels (dBA): A measure of noise level used to compare noise from various sources. A-weighting approximates the frequency response of the human ear.

To establish a baseline for determining if there would be an increase in vibration, DOE measured ambient vibration in the study area at five representative locations: Silver Springs, Schurz, Mina, Silver Peak, and Goldfield (see Section 3.3.8).

4.3.8.2 Construction Impacts

Noise and vibration levels created by construction equipment vary greatly depending on such factors as the type of equipment, the specific model, the operation being performed, and the condition of the equipment. In addition, the proximity of the equipment to noise- and vibration-sensitive locations, duration of the activity, and time of day will influence the effects of construction noise and vibration. The results of this assessment reflect the ***uncertainty*** about the exact details of construction activities that would be required. However, the analysis assumes extreme combinations of equipment and operations known at this time that conservatively estimate upper-bound construction noise and vibration levels.

4.3.8.2.1 Construction Noise

The Federal Transit Administration construction noise analysis method suggests using the two noisiest pieces of equipment to estimate noise levels at sensitive locations (DIRS 177297-Hanson, Towers, and Meister 2006, p. 12-7). For this analysis, DOE used heavy trucks and bulldozers as the two noisiest pieces of equipment, based on the types of construction equipment that would be needed (DIRS 176170-Nevada Rail Partners 2006, Appendix B). There would be no pile driving near populated areas, so no pile-driving noise analysis is required.

DOE developed 8-hour construction noise-level estimates by assuming that a bulldozer (with a noise emission level of 85 dBA at 15 meters [50 feet]) would be at full operation for 8 hours at a given location along a common segment or alternative segment at the approximate minimum distance to the nearest residential receptor anywhere along the Mina rail alignment. Tables 4-238 and 4-239 list estimated construction noise levels for Mina, Silver Peak, and Goldfield. In addition, based on the construction schedule, the analysis conservatively assumed that 15 bulldozers would be operating simultaneously in the same general area. DOE also assumed that trucks (with a noise emission level of 88 dBA at 15 meters) would be at full power at the same general area for 8 hours per day. Based on the construction schedule, DOE conservatively assumed that 27 trucks would be operating simultaneously in the same general area. These analyses assume that there would be no construction activities during the night.

Table 4-238. Estimated construction noise levels along the Mina rail alignment (8-hour L_{eq}).[a]

Location (segment)	Approximate distance to nearest receptor (meters)[b]	8-hour bulldozer L_{eq}	8-hour truck L_{eq}	Total 8-hour L_{eq} (dBA)[a]
Mina (Mina common segment 1)	834	62	67	69
Silver Peak (Montezuma alternative segment 1)	442	67	73	74
Goldfield (Montezuma alternative segment 2)	250	72	78	79

a. dBA = A-weighted decibels; L_{eq} = equivalent sound level.
b. To convert meters to feet, multiply by 3.2808.

Table 4-239. Estimated construction noise levels along the Mina rail alignment (30-day DNL).[a]

Location (segment)	Approximate distance to nearest receptor (meters)[b]	30-day bulldozer DNL	30-day truck DNL	Total 30-day DNL (dBA)
Mina (Mina common segment 1)	834	47	53	54
Silver Peak (Montezuma alternative segment 1)	442	53	58	59
Goldfield (Montezuma alternative segment 2)	250	58	63	64

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. To convert meters to feet, multiply by 3.2808.

The distances from construction activities to the nearest receptors would be great; therefore, construction noise levels would be below the Federal Transit Administration noise guidelines listed in Table 4-237.

There would be construction noise associated with removal of the existing Department of Defense track through Schurz, but this noise would be temporary and no adverse impact would be expected.

The Maintenance-of-Way Facility would be the only railroad operations support facility within the general vicinity of a populated area. However, this facility would be much farther from Silver Peak than the proposed rail line and, consequently, construction of the facility would produce lower noise levels. Therefore, there would be no adverse noise impacts from construction of associated rail facilities.

4.3.8.2.2 Construction Vibration

DOE based the construction vibration analysis on Federal Transit Administration methods (DIRS 177297-Hanson, Towers, and Meister 2006, all). Construction vibration should be assessed in cases where there is a significant potential for impact from construction activities. Such activities include blasting, pile driving, drilling, or excavation close to ***sensitive structures***. No pile driving is planned near populated areas, so pile driving vibration analysis is not required.

Based on the proposed construction equipment and Federal Transit Administration vibration data, DOE estimated potential ground-borne vibration levels due to construction activity. Table 4-240 lists estimated vibration levels associated with potential bulldozer activity.

Table 4-240. Estimated construction vibration levels along the Mina rail alignment.

Location (segment)	Approximate distance to nearest receptor (meters)[a]	Peak particle velocity (inches per second)
Mina (Mina common segment 1)	834	0.000078
Silver Peak (Montezuma alternative segment 1)	442	0.000201
Goldfield (Montezuma alternative segment 2)	250	0.0005

a. To convert meters to feet, multiply by 3.2808.

The vibration levels listed in Table 4-240 are below Federal Transit Administration building vibration damage criteria (0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings). Therefore, DOE would expect no damage to buildings due to vibration during construction. In addition, because of relatively low vibration levels and the temporary nature of construction, human annoyance due to construction vibration would be low.

Blasting operations could be required as part of the excavation process to accommodate the rail roadbed in hilly areas. Uncertainty about the need for and the exact locations of blasting operations is typical at this phase of the proposed project. If blasting were needed and would occur near populated areas, DOE would assess potential blasting noise and vibration and take measures to minimize these temporary impacts, if any.

None of the railroad operations support facilities would be near receptors; therefore, there would be no adverse vibration impacts from construction of these facilities.

4.3.8.2.3 Construction-Train Noise

As the rail roadbed, track, and bridges were completed, construction trains would be employed to move railroad ties, ballast, and other rail-construction equipment to other construction areas. Up to 16 one-way trains per day could pass by certain receptor locations, such as those in Mina and Silver Peak, during a 4-year construction phase. Up to eight trains per day could pass by certain receptor locations on the Union Pacific Railroad Hazen Branchline in Silver Springs during the construction period. If the construction period was extended up to 10 years, the same total amount of construction trains would operate, but at a lower average number of trains per day. This analysis conservatively uses the higher number of 16 trains per day for Mina and Silver Peak and 8 trains per day for Silver Springs. As with operations trains, locomotive horn sounding at grade crossings would be the dominant noise source.

Using the equations in Appendix I, Section I.2.1, and analytical methods described in that appendix, DOE generated construction-train noise contours for Silver Springs (on the Union Pacific Railroad Hazen Branchline) and for two other populated areas near the Mina rail alignment: Mina and Silver Peak. Figures 4-31 through Figures 4-34 show 65 DNL noise contours for construction-train activity in these areas.

DOE estimates that 34 receptors would be included within the construction-train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would not be considered adverse because the construction phase would be temporary. There would be no receptors within the construction-train 65 DNL contours in Mina and Silver Peak. DOE estimates that 713 receptors would be included within the construction-train 3 dBA increase contours in Silver Springs (see Figure 4-35), and 15 receptors would be included within the 3 dBA increase contours in Wabuska (see Figure 4-36). There would be no receptors within the 3 dBA increase contour in Mina as shown in Figure 4-37. However, as shown in Figure 4-38, approximately 12 receptors would be included within the 3 dBA increase contour in Silver Peak. DOE estimates that 190 receptors would be included within the 3 dBA increase contour in Goldfield.

There would be no adverse noise impacts associated with these receptors because they would not experience a 3 dBA increase and also be exposed to 65 DNL or greater noise levels. The purpose of the 3 dBA increase component of STB noise guidelines is to identify potential impact areas and areas where train noise would be particularly audible. However, because transportation noise sources are audible throughout the United States, the audibility of train noise itself does not constitute an adverse noise impact.

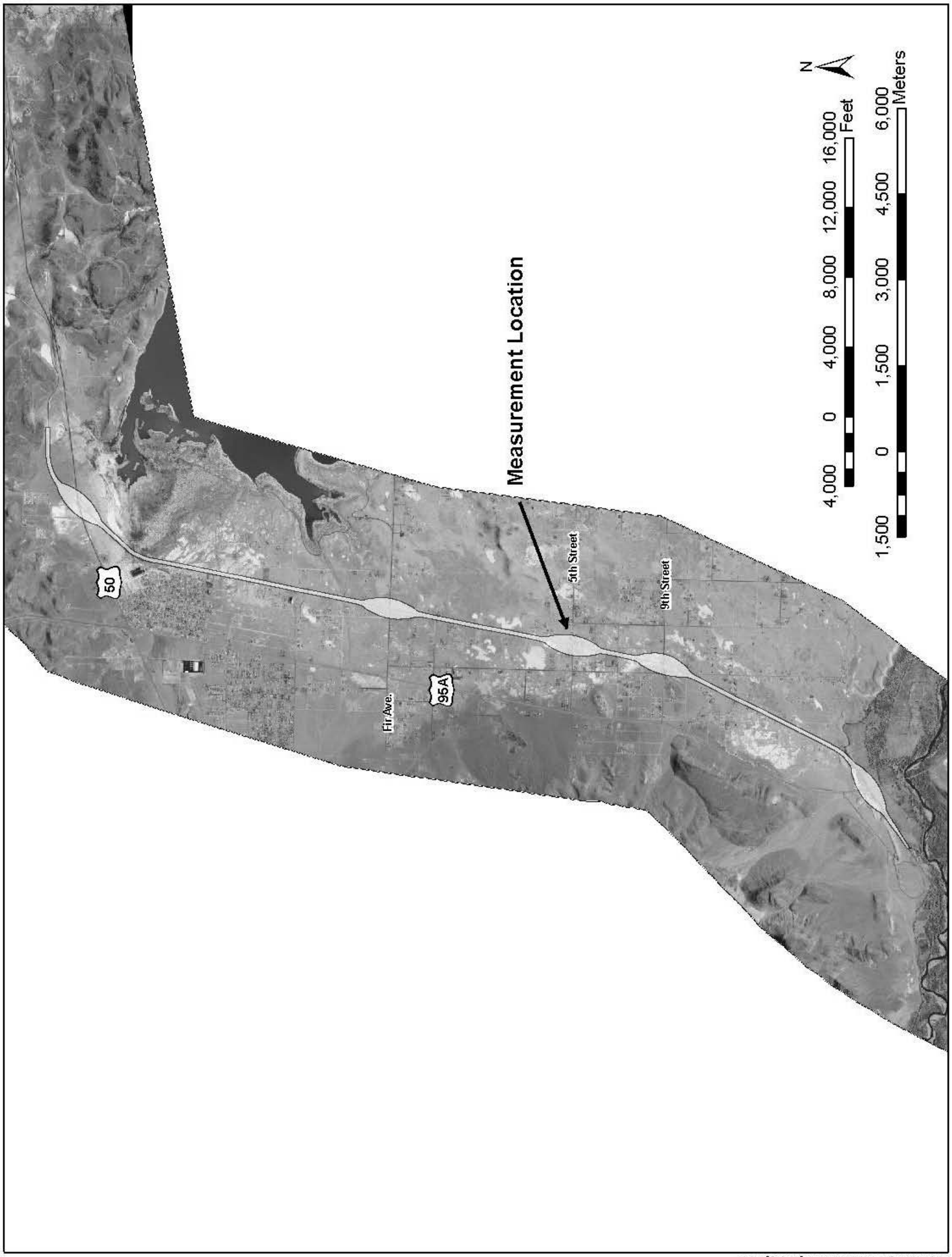


Figure 4-31. Construction-train 65 DNL contour, Silver Springs, Nevada.

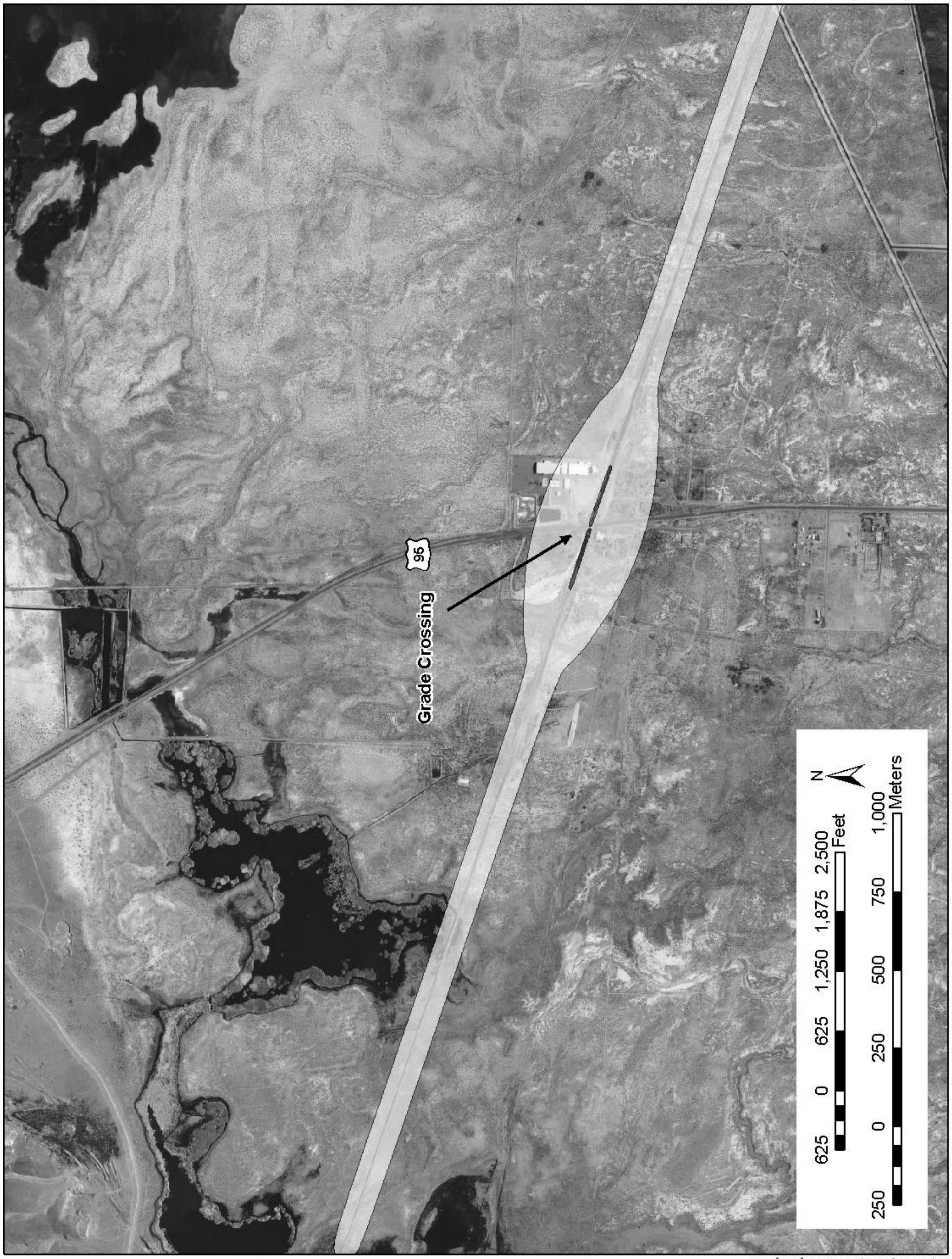


Figure 4-32. Construction-train 65 DNL contour, Wabuska, Nevada.

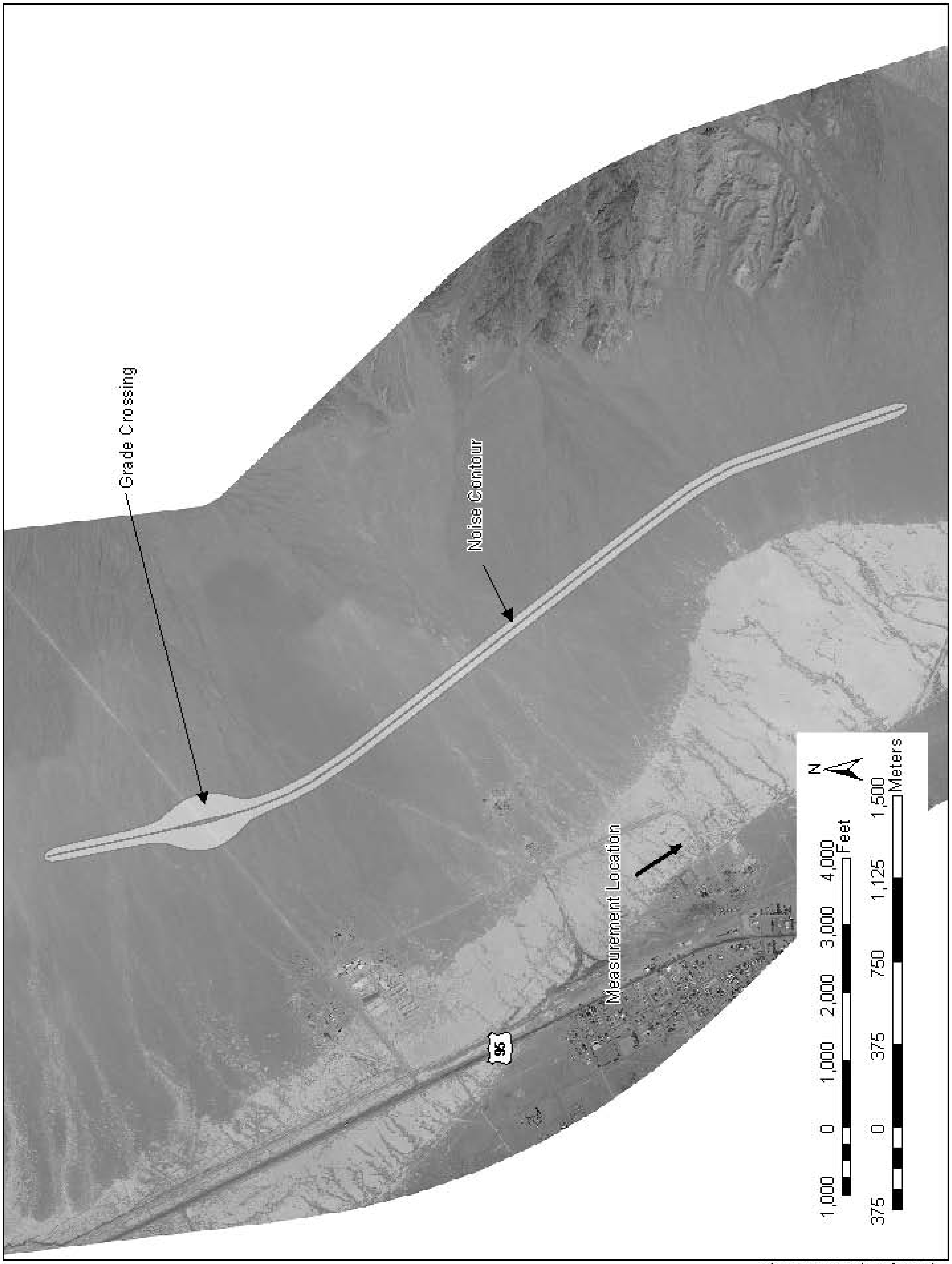


Figure 4-33. Construction-train 65 DNL contour, Mina, Nevada.

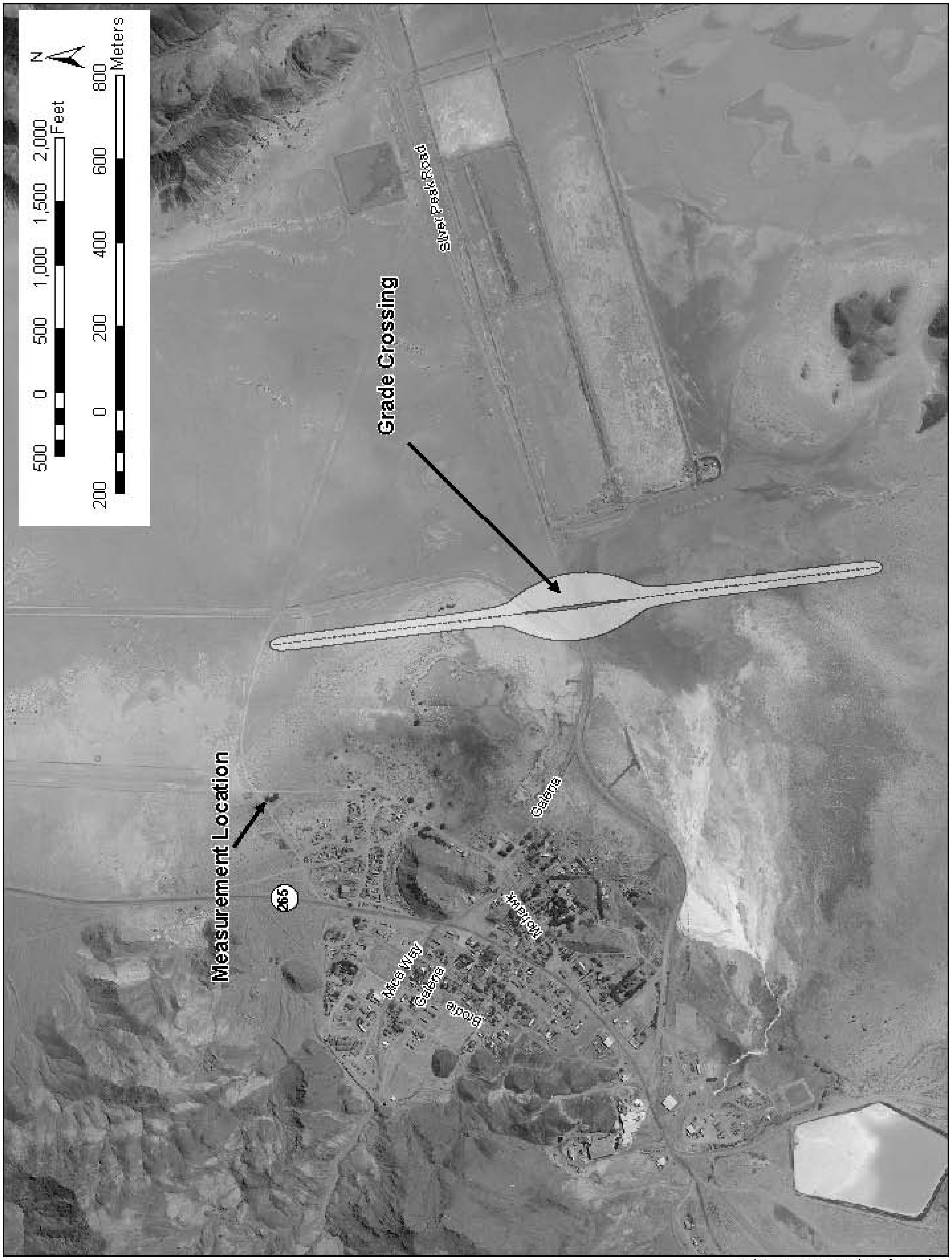


Figure 4-34. Construction-train 65 DNL contour, Silver Peak, Nevada.

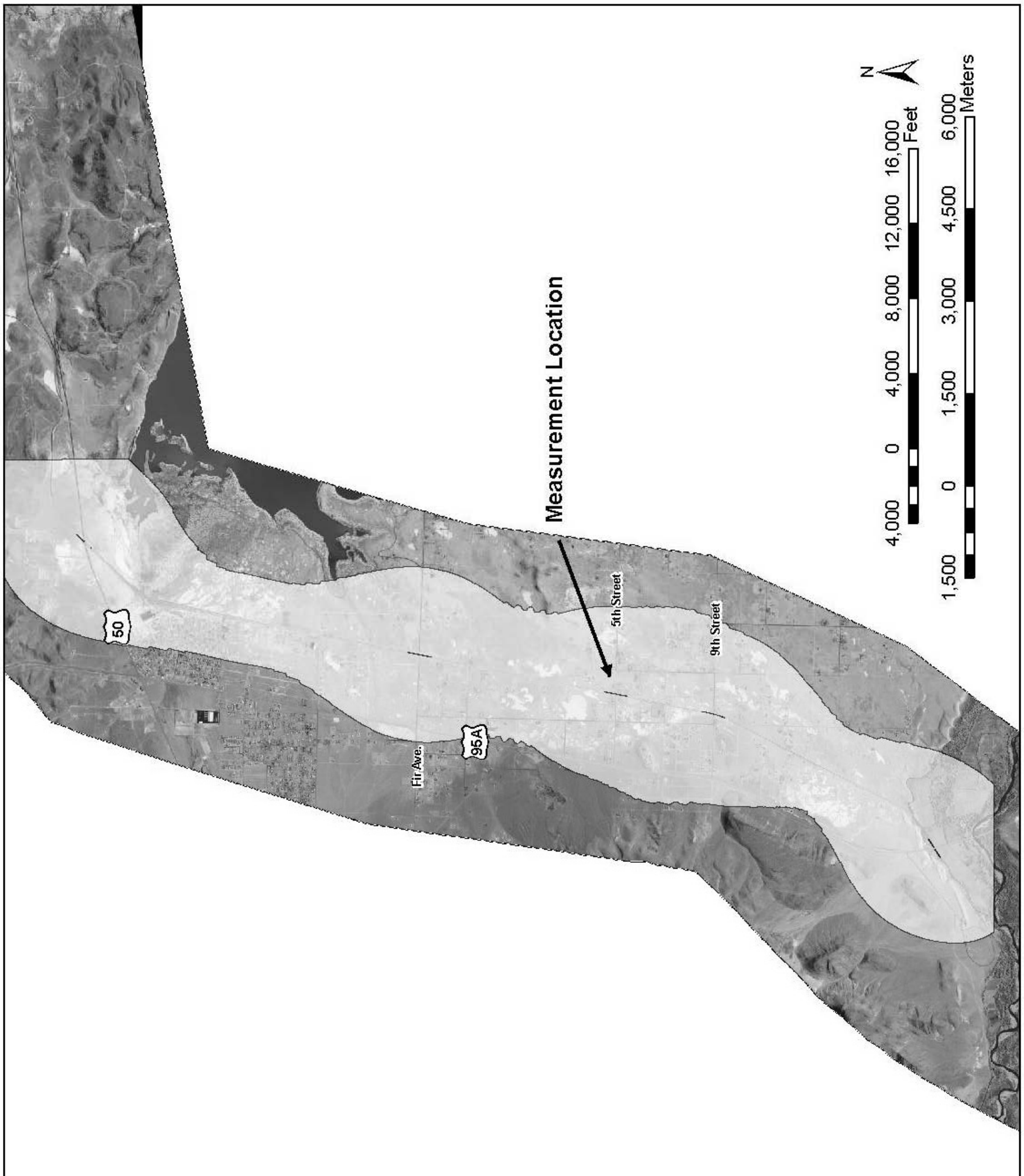


Figure 4-35. Construction-train 3 dBA increase contour, Silver Springs, Nevada.

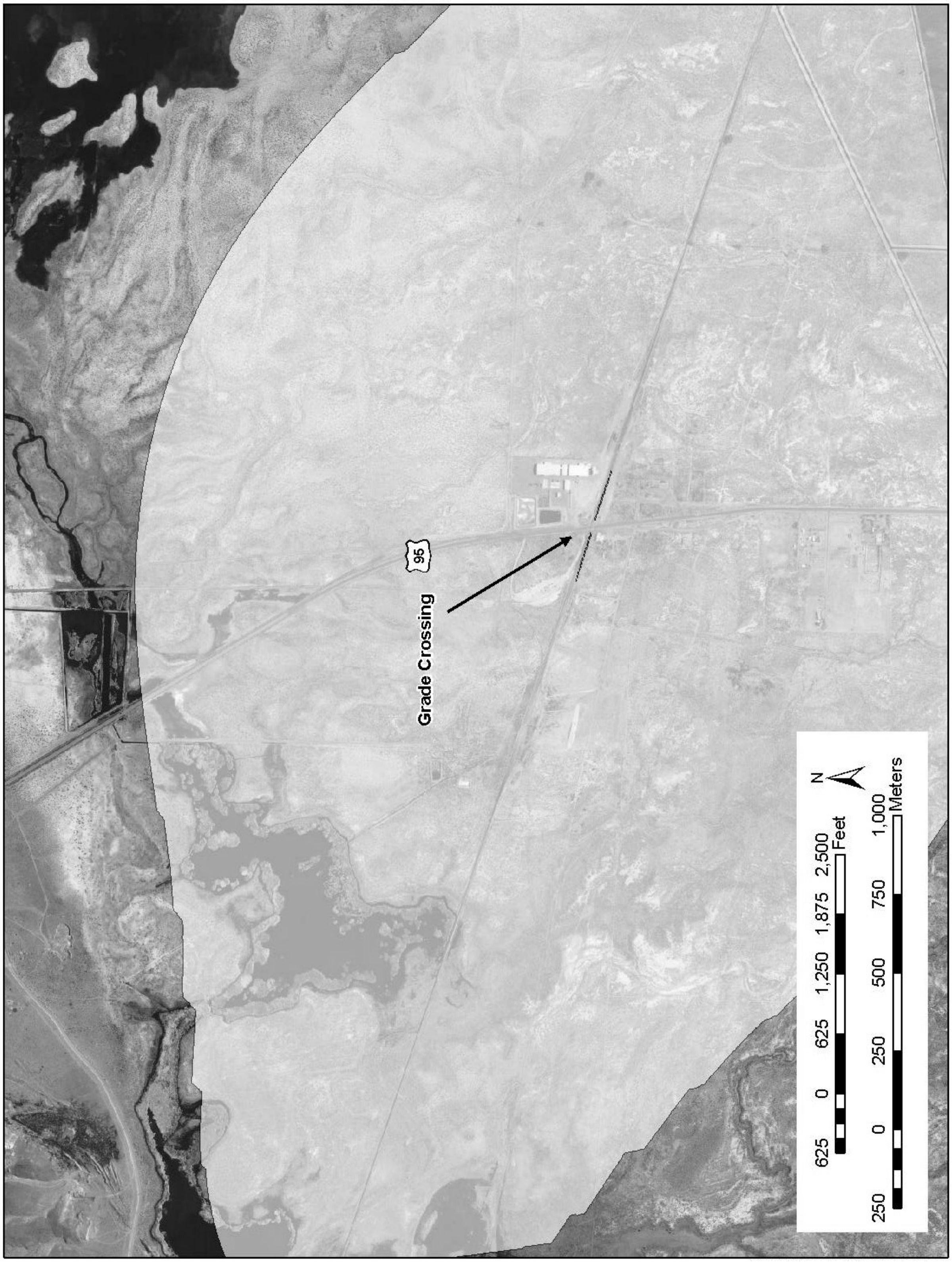


Figure 4-36. Construction-train 3 dBA increase contour, Wabuska, Nevada.

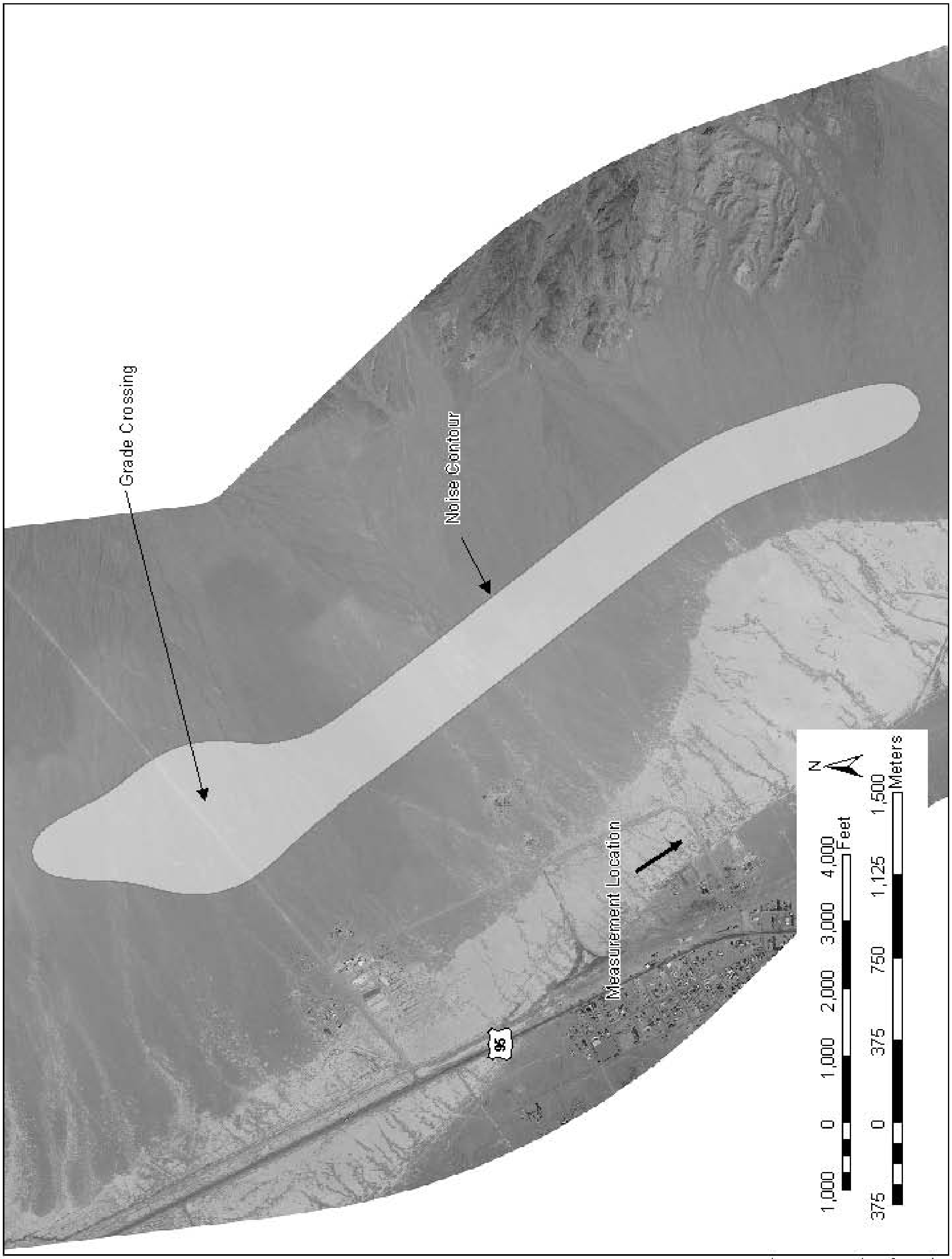


Figure 4-37. Construction train 3 dBA increase contour, Mina, Nevada.

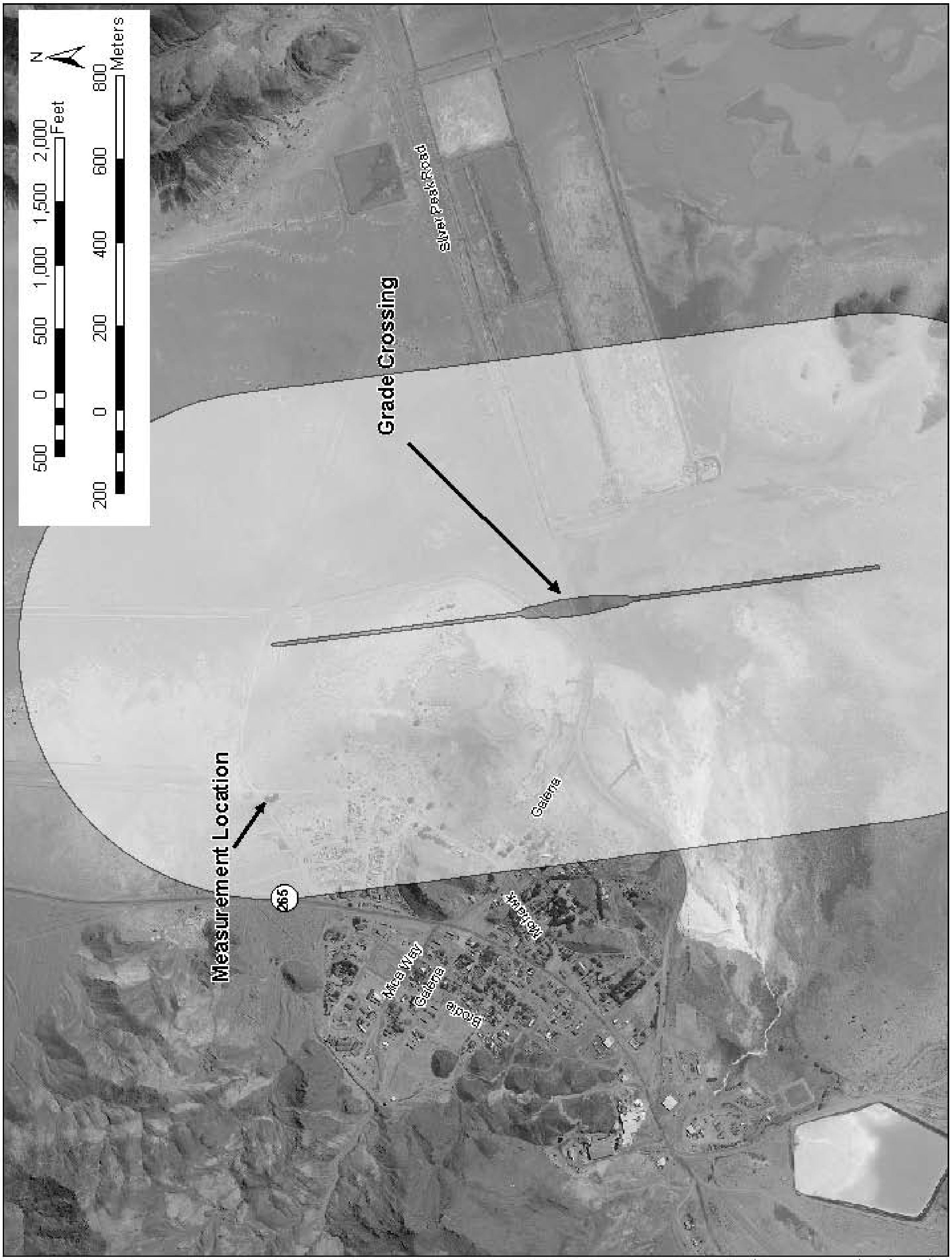


Figure 4-38. Construction-train 3 dBA increase contour, Silver Peak, Nevada.

4.3.8.2.4 Construction-Train Vibration

Construction trains would travel at lower speeds than operations trains. Because vibration is a function of train speed, construction-train vibration would be lower than operations-train vibration (see Section 4.3.8.3.4). Freight trains operating at 80 kilometers (50 miles) per hour would produce an annoyance-based vibration contour extending approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no buildings within approximately 24 meters of the Mina rail alignment, so operations trains would produce no adverse vibration impacts; therefore, there would be no adverse vibration impacts from construction trains.

Construction-train cars carrying ballast could weigh more than operations-train cars; therefore, those cars could produce higher levels of vibration. The locomotive itself would be considered representative of heavier cars. However, typically the locomotive produces the highest vibration level during a train passby, which would determine the maximum passby vibration level. Because operations-train and construction-train locomotives would be similar, the higher-speed operations locomotive would generate the highest level of vibration.

4.3.8.2.5 Quarry-Site Noise

Noise sources associated with potential quarry operations during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic. There are no receptors in the immediate vicinity of the potential Garfield Hills, Gabbs Range, North Clayton, and Malpais Mesa quarry sites. Therefore, there would be no noise impacts associated with operation of these quarries during rail line construction.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in west Goldfield. While quarry noise would likely be audible in west Goldfield, this distance and the intervening topography, which would act as a barrier to and would attenuate noise, would make it unlikely that there would be adverse noise impacts from this quarry.

4.3.8.2.6 Quarry-Site Vibration

Vibration sources associated with operations at potential quarries during the construction phase include blasting, rock crushing, heavy-equipment operation, and truck traffic. Peak overpressures and ground-borne vibration associated with blasting can be an issue in relation to the structural integrity of buildings close to blasting activities.

There are no receptors in the immediate vicinity of the potential Garfield Hills, Gabbs Range, North Clayton, and Malpais Mesa Quarry sites. Therefore, there would be no vibration impacts associated with operation of these quarries during the construction phase.

At potential quarry ES-7 west of Goldfield, there would be blasting and rock-crushing activities at least 1,500 meters (5,000 feet) away from receptors in west Goldfield. Because of this large distance between quarry activities and receptors, it is unlikely that ground-borne vibration would be perceptible at receptor locations; therefore, there would be no adverse vibration impacts.

4.3.8.3 Operations Impacts

The primary sources of noise considered in the analysis for railroad operations were wayside train noise and horn noise. Wayside noise refers collectively to all train-related operations noise adjacent to the operations right-of-way, excluding locomotive warning-horn noise. Wayside noise results from steel train wheels contacting steel rails (wheel-rail noise) and from locomotive exhaust and engine noise. The amount of noise created by the wheels on the rails would depend on train speed; the amount of engine noise created by the locomotive would depend on the throttle setting. Wheel squeal can sometimes occur on curved sections of track where the radius of curvature of the track is small. There would be horn noise in the vicinity of grade crossings to warn motorists and pedestrians of approaching trains; this noise is assessed separately from wayside noise.

Operation of any of the Schurz alternative segments would eliminate future noise from operation of the Department of Defense Branchline through Schurz.

4.3.8.3.1 Wayside Noise

Appendix I describes the methodology DOE used to estimate wayside noise during the operations phase. Wheel-rail noise would vary as a function of speed and could increase by as much as 15 dBA if wheels or rails were in poor condition (DIRS 174623-Kaiser 1998, all). One of the most common causes of additional noise from wheels is the formation of flat surfaces on wheels caused by wheels sliding during hard braking.

The main components of locomotive noise are the exhaust of the diesel engines, cooling fans, general engine noise, and the wheel-rail interaction. Noise associated with the engine exhaust and cooling fans usually dominates; this noise would depend on the throttle setting (most locomotives have eight throttle settings), not on locomotive speed. Tests have shown that locomotive noise levels change by about 2 dBA for each step change in throttle setting, meaning that noise levels increase by about 16 dBA as the locomotive throttle is moved from notch one to notch eight (DIRS 174623-Kaiser 1998, all). Because locomotive engineers constantly adjust throttle settings as necessary, only rough estimates of throttle settings are usually available for noise projections. Numerous field measurements of freight train operations indicate that locomotive noise can be projected with reasonable accuracy by assuming a base condition of throttle position six and adjusting noise levels when better information about typical throttle position is known.

Given the maximum train passby noise level of freight cars and a locomotive under a specific set of reference conditions, the noise models allow estimation of the maximum train passby noise level, the noise exposure level, the DNL, and other noise metrics for varying distances from the track, varying train speeds, and varying schedules.

The spent nuclear fuel and high-level radioactive waste train used to model noise impacts for this analysis would consist of two to three locomotives and four to eight railcars (one to five ***cask cars***, two ***buffer cars***, and one escort car). The average length of the cars would be about 18 to 27 meters (59 to 89 feet), and the length of the locomotives would be 23 meters (75 feet), for a total train length ranging from 118 to 285 meters (390 to 940 feet).

Trains would operate along the rail line at a top speed of 80 kilometers (50 miles) per hour. Because train speed has a direct correlation to noise generated, DOE used the top train speed to conservatively estimate potential noise levels. Table 4-241 lists distances to the wayside 65 DNL noise contour along the Mina rail alignment, assuming an average of 2.4 trains per day (based on 17 one-way trips per week). The average of 2.4 trains per day includes ***cask*** trains, maintenance-of-way trains, and repository supply and construction trains.

Table 4-241. Summary of distances to 65 dBA DNL along the Mina rail alignment.

Area	Speed in kilometers per hour[a]	Distance in meters[b] to 65 dBA DNL contour[c]		Noise level increase (dBA)[c]
		Wayside	Horn	
Silver Springs	80[d]	17	75	0 to 12
Mina	80	17	75	0
Silver Peak	80	17	75	0 to 6
Goldfield	80	17	75	0 to 10

a. To convert kilometers per hour to miles per hour, multiply by 0.62137.
b. To convert meters to feet, multiply by 3.2808.
c. dBA = A-weighted decibels; DNL = day-night average noise level.
d. Actual speeds would be lower.

4.3.8.3.2 Horn Noise

The key components in projecting noise exposure from horn noise are the horn sound level, the duration of the horn noise, the distance of the receptor from the tracks, and the number of trains running during daytime and nighttime hours.

For safety reasons, the Federal Railroad Administration requires train engineers to sound horns when approaching most grade crossings unless a Quiet Zone has been established. Horn sounding is generally not required at private crossings. Federal Railroad Administration regulations at 49 CFR 229.129 require all lead locomotives to have an audible warning device that produces a minimum sound level of 96 dBA at a distance of 30 meters (100 feet) in front of the locomotive.

Most freight train audible warning devices are air horns. The maximum sound level of the air horns can usually be adjusted to some degree by adjusting the air pressure. Maximum sound levels are typically 105 to 110 dBA at 30 meters (100 feet) in front of the trains, well above the 96 dBA value required by the Federal Railroad Administration. Additional noise sources associated with grade crossings would be the grade crossing bells that would start sounding just before the gates were lowered, and idling road traffic that must wait at the crossing. Because train horns create high noise levels, noise exposure would be dominated by horn noise near any grade crossing where sounding horns is required. The analysis assumes that trains would be equally likely to occur at any hour of the day or night. Table 4-241 does not include adjustments for building or terrain shielding. At distances beyond approximately 30 meters, obstructions such as buildings or terrain could act as a partial acoustic shield, causing a noise reduction of approximately 5 to 10 dBA. As one of the final steps in the noise modeling process, where appropriate, DOE included adjustments for building shielding, based on International Organization for Standardization standard number ISO 9613-2 *Acoustics – Attenuation of Sound During Propagation Outdoors – Part 2: General Method of Calculation* (DIRS 176684-ISO 1996, all).

4.3.8.3.3 Railroad Operations Noise Impacts

Table 4-241 lists approximate distances to the wayside for train noise without horns and horn-noise contours from the centerline of the rail alignment in Silver Springs, Mina, Silver Peak, and Goldfield. These distances do not include the effects of building shielding. Also shown are potential increases in noise in relation to ambient noise conditions, which would vary between and within the areas where DOE took ambient noise measurements. Ambient noise refers to existing conditions in the region of influence. At present, there is no train activity in Mina, Silver Peak, or Goldfield, but there is train activity in Silver Springs.

Figures 4-39 through 4-43 show modeled 65 DNL contours in Silver Springs, Wabuska, Mina, Silver Peak, and Goldfield. DOE counted receptors that would be included in the contours in accordance with STB procedures (DIRS 173225-STB 2003, all). These figures show that eight receptors would be included in the 65 DNL contours in Silver Springs and one receptor would be included in Wabuska. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase. Should the Mina rail alignment (currently a nonpreferred alternative) be selected, DOE would investigate mitigation methods for these nine receptors. Mitigation methods, where reasonable and feasible, could include building sound insulation or the development of a Quiet Zone. Alternatively, DOE could provide sound insulation for houses near grade crossings

Figures 4-44 through 4-48 show 3 dBA increase contours in Silver Springs, Wabuska, Mina, Silver Peak, and Goldfield. Table 4-242 shows the number of receptors included in the noise contours.

Table 4-242. Mina Implementing Alternative receptor counts.[a]

	Silver Springs	Wabuska	Mina	Silver Peak	Goldfield
Greater than or equal to 65 DNL + 3 dBA[b]	8	1	0	0	0
Less than 65 DNL + 3 dBA[c]	567	20	0	8	87

a. dBA = A-weighted decibels; DNL = day-night average noise level.
b. Adverse noise impact.
c. No adverse noise impact. The purpose of the 3 dBA-increase criterion is to identify potential impact areas where train noise would be particularly audible.

4.3.8.3.4 Railroad Operations Vibration Impacts

At certain times, such as when a locomotive is idling near a residential building, trains can produce low-frequency airborne noise, which in turn can cause structural vibrations. However, trains generally do not produce enough airborne noise or ground-borne vibrational energy to cause building damage.

DOE evaluated the potential impacts from vibration during railroad operations by using train-induced vibration levels as a function of distance from a rail line, along with vibration levels likely to result in building damage or annoyance, in combination with information on the location of residences or other buildings in relation to the rail line.

Unlike noise, vibration impacts are evaluated on the basis of maximum level. A freight train traveling at 80 kilometers (50 miles) per hour will generate a vibration velocity level of 95 decibels with respect to 1 micro-inch per second (VdB), measured 3 meters (10 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). This level of vibration is substantially lower than levels that can cause cosmetic building damage (0.20 inch per second), nominally a vibration velocity of 106 VdB, or 100 VdB, assuming a crest factor of 2 (DIRS 176857-Martin 1980, all). This level of vibration is even lower than that which can cause structural damage (126 VdB) (DIRS 175495-Nicholls, Johnson, and Duvall 1971, all). There are no buildings within 3 meters of the Mina rail alignment, so there would be no adverse vibration impacts to buildings.

According to the Federal Transit Administration, a vibration velocity of 80 VdB or above constitutes an impact in terms of human annoyance for infrequent train events (that is, fewer than 70 events per day). For a freight train traveling 80 kilometers (50 miles) per hour, this annoyance impact distance extends approximately 24 meters (80 feet) from the tracks (DIRS 177297-Hanson, Towers, and Meister 2006, p. 10-3). There are no residential buildings within this distance of the Mina alignment; therefore, DOE expects no adverse vibration impacts related to annoyance.

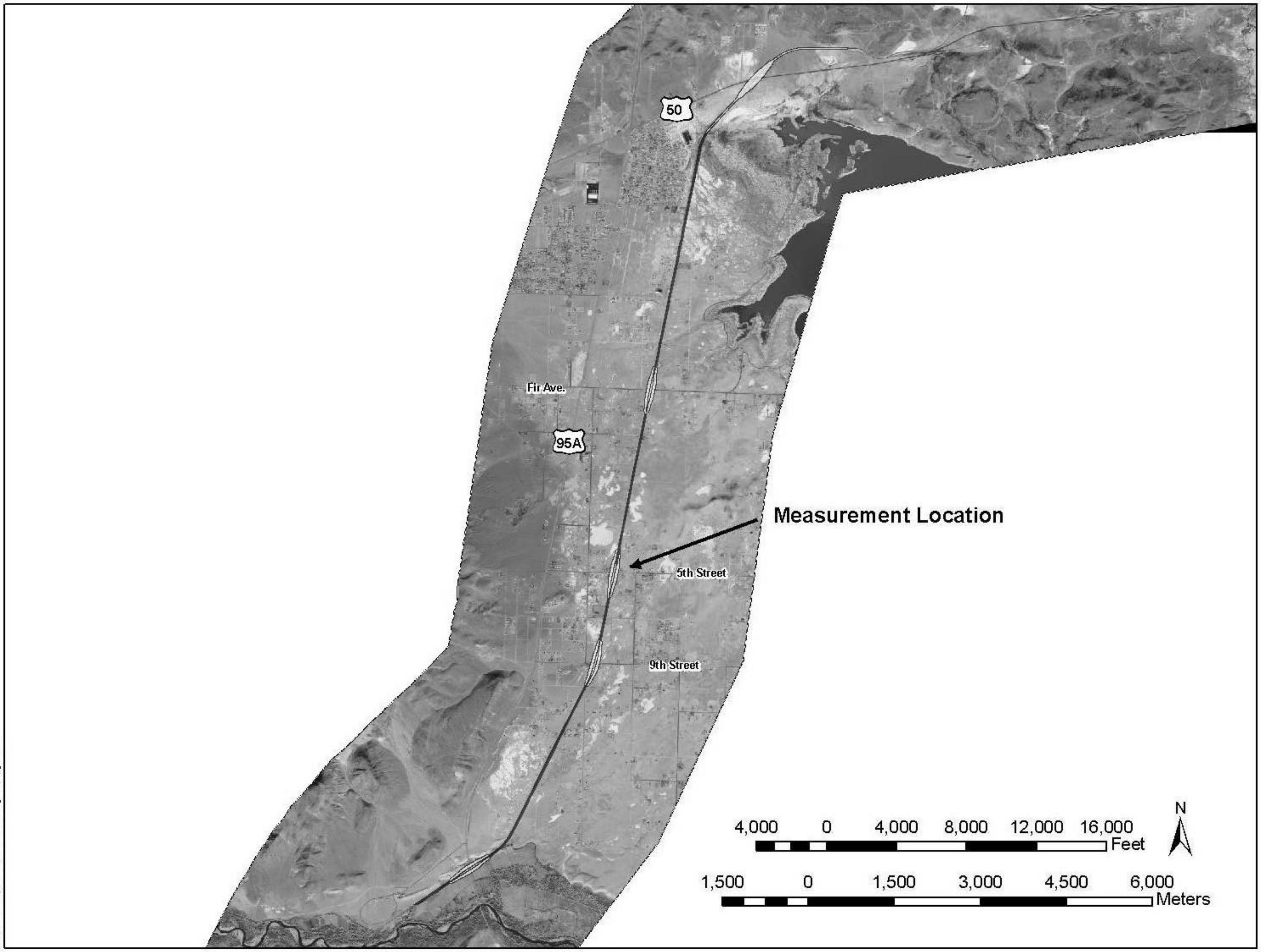


Figure 4-39. 65 DNL contour, Silver Springs, Nevada.

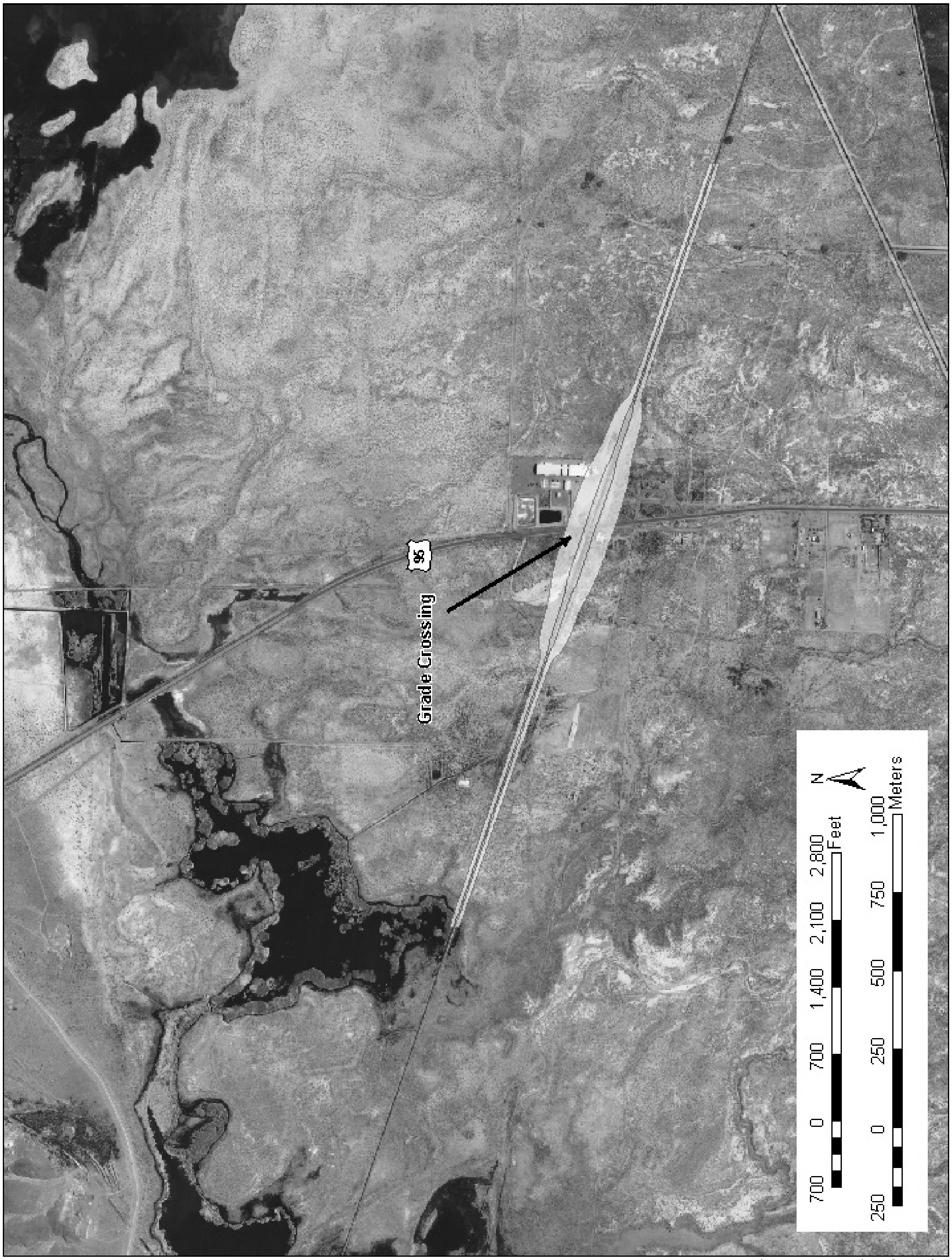


Figure 4-40. 65 DNL contour, Wabuska, Nevada.

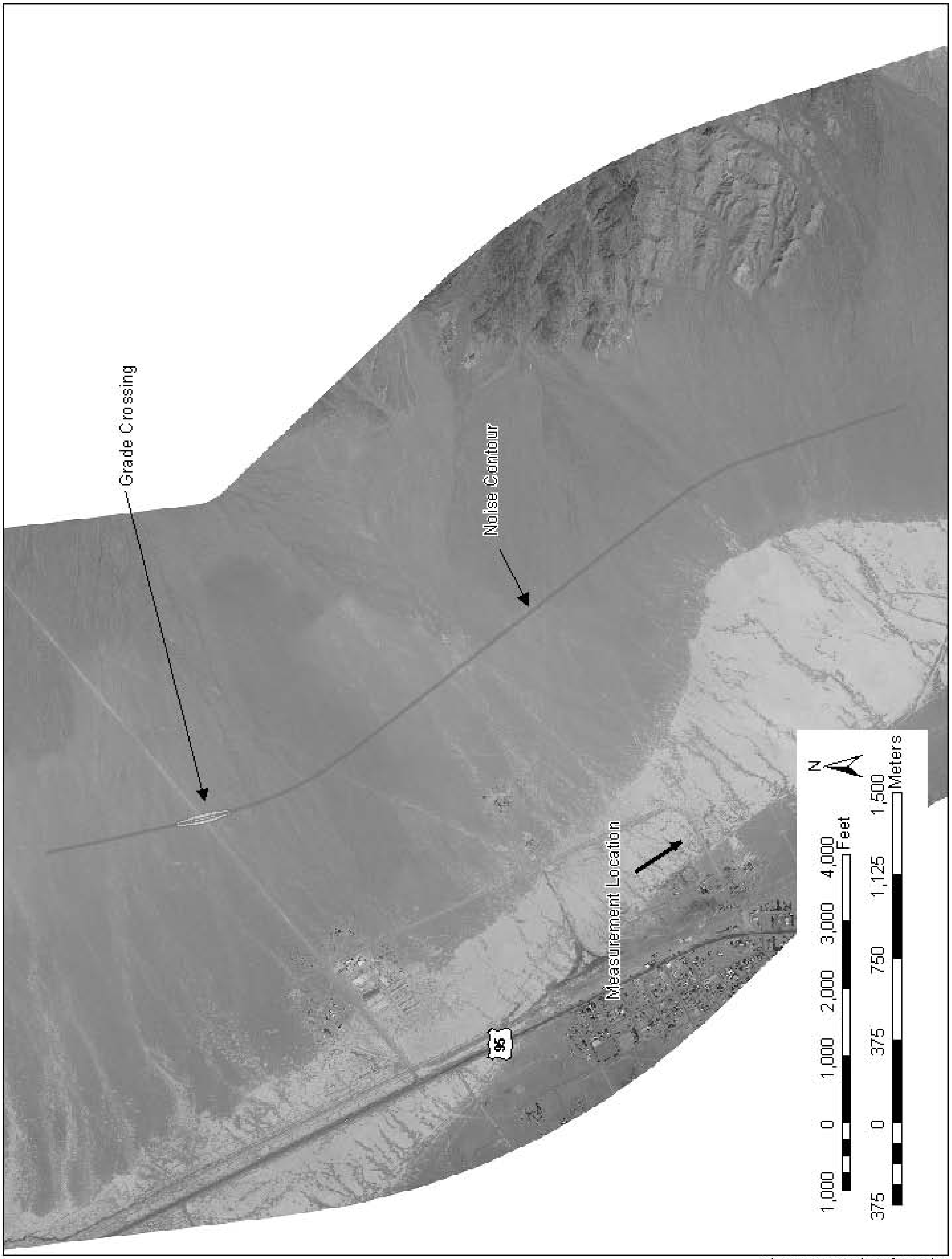


Figure 4-41. 65 DNL contour, Mina, Nevada.

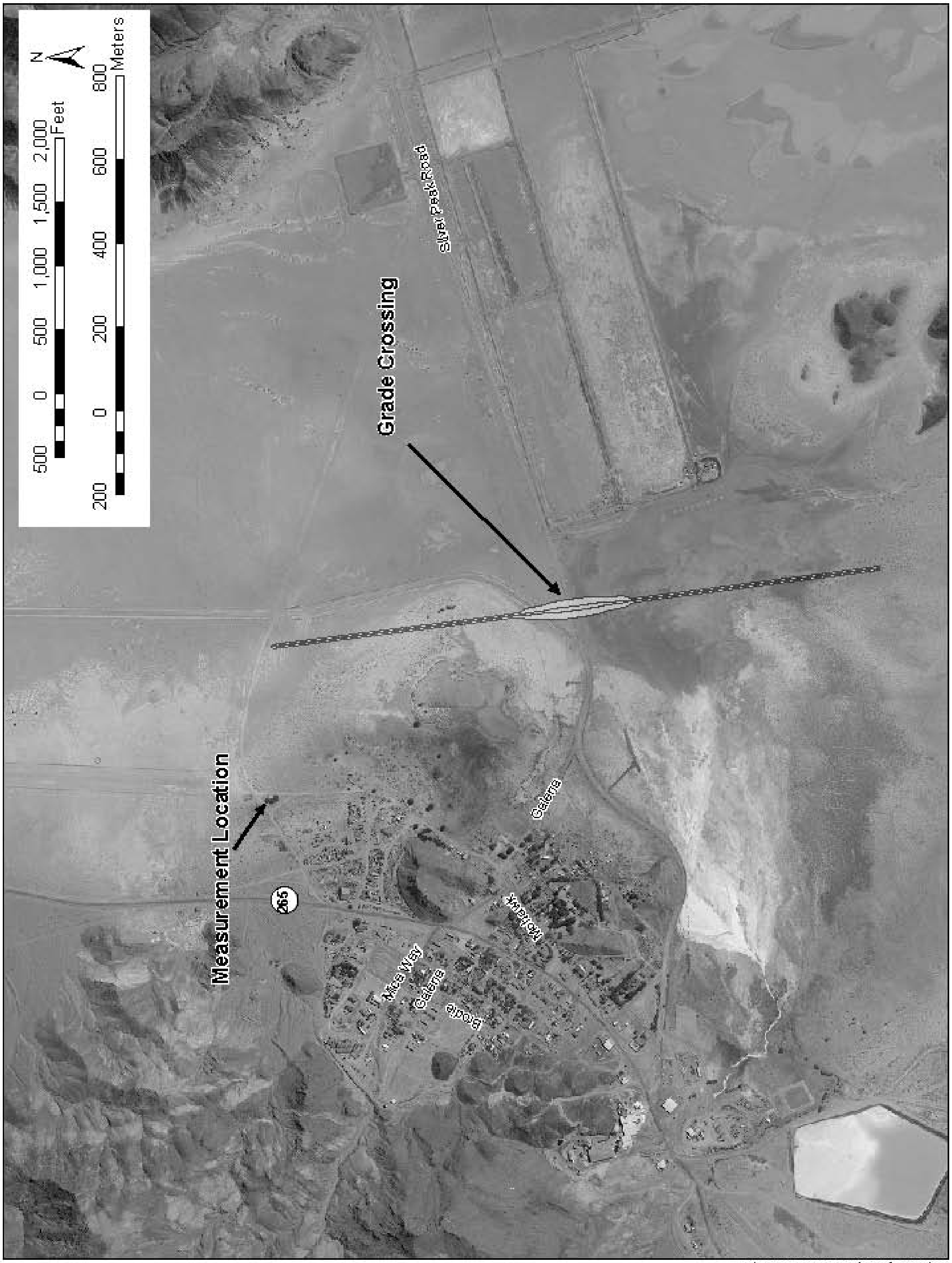


Figure 4-42. 65 DNL contour, Silver Peak, Nevada.

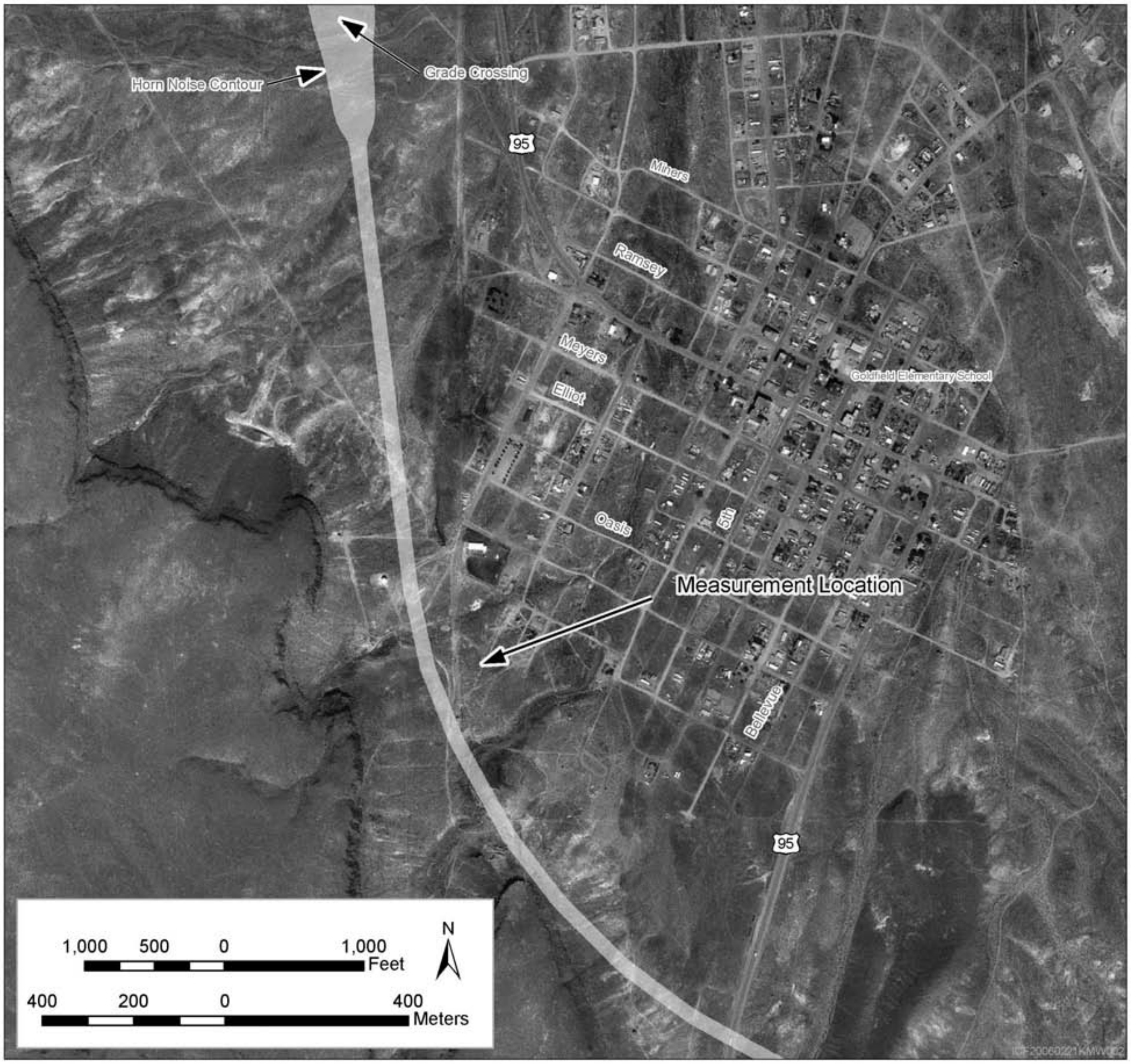


Figure 4-43. 65 DNL contour, Goldfield, Nevada. (Source: DIRS 174497-Keck Library 2004, filename 37117F21.sid.)

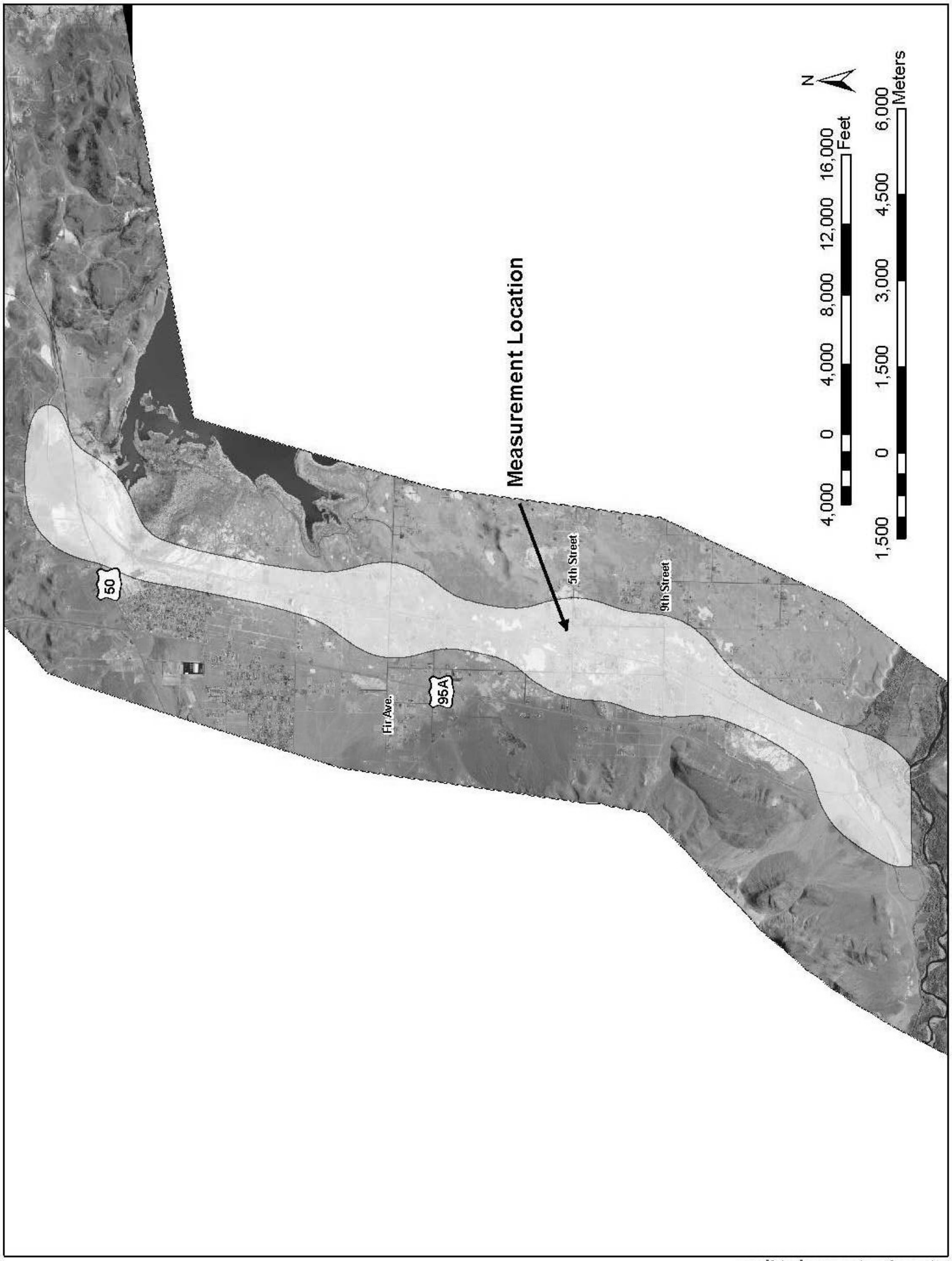


Figure 4-44. 3 dBA increase contour, Silver Springs, Nevada.

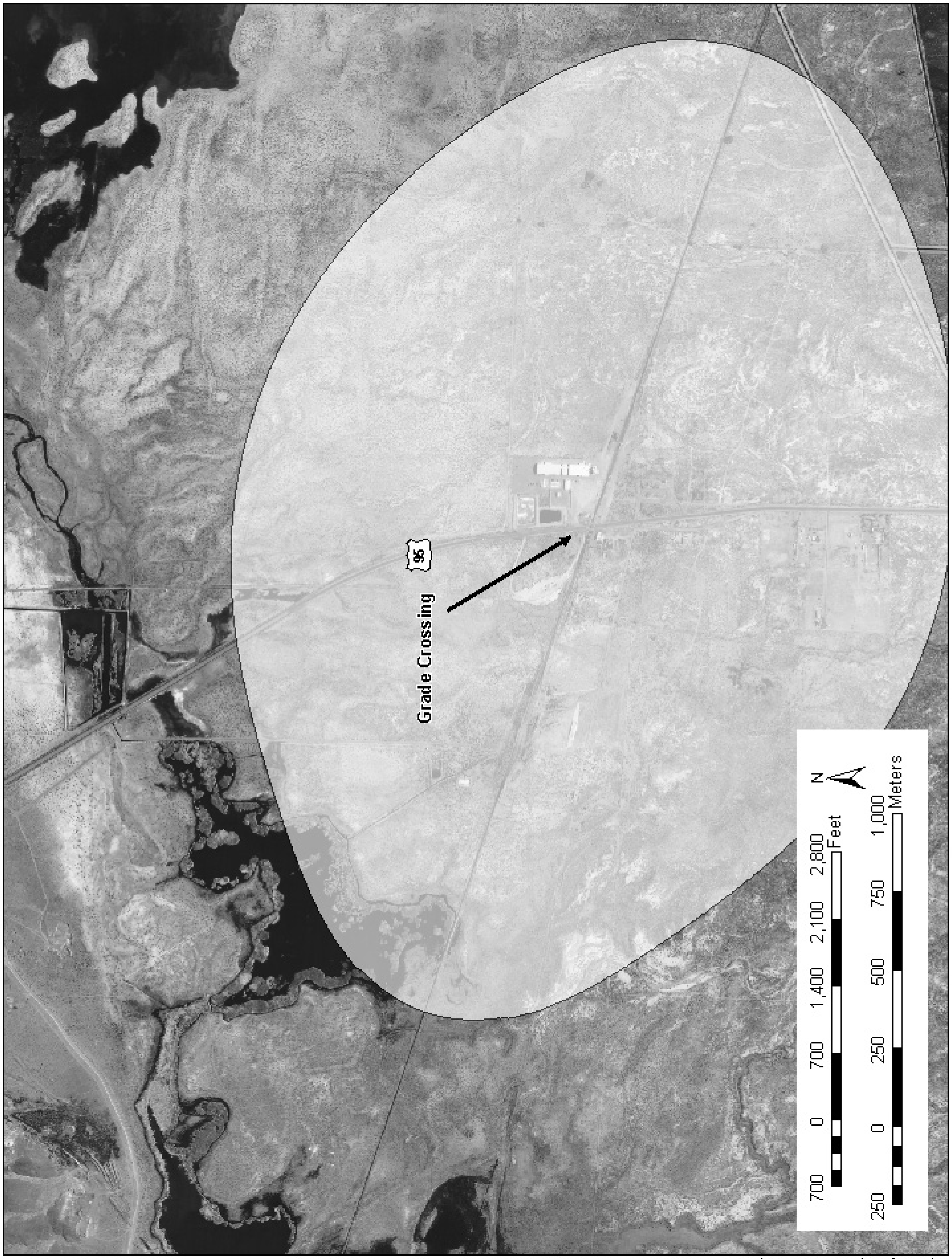


Figure 4-45. 3 dBA increase noise contour, Wabuska, Nevada.

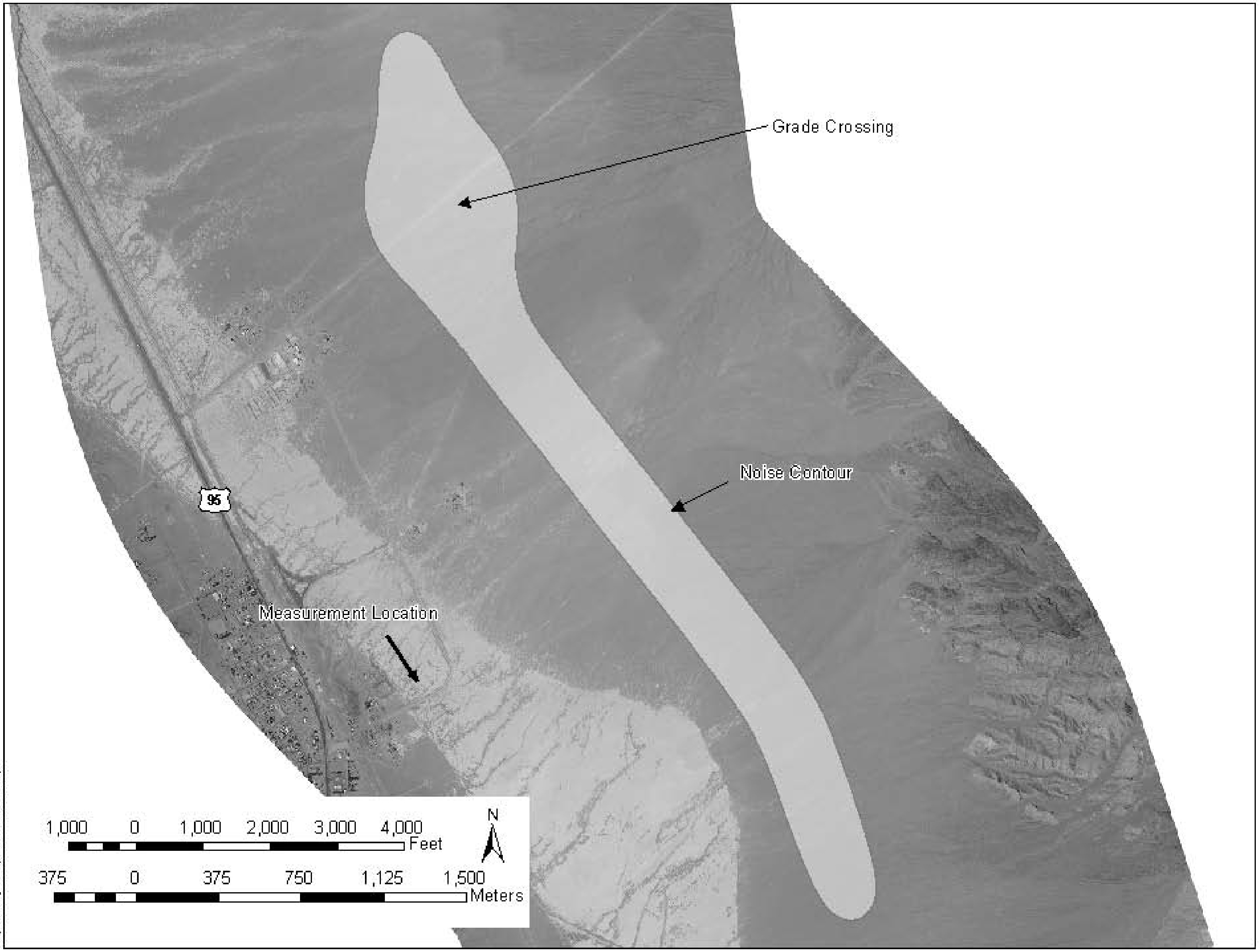


Figure 4-46. 3 DBA increase contour, Mina, Nevada.

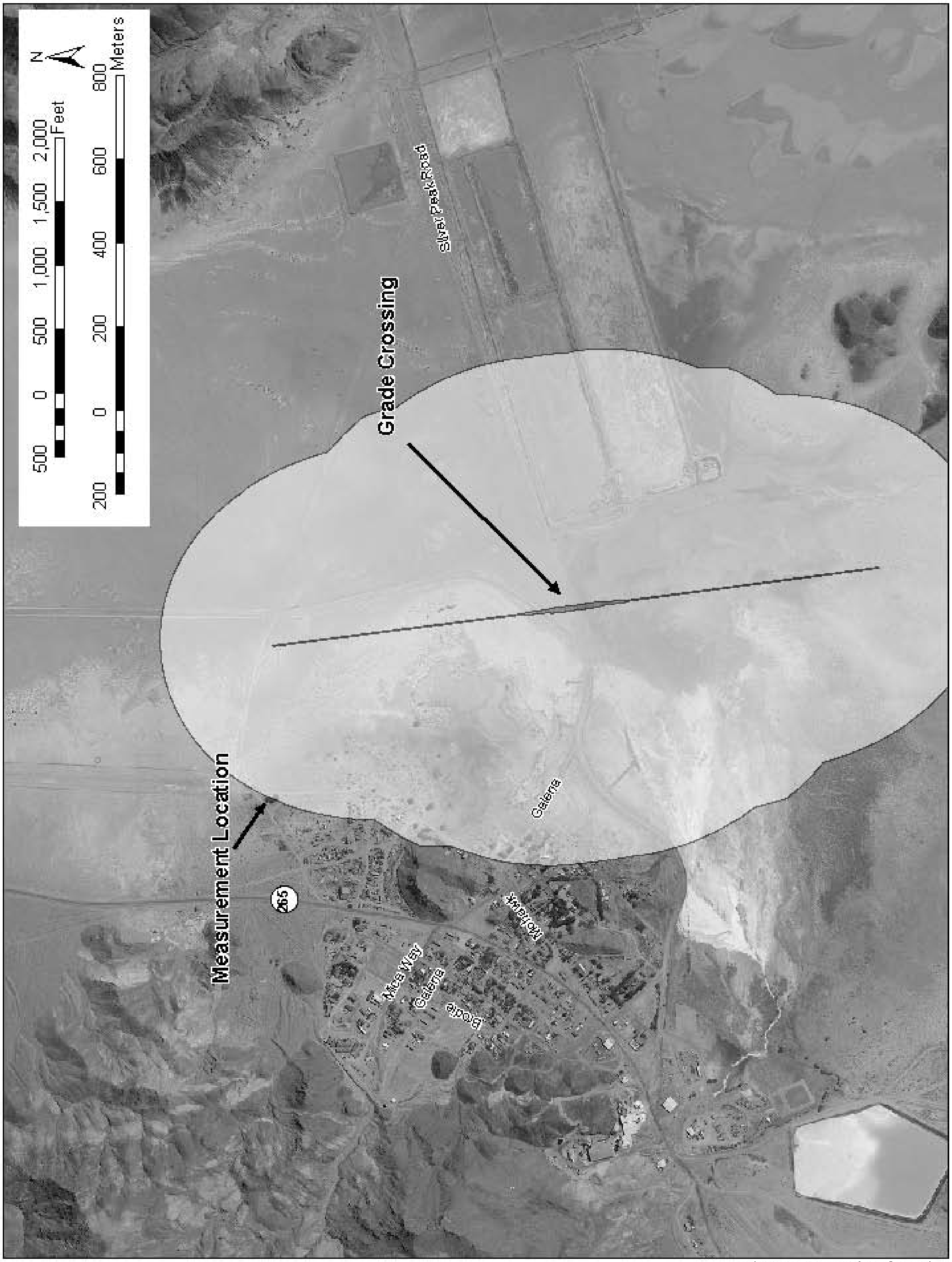


Figure 4-47. 3 dBA increase contour, Silver Peak, Nevada.

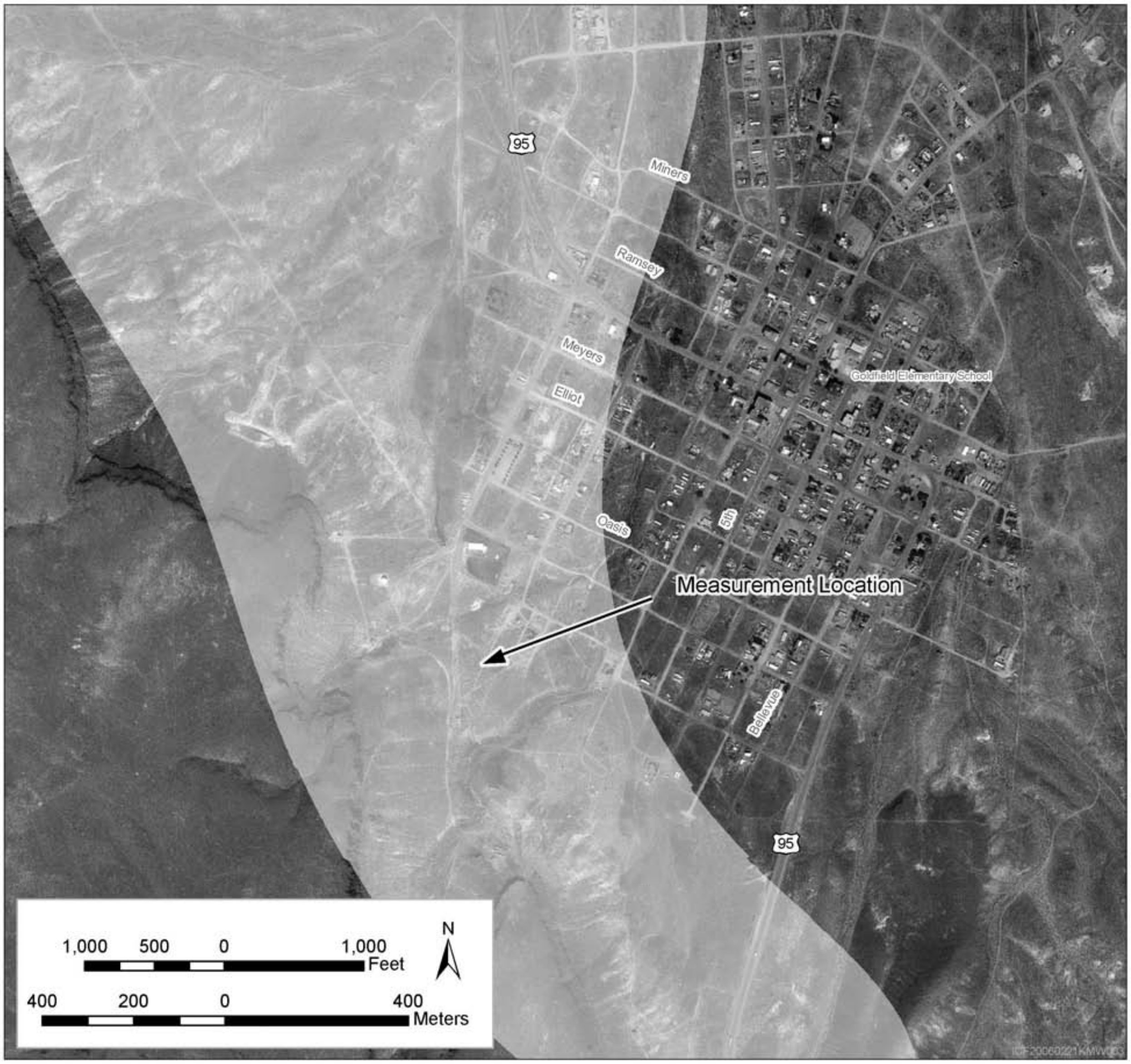


Figure 4-48. 3 dBA increase contour, Goldfield, Nevada. (Source: DIRS 174497-Keck Library 2004, filename 37114F21.sid.)

Operation of any of the Schurz alternative segments would eliminate future vibration from operation of the Department of Defense Branchline through Schurz.

4.3.8.4 Impacts of the Shared-Use Option

The Shared-Use Option could result in increased train operations because DOE would allow commercial shippers to use the rail line. Such increased operations could result in increased noise impacts because DNL is a function of the number of train events per day. Increased train operations would not affect vibration impacts because vibration is evaluated on a maximum-level basis only.

The typical train under the Shared-Use Option would consist of three to four locomotives and up to 60 railcars. The average length of a car would be 18 meters (60 feet) for a total length (railcars only) of

1,100 meters (3,600 feet). Trains would operate along the rail line at a top speed of 80 kilometers (50 miles) per hour. Table 4-243 shows distances to the wayside 65 DNL noise contour, assuming an average of 5 trains per day (the Proposed Action plus Shared-Use Option train volumes).

Table 4-243. Summary of distances to 65 dBA DNL under the Mina rail alignment Shared-Use Option in Silver Springs, Mina, Silver Peak, and Goldfield.[a]

Area	Train speed in kilometers[b] per hour	Distance in meters[c] to 65 dBA DNL contour		Noise level increase (dBA)
		Wayside	Horn	
Silver Springs	80	20	90	0 to 13
Mina	80	20	90	0
Silver Peak	80	20	90	0 to 6
Goldfield	80	20	90	0 to 10

a. dBA = A-weighted decibels and DNL = day-night average noise level.
b. To convert kilometers to miles, multiply by 0.62137.
c. To convert meters to feet, multiply by 3.2808.

The shared-use 65 DNL contours include eight receptors in Silver Springs and one receptor in Wabuska. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase. If DOE selected the Mina rail alignment (currently a non-preferred alternative), DOE would investigate mitigation methods for these nine receptors. Mitigation methods, where reasonable and feasible, could include building sound insulation or the development of a Quiet Zone. There would be no receptors included in the shared-use 65 DNL contours for Mina, Silver Peak, or Goldfield.

DOE estimates that 722 receptors would be included in the shared-use 3 dBA increase contour in Silver Springs, 24 receptors in Wabuska, no receptors in Mina, and 12 receptors in Silver Peak. DOE estimates that 37 receptors would be within the shared-use 3 dBA increase contour in Goldfield. The total estimated number of receptors included within the shared-use 3 dBA increase contour would be 795.

4.3.8.5 Summary

Table 4-244 lists potential noise and vibration impacts related to construction and operation of the proposed railroad along the Mina rail alignment.

During the construction phase, noise levels along the Mina rail alignment would be lower than adverse impact criteria (see Table 4-237). During the operations phase, estimated noise levels at nine receptor locations would be higher than impact criteria (65 DNL, with a 3 dBA or greater increase from the baseline); therefore, there would be adverse noise impacts associated with railroad operations at those locations. Under the Mina Implementing Alternative, DOE would investigate mitigation methods for these nine receptors. Mitigation methods, where reasonable and feasible, could include building sound insulation or the development of a Quiet Zone.

During the construction and operations phase, vibration levels would not exceed the Federal Transit Administration damage criteria of 0.20 inch per second for fragile buildings, and 0.12 inch per second for extremely fragile historic buildings (see Table 4-240); therefore, DOE would expect no building damage due to vibration. In addition, train-generated vibration levels would be lower than Federal Transit Administration human annoyance criterion.

Table 4-244. Summary of potential impacts from noise and vibration as a result of constructing and operating the proposed railroad along the Mina rail alignment[a].

Location (county)	Construction impacts	Operations impacts
Silver Springs (Lyon County)	There would be no impact from vibration, which would fall below Federal Transit Administration criteria. DOE estimates that 34 receptors would be included within the construction-train 65 DNL contours in Silver Springs, and 7 receptors would be included within the 65 DNL contours in Wabuska. These noise impacts would be considered temporary adverse impacts. There would be no adverse impact from vibration, which would fall below Federal Transportation Administration criteria.	There would be adverse noise impacts at eight receptors in Silver Springs and one receptor in Wabuska. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Mina (Mineral County)	There would be no adverse construction noise or vibration impacts. There would be no adverse impact from the operation of construction trains. No receptors would fall within the 3 dBA increase contour or the 65 DNL contours.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Silver Peak (Esmeralda County)	There would be no adverse construction noise or vibration impacts. There would be no adverse impact from the operation of construction trains.	There would be no adverse impacts from noise from the operation of trains along the rail alignment. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Goldfield (Montezuma alternative segment 2) (Esmeralda County)	Noise from construction activities would fall below Federal Transit Administration guidelines. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria. There would be no adverse impact from the operation of construction trains. No receptors within the 65 DNL contours.	There would be no adverse impacts from the operation of trains along the rail alignment. No receptors would fall within the 65 DNL contours. There would be no adverse impact from vibration, which would fall below Federal Transit Administration criteria.
Quarries		
Railroad quarry ES-7 (Esmeralda County)	The nearest receptor would be approximately 1,500 meters[b] away from ES-7; therefore, potential impacts would be small.	The nearest receptor would be approximately 1,500 meters[b] away from ES-7; therefore, potential impacts would be small.
Rail line construction and operations support facilities	No impact. There would be no receptors near these facilities.	No impact. There would be no receptors near these facilities.

a. Adverse impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use.
b. To convert meters to feet, multiply by 3.2808.

4.3.9 SOCIOECONOMICS

This section describes potential impacts to socioeconomic conditions (employment and income, population and housing, public services, and transportation) from constructing and operating the proposed railroad along the Mina rail alignment. This section does not attribute socioeconomic impacts to the rail line alternative segments; rather, it describes impacts of the Proposed Action as a whole on the region of influence. Section 4.3.9.1 describes the methodology DOE used to assess potential impacts; Section 4.3.9.2 describes potential construction impacts; Section 4.3.9.3 describes potential operations impacts; Section 4.3.9.4 describes potential impacts under the Shared-Use Option; and Section 4.3.9.5 summarizes potential impacts.

Section 3.3.9.1 describes the region of influence for the socioeconomic analysis.

4.3.9.1 Impact Assessment Methodology

DOE analyzed socioeconomic impacts by comparing projected conditions in the region of influence during the construction and operations phases with projected baseline conditions (without the project) described in Section 3.3.9. Sections 4.3.9.1.1 through 4.3.9.1.4 describe the methods DOE used to estimate impacts to socioeconomic conditions.

4.3.9.1.1 Employment and Income

Both the projections of baseline employment and income conditions (without the project) and projections of conditions during the construction and operations phases came from the Regional Economic Models, Inc., *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all) described in Section 3.3.9 and Appendix J, Socioeconomics. Impacts are stated in terms of the number of jobs, ***gross regional product***, ***real disposable income***, and state and local government spending. Direct economic effects are the changes in jobs, gross regional product, and income in sectors that would supply directly needed goods and services, such as heavy-duty equipment, during railroad construction and operations. Indirect or secondary economic effects are the changes in sectors that would supply goods and services to the direct sectors (such as the production of construction material components). Secondary effects also would include the spending of income earned from the project (known as indirect effects). The extent to which a local economy could supply goods and services to the proposed project would be constrained by its level of economic development. DOE has assessed adverse impacts qualitatively in terms of disruption of economic activity, particularly for mining and agricultural operations.

> **Gross regional product** is the value of all final goods and services produced in a specified region.
>
> **Real disposable income** is the value of total after-tax income received; it is the income available for spending or saving.

DOE used runs of the *Policy Insight* model to estimate construction impacts over 5 years and operations impacts over 52 years (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all). The actual construction phase would range from 4 to 10 years. DOE expects the construction phase to last a minimum of 4 years and 6 months, so the Department modeled a fifth year. Because impacts, described in this analysis as peak changes from the baseline (without the project), would be strongest and most concentrated under a shorter construction schedule, DOE modeled only the 5-year construction phase. Construction-related impacts under a 10-year schedule would be bounded by the analysis described. Noteworthy impacts associated with a longer construction phase are identified, as appropriate. For the operations phase, this analysis assumes that the first 2 years represent a transition period. During these 2 years (2015 and 2016), the railroad support facilities would be operational. Starting in 2017, DOE would begin shipping spent nuclear fuel and high-level radioactive waste to Yucca Mountain; the shipping campaign would span up to 50 years, with up to 50 years of active shipping.

Because the socioeconomic impacts would vary depending on the county in which DOE placed the Nevada Railroad Control Center and National Transportation Operations Center, DOE modeled two different scenarios for both the construction and operation phases. Scenario 1 has the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County near the beginning of the proposed rail line; Scenario 2 has these facilities in Nye County near the end of the rail line.

4.3.9.1.2 Population and Housing

DOE estimated population impacts by comparing project-related increases or decreases at the county level against the projected population figures without the project. These estimates came from the same *Policy Insight* model runs used to estimate employment and income. Population changes are related to changes in employment; as employment increases in an area, permanent population could also increase, although increases in population typically lag behind increases in employment. DOE assessed impacts on housing by evaluating worker and permanent population increases associated with railroad construction and operation against county and community housing-capacity information.

4.3.9.1.3 Public Services

DOE assessed impacts to public services as changes to the county or community baseline capacity (assuming no railroad), as described in Section 3.3.9. There would be positive impacts when there were project-related enhancements that the community could also access. Adverse impacts would occur when increased demand exceeded the capacities of public services or hastened the deterioration of a particular public service, resulting in a lower ***level of service*** to community users.

4.3.9.1.4 Transportation Infrastructure

There could be an adverse impact on roadways within the region of influence if construction or operation of the proposed railroad would degrade the level of service of a roadway to unacceptable levels (below a level of service of C) as a result of project-related traffic. Section 3.3.9.3.5.1 includes a definition of level of service. As discussed in Section 3.3.9, existing annual average daily traffic data for the major roadways within the Mina rail alignment region of influence were provided by the Nevada Department of Transportation. Baseline levels of service of the roadways were then projected using the Highway Capacity Manual guidelines. To assess the impacts the railroad would have on the roadways, DOE added potential project-related vehicles to baseline traffic volumes and then estimated new levels of service. Because rail line operations along the Mina rail alignment would require operating trains along the existing Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines, DOE compared new rail traffic volumes on the proposed rail line to baseline rail conditions. The Department estimated road-traffic delay at highway-rail grade crossings based on the additional rail traffic along the existing rail segments between Hazen and Thorne. All roads that would cross the new rail segments at grade have very low traffic, and DOE did not estimate delay at grade crossings for these segments. Section 4.3.10, Occupational and Public Health and Safety, provides the safety analysis (traffic accidents and fatalities) for the proposed railroad along the Mina rail alignment.

4.3.9.2 Rail Line Construction Impacts

The Mina Implementing Alternative includes construction and operation of the rail line and its associated construction and operations support facilities. Inputs to the analysis using the *Policy Insight* model (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS

180689-Bland 2007, all) included construction and operations costs, or labor needs, or both when available. The inputs also accounted for the differences between expected project-related wages and average wages, by county and economic sector, contained in the *Policy Insight* model. Project-related wages would generally be higher than the average wages embedded in the model.

The common social and economic activities and changes associated with the construction of the proposed railroad would include:

- A period of brief, intense elevation in project-related employment
- Population increases
- A slightly slower rate of growth in the level of employment as the economy moved from the construction phase to the operations phase
- Some effects on public services (such as health care), particularly where construction activities were concentrated near communities
- Some effects on transportation resources

The equivalent of 1,100 full-time workers would be required during the grading phase of the construction phase, but fewer workers would be required as construction activities moved toward completion (this number reflects full-time work over a typical annual work year of approximately 2,000 hours [accounting for weekends, holidays, and vacation and sick days], and a construction phase of 54 months). More than 1,100 people would be performing this work, because not all employees would work full time. DOE used *Policy Insight* population projections to assess population-related impacts (for example, impacts to housing stock, ***infrastructure***, public services) related to the total number of actual employees resulting from the project. DOE would establish up to 10 temporary construction camps along the rail alignment to house workers.

Construction impacts for employment, income, and population are drawn from model runs of *Policy Insight* (DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all), which used a 5-year modeling period. As mentioned above, the actual construction phase would range from 4 to 10 years; impacts associated with the longer construction phase are noted as appropriate; however, levels of impacts would be higher and more concentrated under the modeled 5-year schedule.

4.3.9.2.1 Employment and Income

Direct employment and income impacts would stem from the hiring of construction workers and their spending of wages. Workers would have the option of shopping in towns near the construction camps, or relying on the cafeterias, drug stores, and non-perishables markets at the construction-camp commissaries (DIRS 174087-Nevada Rail Partners 2005, p. 4-5). Indirect impacts could result from employment of workers by businesses that supply goods and services in support of construction work, including the construction and operation of construction camps, where services such as catering, utility supply, and waste disposal would be needed. For purposes of this analysis, and consistent with the methodology established in the Yucca Mountain FEIS, DOE assumes that most construction workers would live in Clark County (DIRS 155970-DOE 2002, Section 4.1.6.2.1), and reside in construction camps. DOE makes this assumption because the construction sectors in Lyon, Mineral, Nye, and Esmeralda Counties are not large enough to provide enough workers for the construction activities. This section also considers an alternative analysis, which assumes that half of the construction workers for the Mina rail alignment reside in the combined Washoe County-Carson City area, and the other half reside in Clark County. The analysis considers this second scenario because Washoe County and Carson City may be more likely than Clark County to supply construction workers for the northern portions of the Mina rail alignment. Therefore, for the purposes of this second scenario, the analysis presents socioeconomic impacts for the combined area of Washoe County-Carson City.

Table 4-245 lists potential changes in economic measures during the construction phase for the two modeled scenarios. Appendix J describes the analysis in more detail. Each scenario includes the impact of constructing the proposed rail line and railroad construction and operations support facilities. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014. All construction-related economic impact values are presented in 2006 dollars. Table 4-245 lists the estimated changes to current trends (without construction of the railroad) in employment and income for each year of the construction phase. The discussion of the data in the table attempts to identify and address the largest deviations (“peak” changes) from the current trends without the railroad as a way to show the upper bounds of potential impacts.

In all five counties, changes to the baseline (conditions without the proposed railroad) would be similar under the two scenarios. In Lyon County, the increase in peak employment would represent 0.02 percent of the total projected employment levels in Lyon County in the absence of the project. The peak construction-related impact to real disposable income would be 0.03 percent above the baseline, gross regional product would be 0.04 percent above the baseline, and state and local government spending would be 0.01 percent above the baseline.

In Mineral County, the increase in peak employment would represent 6.1 percent of the total projected employment levels in Mineral County in the absence of the project. The peak construction-related impact to real disposable income would be 4.5 percent above the baseline, gross regional product would be 14.1 percent above the baseline, and state and local government spending would be 1.8 percent above the baseline. Residents would likely feel the peak changes to employment and gross regional product.

DOE also considered construction-related impacts to the Walker River Paiute Reservation. If one of the four construction camps proposed in Mineral County is instead placed on the Walker River Paiute Reservation, the Reservation would benefit from increased employment, gross regional product, and real disposable income. The increase in peak employment would be up to 20 additional jobs. The peak construction-related impact to gross regional product would be up to $1.4 million, and the impact to real disposable income would be up to $386,000 (DIRS 180691-Bland 2007, all).

In Nye County, the project-related increase in employment at peak would correspond to 0.6 percent of the total projected employment levels in Nye County without the project. The peak construction-related impact to real disposable income would be a 0.4-percent increase above the baseline, gross regional product would be 1 percent above the baseline, and state and local government spending would correspond to a 0.2-percent increase above the baseline.

In Esmeralda County, the project-related increase in employment at peak would correspond to 13.9 percent of the total projected employment levels without the project. The peak construction-related impact to real disposable income would be a 27-percent increase above the baseline, gross regional product would be 57 percent above the baseline, and state and local government spending would correspond to a 4.6-percent increase above the baseline.

In Clark County, the peak increase in real disposable income, gross regional product, and ***total employment*** would correspond to an increase of one-tenth of 1 percent of the baseline in Clark County. The peak construction-related impacts to state and local government spending would correspond to less than one tenth of 1 percent above the respective baseline, meaning that all impacts, if any, would be small in such a large economy.

Table 4-245. Estimated changes in economic measures during the construction phase – Mina rail alignment (page 1 of 3).[a,b]

	Construction year				
County/scenario/measure	2010	2011	2012	2013	2014
Lyon County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	3	3	3	2	1
State and local government spending	$6,520	$16,900	$27,962	$33,268	$34,101
Real disposable income	$160,757	$282,879	$326,263	$220,986	$125,666
Gross Regional Product	$352,619	$137,754	$167,778	$121,819	$58,443
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	3	3	3	2	1
State and local government spending	$6,329	$16,743	$27,752	$33,085	$33,482
Real disposable income	$157,131	$282,381	$325,845	$220,515	$116,478
Gross Regional Product	$346,203	$137,475	$167,778	$121,689	$53,273
Mineral County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	117	130	148	85	55
State and local government spending	$459,810	$588,945	$698,629	$577,043	$542,342
Real disposable income	$4,314,597	$4,898,513	$5,283,557	$3,131,169	$2,200,068
Gross Regional Product	$22,262,760	$20,265,795	$21,002,441	$10,961,257	$2,676,024
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	115	130	148	85	46
State and local government spending	$456,768	$586,287	$696,276	$574,973	$518,367
Real disposable income	$4,284,540	$4,894,110	$5,280,437	$3,128,990	$1,707,379
Gross Regional Product	$20,826,000	$20,264,400	$21,001,570	$10,960,699	$2,363,470

Table 4-245. Estimated changes in economic measures during the construction phase – Mina rail alignment (page 2 of 3).[a,b]

County/scenario/measure	Construction year				
	2010	2011	2012	2013	2014
Nye County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	80	66	108	108	39
State and local government spending	$238,000	$257,000	$362,000	$398,000	$392,000
Real disposable income	$3,639,000	$1,813,000	$4,302,000	$5,193,000	$2,387,000
Gross Regional Product	$7,563,000	$4,848,000	$11,184,000	$13,432,000	$4,110,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	66	108	111	45	19
State and local government spending	$256,000	$362,000	$404,000	$406,000	$380,000
Real disposable income	$1,812,000	$4,302,000	$5,335,000	$2,642,000	$1,705,000
Gross regional product	$4,847,000	$11,184,000	$14,241,000	$5,510,000	$2,222,000
Esmeralda County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	26	28	64	51	48
State and local government spending	$189,000	$213,304	$305,965	$287,829	$323,463
Real disposable income	$5,363,000	$5,654,654	$8,576,141	$6,150,721	$4,987,123
Gross Regional Product	$7,406,000	$2,699,197	$15,912,004	$14,882,404	$11,612,400
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	26	28	64	51	48
State and local government spending	$189,000	$213,291	$306,005	$287,943	$323,549
Real disposable income	$5,362,000	$5,654,610	$8,577,399	$6,153,042	$4,987,247
Gross regional product	$7,406,000	$2,699,190	$15,912,094	$14,882,574	$11,612,413

Table 4-245. Estimated changes in economic measures during the construction phase – Mina rail alignment (page 3 of 3).[a,b]

County/scenario/measure	Construction year 2010	2011	2012	2013	2014
Clark County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	1,753	1,761	1,812	758	379
State and local government spending	$1,481,000	$2,773,020	$4,009,160	$4,187,717	$4,057,289
Real disposable income	$98,054,000	$99,703,540	$105,692,250	$48,364,419	$29,022,634
Gross Regional Product	$137,080,000	$143,171,330	$152,243,780	$68,719,646	$37,249,419
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	1,740	1,760	1,818	769	386
State and local government spending	$1,470,000	$2,763,540	$4,005,810	$4,196,088	$4,074,022
Real disposable income	$97,309,000	$99,672,300	$106,058,280	$49,024,989	$29,562,624
Gross regional product	$136,071,000	$143,091,000	$152,743,620	$69,674,787	$37,954,566

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.

If half of the construction workers come from the Washoe County-Carson City area, then there would be construction-related socioeconomic impacts to this region. These results are presented in Table 4-246 as a sensitivity analysis. The peak increase in real disposable income, gross regional product, and total employment would correspond to an increase of less than three-tenths of 1 percent of the baseline. The peak construction-related impacts to state and local government spending would correspond to less than one-tenth of 1 percent above the respective baseline, meaning that all impacts, if any, would be small in such a large economy.

The major economic activities that could be adversely affected by construction of the proposed railroad along the Mina rail alignment are mining and grazing interests. Economic activities could be disrupted during the construction phase, which could range from 4 to 10 years. Impacts on private lands (other than patented mining claims) would be small, because as discussed in Section 3.3.2, the Mina rail alignment would lie mostly within BLM-administered public land. DOE would anticipate impacts to private land mainly in the Goldfield area.

There also could be limited disruption of economic activity from construction impacts on the transportation infrastructure as the movement of construction equipment and supplies temporarily disrupted traffic flow along local road systems. Under the construction schedule, DOE traffic modeling predicts that construction of the rail line itself would not affect traffic volume on local roads, but that construction of facilities might. Construction of the Maintenance-of-Way Facility and the Staging Yard would affect traffic on U.S. Highway 95 in the vicinity of Tonopah and Hawthorne; however, the level of service would remain the same in both locations. DOE would limit the impact of these disruptions by measures such as limiting road closures to low-traffic periods. Construction of the facilities inside the Yucca Mountain Site boundary near the repository (the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National Transportation Operations Center) would affect traffic on U.S. Highway 95 at the entrance to the Yucca Mountain Site, resulting in a drop in level of service from a B to a C at peak times during the construction phase.

Table 4-246. Alternative analysis for estimated changes in economic measures in Washoe County-Carson City during the construction phase – Mina rail alignment.[a]

	Construction year				
County/scenario/measure	2010	2011	2012	2013	2014
Washoe County-Carson City[b]					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County					
Employment	809	824	798	268	159
State and local government spending	$690,016	$1,271,038	$1,757,619	$1,718,730	$1,626,718
Real disposable income	$45,080,673	$46,549,836	$46,325,305	$17,239,105	$11,966,869
Gross Regional Product	$56,693,801	$59,920,164	$60,034,931	$21,979,836	$13,866,185
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County					
Employment	809	824	798	268	159
State and local government spending	$689,598	$1,270,620	$1,757,340	$1,718,451	$1,626,300
Real disposable income	$45,068,400	$46,554,300	$46,332,000	$17,245,800	$11,969,100
Gross Regional Product	$56,651,400	$59,915,700	$60,037,164	$21,988,764	$13,850,569

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-245.
b. Source: DIRS 181590-Bland 2007, all.

There would be fewer such impacts under a 10-year construction schedule, because worker trips and materials shipments would be spread over a longer period. As discussed in Section 4.3.11, the supplies needed for construction would not create shortages at a local, regional, or national level. Primary materials include steel for rails and concrete for rail ties, bridges, and drainage structures. These materials are available regionally and nationally; purchasing would not be expected to create demand and supply impacts, and there should be no harmful price effects.

There could be some reductions in mining- and agriculture-related employment and income because of construction-related land disturbances. The nominal width of the rail line construction right-of-way would include land upon which there are grazing and mining activities. The construction right-of-way might be narrower in certain locations to minimize impacts to lands with mining claims, or wider in other places (such as cut and fill areas and bridges) that could affect parcels adjoining the construction right-of-way where mining and agricultural activities take place.

As discussed in Section 4.3.2.2.1.2, the only mining claims that would be within the rail line construction right-of-way are associated with Mina common segment 1 and Montezuma alternative segments 1, 2, and 3. Although DOE would reduce the area of disturbance to minimize impacts to these claims, Mina common segment 1 would intersect 388 mining claims, Montezuma alternative segment 1 would intersect 202 claims, Montezuma alternative segment 2 would intersect 153, and Montezuma alternative segment 3 would intersect up to 249 (see Section 4.3.2.2.6).

Should parties with existing mining claims have plans to explore, develop, or produce minerals on claims within the construction right-of-way, these plans might require accommodations to allow for both railroad construction and mining activities to proceed. Such accommodations might have economic consequences. DOE recognizes that mineral exploration and development is strongly tied to the price of mineral commodities. However, foreseeable impacts to mining from railroad construction would be very small because the mineral production in affected districts is only a small percentage of overall mineral production in Nevada. Further, construction would only temporarily affect the filing of new claims. However, individuals and localized areas could feel the impacts more severely.

As described in Section 4.3.2.2.3.2, wherever the rail line would cross a grazing allotment, DOE quantified the amount of forage loss in animal unit months in accordance with BLM standards. Factors that influence the determination of permitted animal unit months include quantity and quality of forage; type of forage; season in which the forage will be grazed; kind and mix of grazing animals; presence of water; topography; soil, climate, and disturbance regimes; wildlife cover; proper use factor; and management objectives. In 2001, the State of Nevada Department of Agriculture commissioned a report, *Nevada Grazing Statistics Report and Economic Analysis for Federal Lands in Nevada*, in which one animal unit month was assigned a value of $53.40 in direct and indirect contributions to the economy (DIRS 176949-Resource Concepts 2001, p. 47). DOE used this value to estimate economic losses due to impacts to grazing. Section 4.3.2, Land Use and Ownership, describes, for each potentially affected grazing allotment, the potential impacts to grazing activities from a land-use perspective.

Grazing allotments within the Mina rail alignment construction right-of-way would be affected in Mineral, Esmeralda, and Nye Counties for a total potential loss of up to 326 animal unit months and $17,400 to the local economy during each year of construction activity. This is a conservative estimate, because it assumes DOE would select only the most disruptive alternative segments. Table 4-247 summarizes animal unit month loss information presented in Section 4.3.2 and the corresponding economic impact. Table 4-247 only lists portions of the Mina rail alignment that would result in a loss (for example, the Bonnie Claire alternative segments are not included because none would affect animal unit months on nearby allotments). DOE calculated the totals to two significant figures by adding common segments and the most conservative alternative segment losses (shown in bold type).

Of the totals, about 133 of the animal unit months and $7,100 would be lost in Mineral County, 164 animal unit months and $8,800 would be lost in Esmeralda County, and 29 animal unit months and $1550 would be lost in Nye County. As presented in Table 3-140, Mineral, Esmeralda, and Nye Counties were projected to have gross regional products of $131 million, $25.7 million, and $1.16 billion, respectively, in 2007. In economies of these scales, the overall impacts of grazing losses would be small. However, individuals and localized areas could feel the impacts more severely. The BLM could elect to redraw the boundaries of grazing allotments to address these effects.

Table 4-247. Segment-specific annual economic impacts to grazing allotments during construction of the proposed rail line – Mina rail alignment.

Rail line segment	Animal unit months lost[a,b]	Value ($)
Mina common segment 1	133	7,100
Montezuma alternative segment 1	117	6,200
Montezuma alternative segment 2	82	4,400
Montezuma alternative segment 3	164	8,800
Oasis Valley alternative segment 1	8	400
Oasis Valley alternative segment 3	12	600
Common segment 6	17	900
Totals[c]	326	17,400

a. Figures for animal unit months lost for the Facilities at the Interface with the Union Pacific Railroad Mainline include impacts from associated quarries and the Staging Yard.
b. The values shown are worst-case values of the animal unit months that would be lost for 1 year (per year during proposed railroad construction and operations). The table lists only those portions of the rail alignment that would result in a loss.
c. Totals might differ from sums of values due to rounding.

During the construction phase, there could be an additional impact from construction trains colliding with cattle. DOE would compensate ranchers for any such losses of cattle in accordance with Nevada Revised Statutes 705.150 to 705.200.

The potential economic impacts to prime farmland areas are described in relation to employment and lost market value of crops. As discussed in Section 4.3.1.2.1.3, some portion of the 37,000 square meters (9.2 acres) of prime farmland soils would be lost under the Mina Implementing Alternative. This calculated amount of prime farmland is based on the total disturbed area, and is therefore an upper-bound measurement. Table 4-248 lists the estimated impacts to prime farmland.

Table 4-248. Potential impacts to prime farmland – Mina rail alignment.

Rail line segment	Number of acres affected	Market value of crops per acre ($)	Workers per acre	Market value lost ($)	Employment lost
Schurz alternative segment 1					
Lyon County	2.7	510	0.01	1,380	0.03
Schurz alternative segment 4					
Lyon County	3	510	0.01	1,530	0.03
Schurz alternative segments 5 and 6					
Lyon County	3.5	510	0.01	1,780	0.04

a. Source: DIRS 173571-USDA 2004, Tables 1 and 7.

Based on data from Nevada's Census of Agriculture, DOE estimated the market value of crops lost as less than $2,000 in Lyon County regardless of the Schurz alternative segment selected. DOE also estimates that less than one job would be lost in Lyon County under the Mina Implementing Alternative. The other counties in the Mina rail alignment region of influence would not experience any impacts because the rail line would not cross prime farmland in these counties.

4.3.9.2.2 Population and Housing

Population changes are related to changes in employment. DOE modeled employment of construction workers and some support workers as beginning in 2010 and ending in 2014, and estimated population impacts for the same period. Table 4-249 lists the estimated changes to population during the construction phase for each of the modeled scenarios. Appendix J describes the analysis in more detail. In Esmeralda and Lyon Counties and Washoe County-Carson City, population changes would be identical under either scenario. The peak population increases would be largely due to indirect employment effects.

In Lyon County, the peak estimated population change attributed to railroad construction along the Mina rail alignment would be an increase of eight people, which would correspond to a 0.01-percent increase in the Lyon County projected 2014 population level without the project. Two of these people would be school-aged children, according to the age distribution of Lyon County published by the Bureau of Census (DIRS 181384-Bureau of Census).

In Mineral County, the peak estimated population change attributed to railroad construction along the Mina rail alignment would be an increase of 64 people, which would correspond to a 1.4-percent increase in the Mineral County projected 2013 population level without the project. Twelve of these people would be school-aged children, according to the age distribution of Mineral County published by the Bureau of Census (DIRS 181384-U.S. Census Bureau [n.d.]).

Table 4-249. Estimated changes to population during railroad construction – Mina rail alignment.[a,b]

Location	2010	2011	2012	2013	2014
Lyon County	2	4	7	8	8
Mineral County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	35	51	64	64	63
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	34	50	64	64	60
Nye County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	23	27	51	83	86
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	23	51	84	89	88
Esmeralda County	5	8	18	27	33
Clark County					
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	387	717	1,024	1,057	1,011
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	385	714	1,023	1,059	1,015

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Model does not discriminate non-county regions, such as the Walker River Paiute Reservation.

In Esmeralda County, the peak population gain of 33 people would translate to approximately five additional school-aged children, according to the age distribution of Esmeralda County published by the Bureau of Census (DIRS 175922-Census Bureau 2000, all). The *Policy Insight*-estimated population gain attributed to railroad construction along the Mina rail alignment represents a 3.1-percent increase in the projected 2014 population level for Esmeralda County without the project.

In Nye County, the peak population increase would be 89 people, about 16 of whom would be school-aged children, according to the age distribution of Nye County published by the Bureau of Census (DIRS 181384-U.S. Census Bureau [n.d.]). The estimated population gain attributed to construction of the proposed railroad along the Mina rail alignment would be less than a 1-percent increase over Nye County's projected population level without the project for all construction years.

In Clark County, the peak population increase would be 1,059 people. Of this increase, about 191 people would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Census Bureau 2004, all). The estimated population increase attributed to construction of the proposed railroad along the Mina rail alignment would represent less than a 1-percent increase over Clark County's projected population level without the project for all construction years.

If half of the construction workers for the project come from Washoe County-Carson City, then the peak population increase would be 384 people (Table 4-250). The estimated population increase attributed to construction of the proposed railroad along the Mina rail alignment would represent less than a 1-percent increase over the region's projected population level without the project for all construction years.

Table 4-250. Alternative analysis for estimated changes to population in Washoe County-Carson City during railroad construction – Mina rail alignment.[a]

Location	2010	2011	2012	2013	2014
Washoe County-Carson City[b]	160	291	397	384	359

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-249.
b. Source: DIRS 181590-Bland 2007, all.

Impacts on housing infrastructure would be small during the construction phase because most construction workers would be housed in construction camps at strategic locations along the rail alignment, rather than in nearby communities. If construction workers elected not to stay in the camps, motels or recreational vehicle parks could substitute as housing options. As discussed in Section 3.3.9.3.3, lodging is available along U.S. Highway 95 and 95A in and around Yerington, Hawthorne, Walker Lake, Mina, Goldfield, Beatty, and Town of Amargosa Valley. These towns offer 21 motels with a total of 733 rooms, and 13 recreational vehicle parks with a total of 412 spaces. These lodging options could not accommodate all workers and completely substitute for construction camps.

Some contractors could elect to use commercially available facilities to house construction personnel, such as those in Yerington, Hawthorne, Walker Lake, Mina, Goldfield, Beatty, and Town of Amargosa Valley. As indicated in Section 3.3.9.3.3, it appears there would be sufficient vacant housing stock in these areas to meet the needs of construction personnel.

4.3.9.2.3 Public Services

Impacts to public services at the county level would likely be small because the population projections with the project show very limited increases in overall counts. An additional demand on local health-care capacity would be the primary impact on public services. The area that is likely to experience the greatest impact is southern Nye County, where the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and the Nevada Railroad Control Center and National Transportation Operations Center would be.

4.3.9.2.3.1 Health Care. As presented in Section 4.3.10, Occupational and Public Health and Safety, during the construction phase, DOE expects approximately 620 total recordable and ***lost workday cases*** among involved and noninvolved workers; that is, approximately 120 per year. Construction workers would be served by one of the health services centers at each construction camp to be staffed by four medical personnel who would rotate shifts (DIRS 174087-Nevada Rail Partners 2005, p. 4-5). In addition, Nevada Test Site personnel could provide medical services for construction workers along common segment 6 as they do at present for workers at the Yucca Mountain Site. As is the practice at both the Nevada Test Site and the Yucca Mountain Site, medical evacuation services from Las Vegas would transport cases to facilities in Clark County or in Utah as needed.

Nevertheless, to conservatively estimate potential impacts to health-care capacity in the region of influence, DOE assumed that all of the accident and injury cases would be treated at existing facilities in Nye County. This addition of approximately 120 cases per year (related to the less than 1 percent increase in population attributable to the construction effort) could have a small adverse impact on the existing health-care capacity in Nye County. As described in Section 3.3.9.3.4, Nye County is considered medically underserved. The Nye Regional Medical Center in Tonopah has ambulance services, but lacks surgical facilities. The new hospital in Pahrump increased the county capacity to respond to routine and emergency and surgical needs, but the 25-bed increase in capacity might not be sufficient to meet current needs. Thus, any additional number of cases could affect the capacity of Nye County to address the health care needs of local users.

4.3.9.2.3.2 Education. Although there are only 39 schools in Lyon, Mineral, Nye, and Esmeralda Counties, it is unlikely that the capacities of these schools would be affected by railroad construction. DOE would not expect workers to be accompanied by their families and children because the availability of work camps and the use of 1- to 2-week work shifts would encourage workers to work from camps and return home on their weeks off to established residences in these counties, Clark County, or other Nevada counties. Any small increase in the number of children could be accommodated by the school systems, which have student-to-teacher ratios that are comparable to the national average.

4.3.9.2.3.3 Fire Protection. As discussed in Section 3.3.9.3.4, Lyon, Mineral, Nye, and Esmeralda Counties all meet fire-suppression needs with volunteers, with the exception of Pahrump, which has a paid fire department. In addition, three of the four fire districts in Lyon County are part of a quad-county partnership with Douglas County, Storey County, and Carson City. Although most communities characterized in the region of influence are currently able to provide adequate protection (except for Pahrump, which is currently underserved), any increased demand would move them closer to the limit that existing resources (personnel and equipment) could address. However, each construction camp would have personnel dedicated to fire response, and water wells and a water-tank trailer that would be used to respond to fire emergencies at the camps and construction areas. Because of this and low population increases expected for volunteer-reliant Lyon, Mineral, and Esmeralda Counties, construction-phase activities would not have an adverse impact on fire-protection capacity in the region of influence.

4.3.9.2.3.4 Law Enforcement. Because workers would be dispersed along the rail alignment, and given the low crime rate in the counties that would be directly affected (Lyon, Mineral, Nye, and Esmeralda) (particularly in comparison to the substantially higher Clark County and national crime rates), it is unlikely that the incidence of crime would increase to the extent that existing law enforcement services became inadequate. In other words, project-related increases in crime would be unlikely to overwhelm existing services. Additionally, construction camps would be staffed with security personnel (DIRS 174087-Nevada Rail Partners 2005, pp. 4-4 to 4-7). Accommodations could be made to decrease the possibility of adverse impacts to local law enforcement capacity. Although civil or domestic issues requiring law enforcement interface would be handled by the appropriate authorities, there have been no detailed discussions on protocols and working relationships.

4.3.9.2.4 Transportation Infrastructure

4.3.9.2.4.1 Traffic Impacts. The increased traffic required to support proposed railroad construction would have some additional impacts on existing roadways. Key roads likely to be affected are portions of U.S. Highway 95. At present, these roads are mainly operating at levels of service A or B as defined in Section 3.3.9.3.5, except for a stretch south of U.S. Highway 6 in Tonopah that is currently operating at level of service C. There could be impacts along these routes, particularly in communities that are near construction sites for the railroad operations support facilities. Areas where local road systems could be most affected are Hawthorne in Mineral County; Tonopah, Beatty, Town of Amargosa Valley, and at the entrance to the Yucca Mountain Site in Nye County; and Goldfield and Coaldale in Esmeralda County. The busiest roads within the transportation region of influence, in the Hazen, Silver Springs, and Wabuska areas, would not be affected by railroad construction or operations because no new rail lines or facilities are proposed in these areas.

Railroad construction would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. Truck traffic would be highest at the beginning and end of the construction phase while equipment was brought in and taken away, and could therefore adversely impact traffic conditions during specific weeks. However, trucks could be directed to move during off-peak hours to minimize their impacts on local traffic. Additionally, most construction materials for the Staging Yard and Maintenance-of-Way Facility would be transported by rail; therefore, there would be limited truck trips associated with the movement of materials for these facilities. For both reasons, the analysis does not account for transportation of materials, focusing instead on the transportation of workers to and from the work sites.

Construction of the rail line itself would not be likely to adversely affect traffic volumes on local roads, because much of the construction material would be transported by rail. Additionally, workers would be housed in construction camps close to work sites, so transportation of construction workers along local roads would be minimal. This would place only limited pressure on the transportation infrastructure, mainly at the end of a work week and possibly over the weekend when travel to local towns might increase. Therefore, the analysis of impacts to levels of service focuses on construction of the railroad operations support facilities.

The level of service analysis evaluates the additional traffic volume in terms of the "peak hour," which is the hour with the highest volume of traffic during a study period, usually a peak period. For example, DOE estimated that the movement of employees for the Rail Equipment Maintenance Yard and the Cask Maintenance Facility would require approximately 600 trips per day and 300 trips during the peak hour at the height of construction activities. The traffic analysis assumes that each employee would generate two vehicle trips per day, one of which would be during the peak hour.

The level of service analysis in this section is conservative because it assumes construction activities during a peak period when all workers are working simultaneously. DOE estimated the number of workers assigned to each facility (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425-Cask Maintenance Facility Technical Report, March 2007, p. 5). Table 4-251 lists the estimated number of vehicle trips during the construction phase.

Based on the estimated increases in traffic volumes listed in Table 4-251, DOE calculated the effect on the level of service of the affected roadways during peak hour traffic for construction of the three key facilities. All affected roadways were assumed to be configured as two-lane, non-divided paved highways.

The Staging Yard would be near Hawthorne along Mina common segment 1, potentially affecting traffic levels along U.S. Highway 95 and State Route 359. Construction of the Staging Yard would not degrade the level of service on either road, which would remain at C and A, respectively.

The Maintenance-of-Way Facility would be approximately 1.6 kilometers (1 mile) south of Silver Peak (Montezuma alternative segment 1) or near Klondike, about 2.9 kilometers (1.8 miles) west of U.S. Highway 95 between Tonopah and Goldfield (Montezuma alternative segment 2 or 3). Its construction could affect traffic levels on local roads, including U.S. Highway 95 between Tonopah and Goldfield. The analysis assumes that all traffic is channeled through U.S. Highway 95, which is the most heavily traveled road in the region. Construction of the Maintenance-of-Way Facility would not degrade the level of service, which would remain at B.

Table 4-251. Estimated highway trips during construction of the railroad operations support facilities – Mina rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for construction of the Staging Yard	220	110
Employees for construction of the Maintenance-of-Way Facility	120	60
Employees for construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility	600	300

a. Sources: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 2; DIRS 181425-Cask Maintenance Facility Technical Report, March 2007, p. 5.

Construction of the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would affect traffic on U.S. Highway 95 near the entrance to the Yucca Mountain Site, degrading its level of service from B to C during the peak hour. Level C would still represent stable traffic flow, but would mark the beginning of the range of flow that would become affected by interactions with others in the traffic stream.

4.3.9.2.4.2 Traffic Delay at Grade Crossings. DOE examined the potential for delays at grade crossings along existing rail lines in the region of influence and along the proposed rail line. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. The delay analysis at grade crossings concentrates on the existing rail line between Hazen and Thorne because grade separation is not planned for any of these existing rail-highway intersections. DOE did not estimate delay at grade crossings for new rail segments because all major roads (U.S. Highways 95 and 6, and State Route 361) would be grade separated, and all roads that would cross the new rail segments at grade have very low traffic.

DOE estimated road traffic delay at rail-highway grade crossings based on the additional rail traffic from construction trains along the existing rail segments between Hazen and Thorne. Over the 4-year construction period, DOE estimated that eight one-way trains per day would be necessary (DIRS 180874-Nevada Rail Partners 2007, Appendix A, p. A-9). This estimate does not account for ballast trains, since they would not originate in Hazen, but at quarries along the rail alignment.

DOE calculated blocked crossing time per train according to the speed and length of trains, and determined crossing delay per stopped vehicle based on blocked crossing time, road arrival, and road departure rates. The Department calculated the total number of vehicles delayed per day as a function of the number of daily trains, average daily road traffic volume, and blocked crossing time. Total delay per day is the product of crossing delay per stopped vehicle and total number of vehicles delayed per day. Appendix J includes a detailed description of the methodology DOE used to calculate delay at grade crossings.

Table 4-252 summarizes total daily delay at each grade crossing analyzed. The maximum average delay per vehicle would be 1.7 seconds, up from 0.36 second without the additional construction rail traffic. Therefore, the maximum average delay at grade crossings caused by the additional rail traffic under the Proposed Action would be 1.3 seconds per vehicle, which represents a very small impact. The level of service on any of the analyzed intersections would not be degraded due to delay at grade crossings from additional rail traffic. Vehicles traveling on U.S. Highway 50A in Hazen, which currently has the lowest level of service (C) in the transportation region of influence, would experience an average delay of 0.6 second. The number of vehicles delayed in a day would increase from 10 to 89, and each stopped vehicle would be delayed by an average of 0.89 minute. Even though the number of vehicles affected would increase substantially, the average daily traffic at this intersection is about 7,900 vehicles. Therefore, less than one percent of vehicles traveling along U.S. Highway 50A would incur a delay of less than one minute.

4.3.9.2.4.3 Impacts to Existing Rail Lines. DOE examined the impacts of additional construction rail traffic to existing rail traffic along the Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines. At present, these existing branchlines operate a few trains per week that would continue after construction of the proposed railroad. From Hazen to Wabuska, there are approximately two Union Pacific Railroad trains per week that operate on the Hazen Branchline. For purposes of analysis in this EIS, DOE estimated that approximately two Union Pacific Railroad trains en route to Wabuska and two Department of Defense trains en route to the Hawthorne Army Depot would run from Hazen to Hawthorne per week. During the construction phase, there would be five additional trains per day, which would be a substantial increase in the number of existing trains.

Table 4-252. Delay at highway-rail grade crossings during the construction phase – Mina rail alignment.

Federal Railroad Administration Crossing ID Number	Road name	County/ Reservation	Number of vehicles delayed per day		Average delay per vehicle (seconds)		Total delay per day (vehicle-minutes)	
			Existing	With proposed rail line	Existing	With proposed rail line	Existing	With proposed rail line
740905S	U.S. Highway 50A	Churchill	10	89	0.04	0.60	5.00	80.00
740906Y	Bango Road	Churchill	0	0	0.03	0.41	0.01	0.18
740907F	City Street	Churchill	0	0	0.03	0.41	0.00	0.01
740912C	U.S. Highway 50	Lyon	3	21	0.03	0.42	1.00	15.00
740914R	Fir Avenue	Lyon	1	9	0.03	0.42	0.47	6.70
740915X	5th Street	Lyon	1	8	0.03	0.42	0.38	5.50
740916E	9th Street	Lyon	1	13	0.03	0.42	0.64	9.00
740918T	U.S. Highway 95A	Lyon	3	28	0.03	0.42	1.40	20.00
740919A	Fort Churchill PA	Lyon	0	2	0.03	0.41	0.11	1.60
740920U	Adrian Valley	Lyon	0	0	0.03	0.41	0.01	0.10
740922H	Church Hill	Lyon	0	1	0.03	0.41	0.06	0.85
740923P	Thompson Smelter	Lyon	0	1	0.03	0.41	0.06	0.80
740925D	U.S. Highway 95A	Lyon	3	28	0.03	0.42	1.40	20.00
740927S	Mason Valley Road	Lyon	0	0	0.02	1.60	0.01	0.45
740945P	Walker Lake North	Mineral	0	0	0.02	1.60	0.00	0.03
740946W	Nolan	Mineral	0	0	0.02	1.60	0.00	0.42
740947D	Near Nolan	Mineral	0	0	0.02	1.60	0.00	0.07
740948K	Walker Lake South	Mineral	0	0	0.02	1.60	0.00	0.35
740951T	Thorne	Mineral	1	4	0.36	1.70	0.86	4.00

Because there is very little traffic currently operating along the existing rail segments, DOE would not expect that existing trains would experience long delays, especially because train traffic would be coordinated to avoid delays. Therefore, impacts of new construction rail traffic on existing rail traffic would be moderate.

4.3.9.3 Railroad Operations Impacts

The common social and economic activities and changes associated with the operations phase would include:

- Increases in project-related employment, particularly associated with railroad operations support facilities
- Slight population increases associated with employment increases
- Some pressure on housing in southern Nye County where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be
- Continued effects on mining and agriculture
- Possible effects on public services (health and education)
- Possible effects on transportation infrastructure

4.3.9.3.1 Employment and Income

Local impacts during the operations phase would be linked to the location of facilities, size of the workforce, and the extent to which the community would provide goods and services to facilities and workers. Table 4-253 lists the estimated number of full-time-equivalent workers that would be required for each railroad operations support facility. DOE used these employment figures as input to the *Policy Insight* model.

Table 4-253. Estimated average employment by railroad operations support facility – Mina rail alignment.[a]

Facility	Location	Workforce (full-time equivalent)
Staging Yard	Hawthorne	40
Cask Maintenance Facility	Inside the Yucca Mountain Site boundary near the repository	30
Nevada Railroad Control Center/National Transportation Operations Center	Mineral County or collocated with the Rail Equipment Maintenance Yard	15
Maintenance-of-Way Facility	Esmeralda County	40
Rail Equipment Maintenance Yard	Inside the Yucca Mountain Site boundary near the repository	25

a. Sources: DIRS 180873-Nevada Rail Partners 2007, Table 2-1; DIRS 180874-Nevada Rail Partners 2007, Table 3.

As it did for railroad construction, DOE modeled two scenarios for railroad operations – one with the Railroad Control Center and National Transportation Operations Center in Mineral County (Scenario 1) and the other with these facilities in Nye County (Scenario 2).

DOE modeled employment of operations workers and some support workers as beginning in 2015 and ending in 2067. Table 4-254 lists the economic impacts of both scenarios during the operations phase. All operations-related economic impact values are given in 2006 dollars.

The employment impacts on the Walker River Paiute Reservation are included in the estimates for Mineral County. The economic forecasting model is unable to discriminate impacts for the Reservation.

Table 4-254. Estimated changes in average annual economic measures during the operations phase – Mina rail alignment.[a]

Location/scenario	Total employment	Real disposable income	Gross regional product	State and local government expenditures
Lyon County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	1	$207,887	$107,280	$46,680
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	1	$155,125	$74,945	$35,205
Mineral County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	58	$3.6 million	$4.2 million	$599,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	38	$2.3 million	$3.3 million	$344,000
Nye County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	22	$2.2 million	$3.7 million	$419,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	27	$2.6 million	$4.6 million	$479,000
Esmeralda County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	62	$4.6 million	$11.2 million	$776,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	62	$4.6 million	$11.2 million	$776,000
Clark County				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	85	$11.4 million	$12.8 million	$1.3 million
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	98	$12.7 million	$14.8 million	$1.4 million

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.

In Lyon County, increases in economic measures would be similar under the two scenarios; however, the larger increases would be under Scenario 1, with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County. However, all increases would represent less than a 1-percent average annual increase over the projected annual average without the project. See Table 3-136 for baseline population data.

In Mineral County, the greater increases would be under Scenario 1, with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County. The total increased employment in Mineral County would average about 58 jobs annually over the operations phase. This would represent a 2.6-percent increase above the projected annual average employment level without the project. The peak operations-related impact to real disposable income, gross regional product, and state and local government spending would correspond to 2.8-, 1.9-, and 1.5-percent increases, respectively, above the projected levels for each measure without the project.

In Nye County, the greater increases in economic measures would be for Scenario 2, with the Nevada Railroad Control Center and National Transportation Operations Center in Nye County. However, all increases would represent less than a 1-percent average annual increase over the projected annual average without the project.

In Esmeralda County, changes in economic measures during the operations phase would be nearly identical under the two scenarios. The annual average change in employment would be an average increase of 62 jobs over the baseline during the operations phase. This peak impact would represent a 14-percent increase above the projected level without the project. The average increases in economic indicators would be $4.6 million above the baseline for real disposable income, $11.2 million above the baseline for gross regional product, and $776,000 above the baseline for state and local government spending. These impacts represent 10-, 24-, and 10-percent increases, respectively, above the projected levels for each measure without the project.

In Clark County, the greater increases in economic measures would be observed under Scenario 2, with the Nevada Railroad Control Center and National Transportation Operations Center in Nye County. However, all increases would represent less than a one-tenth of 1-percent average annual increase over the projected annual average without the project.

If half of the construction workers come from the combined area of Washoe County and Carson City, then there will be socioeconomic impacts that linger into the operations phase of the Proposed Action. The greater increases in economic measures would be observed under Scenario 1, with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County (see Table 4-255). However, all increases would represent less than a one-tenth of 1-percent average annual increase over the projected annual average without the project.

Section 4.3.11, Utilities, Energy, and Materials, describes impacts related to the use of construction materials and fossil fuel during the construction and operations phases.

The small economic impacts to mining and agriculture identified for the construction phase would continue during the operations phase. As for the construction phase, there would be a risk of trains colliding with cattle. DOE would compensate ranchers for any loss of cattle during railroad operations in accordance with Nevada Revised Statutes 705.150 to 705.200. Train and track inspection and maintenance activities would be confined to areas disturbed by construction activities, so there would be no additional disturbances to the physical environment. There could be some areas that were disturbed during construction activities that would not be affected during operations (for example, staging areas), and on which agricultural and mining activities could be resumed. Areas disturbed during construction but not needed for operations would be reclaimed in accordance with BLM guidance.

Table 4-255. Alternative analysis for estimated changes in average annual economic measures in Washoe County-Carson City during the operations phase – Mina rail alignment.[a]

Location/scenario	Total employment	Real disposable income	Gross regional product	State and local government expenditures
Washoe County-Carson City[b]				
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	28	$3.6 million	$3.8 million	$405,000
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	27	$3.6 million	$3.6 million	$393,000

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-254.
b. Source: DIRS 181590-Bland 2007, all.

4.3.9.3.2 Population and Housing

Population changes would be related to changes in employment. DOE modeled employment of railroad operations workers and some support workers as beginning in 2015 and ending in 2067. Population impacts are estimated for the same period. Table 4-256 lists estimated population changes for the two modeled scenarios during the operations phase.

Table 4-256. Estimated changes to population during the operations phase – Mina rail alignment (page 1 of 2).[a]

Location	Average change in population
Lyon County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	9
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	7
Mineral County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	66
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	38
Nye County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	86
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	98
Esmeralda County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	76
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	76

Table 4-256. Estimated changes to population during the operations phase – Mina rail alignment (page 2 of 2).[a]

Location	Average change in population
Clark County	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	280
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	310

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.

The population impacts on the Walker River Paiute Reservation are included in the estimates for Mineral County. The economic forecasting model is unable to discriminate impacts for the Reservation.

In Lyon County, Scenario 1 would result in an average gain of 9 people annually above the projected levels without the project. Of this increase, about 2 people would be school-aged children, according to the age distribution of Lyon County published by the Bureau of the Census (DIRS 181384-U.S. Census Bureau [n.d.], all). The estimated average annual population increase attributed to the operations phase would be less than 1 percent above Lyon County's projected population annual average without the project.

At the county level, Lyon County would be able to absorb the increased demand for housing. At present, there are 1,272 vacant housing units in Lyon County (see Table 3-141).

In Mineral County, Scenario 1 would result in an average gain of 66 people annually above the projected levels without the project. Of this increase, about 13 people would be school-aged children, according to the age distribution of Mineral County published by the Bureau of the Census (DIRS 181384-U.S. Census Bureau [n.d.], all). The estimated average annual population increase attributed to the operations phase would be 1.6 percent above Mineral County's projected population annual average without the project.

At the county level, Mineral County might be able to absorb the increased demand for housing. At present there are 669 vacant housing units in Mineral County (see Table 3-141).

In Nye County, the greater average increase in population would be under Scenario 2, with an average gain of 98 people annually above the projected levels without the project. Of this increase, about 17 would be school-aged children, according to the age distribution of Nye County published by the Bureau of the Census (DIRS 181384-U.S. Census Bureau [n.d.], all). The estimated average annual population increase attributed to the operations phase would be less than 1 percent above Nye County's population projected annual average level without the project.

At the county level, Nye County, with 2,625 vacant housing units, would likely be able to absorb the increased demand for housing. Within the county, workers would likely choose to live in southern Nye County, where the Cask Maintenance Facility, Rail Equipment Maintenance Yard, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be. The 1,058 vacant housing units in Pahrump could accommodate increased demand, though it should be noted that Pahrump has been undergoing a substantial population increase recently (more than 25 percent between 2000 and 2004). Future increases in population are expected, which will place additional demand on the current housing stock. Therefore, project-worker demand for housing in the community would have the potential to create small impacts on the supply of available housing. No impact is expected on housing availability in the Tonopah area; the number of operations workers residing in that community would likely be small, and there would be adequate vacant housing available in the community to accommodate this increase, as discussed in Section 3.3.9.

In Esmeralda County, the average increase in population would be the same under either scenario, with an average gain of 76 people annually above the projected levels without the project. Of this increase, about 12 would be school-aged children, according to the age distribution of Esmeralda County published by the Bureau of the Census (DIRS 175922-Census Bureau 2000, all). The estimated average annual population increase attributed to the operations phase is 7 percent above the baseline.

At the county level, Esmeralda County, with 378 vacant housing units, would likely be able to absorb the increased demand for housing. At the local level, no impact is expected on housing availability in Goldfield or Tonopah, which are both close to Klondike and Silver Peak, the two alternative locations for where the Maintenance-of-Way Facility would be. The number of operations workers residing in either community would likely be small, and there would be adequate vacant housing available, as discussed in Section 3.3.9.3.3.

In Clark County, the greater average increase in population would be under Scenario 2, with an average gain of 310 people annually above the projected levels without the project. Of this increase, about 56 would be school-aged children, according to the age distribution of Clark County published by the Bureau of the Census (DIRS 171297-Bureau of Census 2004, all). The estimated average annual population increase attributed to the operations phase would be a less than one-tenth of 1-percent increase above Clark County's projected population annual average level without the project.

If half of the construction workers came from Washoe County and Carson City, then there would be population impacts that linger into the operations phase. The greater average increase in population for this combined region would be under Scenario 1, with an average gain of 81 people annually above the projected levels without the project (see Table 4-257). The estimated average annual population increase would be less than one-tenth of 1-percent increase above the combined region's projected population annual average level without the project.

Table 4-257. Alternative analysis for estimated changes to population in Washoe County-Carson City during the operations phase – Mina rail alignment.[a]

Location	Average change in population
Washoe County-Carson City[b]	
Scenario 1: Nevada Railroad Control Center/National Transportation Operations Center in Mineral County	81
Scenario 2: Nevada Railroad Control Center/National Transportation Operations Center in Nye County	79

a. This table does not list data for Clark County, but under the alternative analysis, Clark County impacts would be approximately half of the Clark County impacts identified in Table 4-256.
b. Source: DIRS 181590- Bland 2007, all.

4.3.9.3.3 Public Services

Railroad operations along the Mina rail alignment would result in small impacts to health-care capacity in Lyon, Mineral, Nye, and Esmeralda Counties and on education infrastructure in southern Nye County (Pahrump). The exact extent of impacts to other public services would depend on the total number of workers and their residential locations, and operations activities in relation to existing system capacity. However, workers could create small to moderate impacts in the form of additional demand for fire-protection services in Lyon, Mineral, Nye, and Esmeralda Counties.

4.3.9.3.3.1 Health Care. The increased demand for health care associated with the railroad operations support facilities could result in small adverse impacts to the existing health service capacity. As discussed in Section 3.3.9.3.4, Lyon, Mineral, Nye, and Esmeralda Counties are all considered medically underserved. This analysis assumes that there will be no health-care support for the project on the Walker River Paiute Reservation.

In particular, population impacts associated with facilities in southern Nye County could place increased demand on the health-care system in the county. The peak average increase in Nye County's permanent population would be 98 people (0.22 percent above the projected population without the project, or less than one-quarter of 1 percent), and it is assumed that many of these people would reside in or near Pahrump. Pahrump does have preventive care clinics and a new hospital although, as noted in Section 4.3.9.2.3.1, it is not clear whether the hospital is able to serve the routine and emergency health-care needs of the local population. Increased demand related to project increases in workers and permanent population, however small, could adversely affect the capacity of Pahrump's health-care system to meet local needs. If the Nevada Railroad Control Center and National Transportation Operations Center were in Mineral County instead of Nye County, the impacts to the health-care system in Nye County would be slightly less. Under this scenario, Nye County's permanent population would increase by 86 people, which would represent a 0.19-percent average increase.

4.3.9.3.3.2 Education. As indicated in Section 4.3.9.2.3.2, the annual impact to schools in Lyon, Mineral, Nye, and Esmeralda Counties that would result from the increase in population would average about 2, 13, 17, and 12 additional pupils, respectively. The operations phase workforce could place limited strains on the education system in Mineral and Nye Counties, resulting in small, if any, impact. The exact extent of this impact would depend on the final location of railroad operations support facilities, where workers choose to reside, whether workers relocated families and children, the ages of children, and the capacities of particular schools in 2015 and later.

In Nye County, DOE estimates a peak average annual increase of 132 people above the county's projected population without the project in 2066. The addition of these workers and permanent population to the county would have the potential to increase the number of children in the school system by 23.

The location of railroad facilities at the end of the line could result in many workers and their families residing in Pahrump. As noted in Section 3.3.9, independent of the proposed railroad, Pahrump is experiencing a fairly rapid increase in its population, and all schools are functioning at or above maximum design capacity. Further baseline population increases are predicted, meaning that even without project-related impacts, school capacity would become strained in the future. While any additional increases to the projected baseline population would increase the need for school capacity, the estimated additional 23 students associated with the proposed railroad would be a small incremental increase in relation to the school population increases Pahrump is experiencing at present. Therefore, the projected project-related impact would be small in comparison with the impact related to other factors.

Impacts in Esmeralda County would be limited because the number of resident workers at the Maintenance-of-Way Facility would be small; the elementary school system in Esmeralda County can accommodate an additional 100 students (DIRS 174970-Arcaya 2005, all); and students can attend high school in Tonopah, where there are elementary, middle, and high school facilities. The influx of operations-phase workers to Tonopah or Goldfield would not adversely affect school capabilities.

4.3.9.3.3.3 Fire Protection. As discussed in Section 4.3.9.2.3.3, Lyon, Mineral, Nye, and Esmeralda Counties all meet fire suppression needs with volunteers, with the exception of Pahrump's paid fire department. At present, most communities characterized in the region of influence are able to provide adequate protection (except for Pahrump, which is currently underserved), but increased demand on these services could move them closer to the limit that existing resources (personnel and equipment) could address. Increases to permanent county populations could result in small to moderate impacts in Lyon, Mineral, Nye, and Esmeralda Counties, and particularly in Pahrump, where, as noted in Section 3.3.9, fire-protection capabilities are already overextended. With the Cask Maintenance Facility collocated with the Rail Equipment Maintenance Yard, and most workers and their families residing in Pahrump, these additional demands on the fire-protection capabilities of Pahrump could affect the system's ability to meet the community's needs.

4.3.9.3.3.4 Law Enforcement. Given the low crime rates in Lyon, Mineral, Nye, and Esmeralda Counties, it is not likely that population increases would increase the incidence of crime to the extent that the existing level of law enforcement services would become inadequate to meet the demand.

4.3.9.3.4 Transportation Infrastructure

4.3.9.3.4.1 Traffic Impacts. There would be fewer road traffic impacts during the operations phase than during the construction phase because there would be considerably fewer workers during the operations phase. DOE estimates that a total of 150 employees would be needed to operate the railroad operations support facilities. A total of 70 employees would be working at the Nevada Railroad Control Center and National Transportation Operations Center, Rail Equipment Maintenance Yard, and Cask Maintenance Facility. Additionally, 40 employees would work at the Staging Yard, and 40 would work at the Maintenance-of-Way Facility (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 4). Table 4-258 summarizes the projected number of vehicle trips that would be generated during the operations phase, assuming that each of these employees would generate two trips per day, one of them during the peak hour. The affected road segments would be the same as the ones considered in the analysis for the construction phase (see Section 4.3.9.2.4.1).

Table 4-258. Projected highway trips during operation of the railroad operations support facilities – Mina rail alignment.[a]

Facility	Number of daily vehicle trips	Number of peak hour vehicle trips
Employees for operations of the Staging Yard	80	40
Employees for operations of the Maintenance-of-Way Facility	80	40
Employees for operations of the facilities inside the Yucca Mountain Site boundary near the repository	140	70

a. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 4.

DOE determined that the projected trips listed in Table 4-258 for the three key areas could result in the following impacts to traffic:

- Operations at the Staging Yard would have a small impact on traffic along U.S. Highway 95 and State Route 359, and levels of service would remain at C and A, respectively (no degradation in level of service).
- Operations at the Maintenance-of-Way Facility would have a small impact on traffic along U.S. Highway 95 between Tonopah and Goldfield, and level of service would remain at B (no degradation in level of service).
- Operations at the facilities inside the Yucca Mountain Site boundary near the repository would affect traffic along U.S. Highway 95 near the entrance to the Yucca Mountain Site, which would degrade the level of service from B to C.

4.3.9.3.4.2 Traffic Delay at Grade Crossings. As in Section 4.3.9.2.4.2, DOE examined the effects of the Mina Implementing Alternative on delay at grade crossings along existing rail lines in the region of influence and along the proposed rail line. Rail-highway crossings can be a source of delay to motorists because trains have movement priority. The delay analysis at grade crossings concentrates on the existing rail line between Hazen and Thorne because grade separation is not planned for any existing rail-highway intersections. Delay at grade crossings was not estimated for new rail segments because all major roads (U.S. Highways 95 and 6, and State Route 361) would be grade separated, and all roads that would cross the new rail line at grade have very low traffic.

DOE estimated road traffic delay at rail-highway grade crossings based on the additional rail traffic at the existing rail segments between Hazen and Thorne. Over the 50-year operations phase, there would be a maximum of 17 one-way trains per week, including cask trains, maintenance-of-way trains, and repository supply trains (DIRS 180874-Nevada Rail Partners 2007, Appendix A, p. A-9). To provide a conservative estimate, DOE assumed that all trains would originate in Hazen. Assuming that trains would only travel on weekdays, an average of approximately 3.4 trains per day would be expected.

DOE calculated blocked crossing time per train according to the speed and length of trains, and determined crossing delay per stopped vehicle based on blocked crossing time, road arrival, and road departure rates. The Department calculated the total number of vehicles delayed per day as a function of the number of daily trains, average daily road traffic volume, and blocked crossing time. Total delay per day is the product of crossing delay per stopped vehicle and total number of vehicles delayed per day. Appendix J includes a detailed description of the methodology DOE used to calculate delay at grade crossings.

Table 4-259 summarizes total daily delay at each grade crossing analyzed. The maximum average delay per vehicle would be 0.48 second, up from 0.36 second without the additional rail traffic. Therefore, the maximum average delay at grade crossings caused by the additional rail traffic under the Proposed Action would be 0.12 second per vehicle, which would represent a very small impact. The level of service on any of the analyzed intersections would not be degraded due to delay at grade crossings from additional rail traffic. Vehicles traveling on U.S. Highway 50A in Hazen, which currently has the lowest level of service (C) in the transportation region of influence, would experience an average delay of 0.1 second. The number of vehicles delayed in a day would increase from 10 to 27, and all stopped vehicles would be delayed by an average of 0.5 minute. Even though the number of vehicles affected would increase substantially, the average daily traffic at this intersection is about 7,900 vehicles per day. Therefore, less than one percent of vehicles traveling along U.S. Highway 50A would incur a delay of 0.5 minute.

4.3.9.3.4.3 Impacts to Existing Rail Traffic. DOE examined the impacts of additional rail traffic to existing rail traffic along the Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines. These existing branchlines currently operate a few trains per week that would continue after the proposed railroad was constructed. From Hazen to Wabuska, there are approximately two Union Pacific Railroad trains per week that operate on the Hazen Branchline. For purposes of analysis in this EIS, DOE estimated that approximately two Union Pacific Railroad trains en route to Wabuska and two Department of Defense trains en route to the Hawthorne Army Depot would run from Hazen to Hawthorne per week. During the operations phase, there would be between three and four additional trains per day, which is a significant increase to the number of existing trains. Because there is very little traffic currently operating along the existing rail segments, it is not expected that existing trains would face long delays, especially because train traffic would be coordinated to avoid delays. Therefore, impacts of new rail traffic on existing rail traffic would be moderate.

Table 4-259. Delay at highway-rail grade crossings during the operations phase – Mina rail alignment.

Federal Railroad Administration Crossing ID Number	Road name	County/ Reservation	Number of vehicles delayed per day		Average delay per vehicle (seconds)		Total delay per day (vehicle-minutes)	
			Existing	With proposed rail line	Existing	With proposed rail line	Existing	With proposed rail line
740905S	U.S. Highway 50A	Churchill	10	27	0.04	0.10	5.00	13.00
740906Y	Bango Road	Churchill	0	0	0.03	0.08	0.01	0.03
740907F	City Street	Churchill	0	0	0.03	0.08	0.00	0.00
740912C	U.S. Highway 50	Lyon	3	7	0.03	0.08	1.10	2.90
740914R	Fir Avenue	Lyon	1	3	0.03	0.08	0.47	1.30
740915X	5th Street	Lyon	1	2	0.03	0.08	0.38	1.00
740916E	9th Street	Lyon	1	4	0.03	0.08	0.64	1.70
740918T	U.S. Highway 95A	Lyon	3	9	0.03	0.08	1.40	3.80
740919A	Fort Churchill PA	Lyon	0	1	0.03	0.08	0.11	0.30
740920U	Adrian Valley	Lyon	0	0	0.03	0.08	0.01	0.02
740922H	Church Hill	Lyon	0	0	0.03	0.08	0.06	0.16
740923P	Thompson Smelter	Lyon	0	0	0.03	0.08	0.06	0.15
740925D	U.S. Highway 95A	Lyon	3	9	0.03	0.08	1.40	3.80
740927S	Mason Valley Road	Lyon	0	0	0.02	0.14	0.01	0.04
740945P	Walker Lake North	Mineral	0	0	0.02	0.14	0.00	0.00
740946W	Nolan	Mineral	0	0	0.02	0.14	0.00	0.04
740947D	Near Nolan	Mineral	0	0	0.02	0.14	0.00	0.01
740948K	Walker Lake South	Mineral	0	0	0.02	0.14	0.00	0.03
740951T	Thorne	Mineral	1	2	0.36	0.48	0.86	1.20

4.3.9.4 Impacts under the Shared-Use Option

The Shared-Use Option could result in additional facilities to support commercial use of the DOE rail line. Shared-use facilities could include access sidings in any of the following areas: Hawthorne, Luning, Mina, Goldfield, Silver Peak, and the Beatty area. Consideration of the Shared-Use Option addresses only those impacts that are reasonably foreseeable based on existing conditions in the affected communities.

4.3.9.4.1 Construction Impacts under the Shared-Use Option

Because commercial entities or local government would build commercial sidings at the locations of selected passing sidings (to the extent practicable), the incremental effort to construct the commercial sidings would be reduced. While there would be a need for some additional materials and labor, the increase over that needed under the Proposed Action without shared use would be small. As discussed in the following sections, DOE would expect impacts on population and housing; employment and income; public services; and transportation resources to be small under the Shared-Use Option, and similar to those under the Proposed Action without shared use.

4.3.9.4.1.1 Population and Housing. Given the minimal increase in economic activity that would be associated with railroad construction under the Shared-Use Option, there would be no to low population changes and attendant pressures on the available housing stock.

4.3.9.4.1.2 Employment and Income. There could be very limited increases in employment and income associated with construction under the Shared-Use Option. These increases would be similar to the changes in employment and income associated with construction under the Proposed Action without shared use. There could be limited loss of economic activity associated with land acquisition for the commercial-siding and parking-area rights-of-way, but DOE would expect such impacts, if any, to be small.

4.3.9.4.1.3 Public Services. Railroad construction under the Shared-Use Option would impact existing public services similar to the Proposed Action without shared use. Given the minimal incremental change in labor and population under the Shared-Use Option, impacts to health care, education, law enforcement, and fire-protection services would be small.

4.3.9.4.1.4 Transportation Infrastructure. The volume of daily and peak-hour trips that would be generated during railroad construction under the Shared-Use Option would be consistent with the volumes generated under the Proposed Action without shared use. For purposes of this analysis, DOE assumed that commercial access sidings and facilities would be constructed at the same time as the rail line, although it could also occur at a later date. There would be little increased traffic volume beyond that described for the Proposed Action without shared use.

The construction approach under the Shared-Use Option would be the same as that described for the Proposed Action without shared use, with construction being phased and best management practices implemented. Because, to the extent practicable, commercial sidings would be built at the locations of selected passing sidings, the incremental effort to construct commercial-use sidings would be minimized. There would be no need for additional construction camps and no need for new roads because the temporary access roads would also be used for commercial siding construction. Therefore, although there would be a need for some additional materials and labor under the Shared-Use Option, there would be little increase beyond that described for the Proposed Action without shared use. Based on the lengths of track involved under the Shared-Use Option, the incremental impacts to traffic from constructing the additional sidings would be a small fraction of the overall impacts for railroad construction under the Proposed Action without shared use. Thus, impacts to the transportation infrastructure under the Shared-Use Option would be small.

Traffic delay impacts at highway-rail grade crossings from construction trains would be consistent with the delay impacts under the Proposed Action without shared use.

4.3.9.4.2 Operations Impacts under the Shared-Use Option

The impact assessment for railroad operations under the Shared-Use Option draws on information from a DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), as described in Section 2.2.6. In the near term, commercial shippers using the DOE rail line would be existing nearby companies that currently transport materials and goods by truck.

4.3.9.4.2.1 Population and Housing. It is not likely that there would be noticeable increases in population associated with railroad operations under the Shared-Use Option. Increases in economic activity and associated indicators, particularly in terms of employment, would likely be limited and therefore would not generate substantial changes in permanent population. Therefore, DOE would expect no impacts on housing under the Shared-Use Option.

4.3.9.4.2.2 Employment and Income. Shared use of the DOE rail line could allow business activity to develop and expand in the region of influence, which would result in some employment and income benefits. For some companies, especially those involved in the shipment of heavy or bulk products, the rail line could allow firms to access new markets and to ship greater quantities of products to existing and new markets.

Based on the DOE analysis (DIRS 180694-Ang-Olson and Gallivan 2007, all), and as described in Section 2.2.6, overall potential commercial shipments are estimated at 2,465,000 metric tons (2,711,000 tons) or 27,110 carloads annually, with shipments of stone estimated at 878,000 metric tons (966,000 tons) or 9,660 carloads (consisting primarily of outgoing decorative rock); nonmetallic minerals at 251,000 metric tons (276,000 tons) or 2,760 carloads (consisting primarily of pozzolan); and petroleum products at 13,000 metric tons (14,000 tons) or 140 carloads (consisting of incoming crude oil).

Therefore, access to commercial rail service could support business expansion and revenue increases for firms in Mineral and Nye Counties. These increases in revenue might generate small direct and indirect employment and income impacts. However, there are a number of factors, such as a firm's overall business objectives and planning decisions, which would influence the extent to which revenue translated into increased hiring or increased income.

Railroad operation under the Shared-Use Option would generate limited employment and income impacts. It is expected that a crew of three people would be needed to operate the commercial train service. As discussed in Section 2.2.4.1, depending on the total travel time for the commercial train, a crew change point might be needed. Train crews would use local commercial facilities for sleeping and provision needs, causing some small, but positive, impacts to employment and income. There might also be small economic benefits associated with maintenance of the commercial rail facilities by a commercial contractor.

4.3.9.4.2.3 Public Services. Because the impacts to population and employment would be so small in Lyon, Mineral, Esmeralda, Nye, and Clark Counties, impacts to public services under the Shared-Use Option would be unlikely in any of these counties.

4.3.9.4.2.4 Transportation Infrastructure. Under the Shared-Use Option, commercial rail service would begin after the completion of construction. During railroad operations, trains carrying casks would have priority over trains carrying commercial shipments in terms of time in transit. Up to 18 one-way commercial trains per week would run along the rail line (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 one-way trains would run between Hazen and the repository per week carrying casks and other materials for ***maintenance-of-way activities*** (DIRS 175036-BSC 2005, Table 4.2). The commercial trains (not including the locomotives) would consist of up to 60 cars and would be approximately 1,100 meters (3,600 feet) long. Depending on the weight of the train, three or four locomotives would be required (DIRS 176756-Ang-Olson and Khan 2005, all).

Commercial trains would haul a range of products to and from businesses, including stone and other nonmetallic minerals, oil and petroleum products, and nonradioactive waste materials. DOE expects the operating characteristics of these trains to be similar to those typical of freight train operations. The Nevada Railroad Control Center would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line.

The volume of daily and peak-hour vehicle trips that would be generated during operations under the Shared-Use Option would be consistent with operations under the Proposed Action without shared-use. There would be little increase in traffic volumes beyond those described in Section 4.3.9.2.4.1.

During operation of commercial service on the rail line, there would be an increase in truck traffic to and from the commercial sidings as compared to the Proposed Action without shared use. DOE assumed that under the Proposed Action without shared use, private companies near the rail line would continue to ship and receive freight using truck-only transport. Under the Shared-Use Option, some of those shipments would be diverted to rail, with trucks accessing the commercial sidings. The reduced number of truck shipments that would result from rail shipment would offset the adverse impacts due to additional increase in number of trucks under the Shared-Use Option. Therefore, DOE would anticipate little increase in adverse impacts to the traffic levels of service of nearby roadways.

Road traffic delay impacts at highway-rail grade crossings would be higher than under the Proposed Action without shared use because of the additional commercial trains. Over the 50-year operations phase, there would be up to 18 one-way commercial trains per week (DIRS 180694-Ang-Olson and Gallivan 2007, all). To provide a conservative estimate, DOE assumed all trains would originate in Hazen. Assuming that trains would only travel on weekdays, an average of approximately 3.6 commercial trains per day would be expected. Even though the train length could vary based on the number of railcars, DOE used the maximum train length (with 60 railcars and four locomotives) in this analysis. Because there would be approximately 3.4 trains per day operating along the rail line (including cask trains, maintenance-of-way trains, and repository supply/construction trains), DOE considered a total of 7 trains per day in the analysis.

Table 4-260 summarizes total daily delay at each grade crossing analyzed. The maximum average delay per vehicle would be 4.4 seconds, up from 0.36 second without the additional rail traffic. Therefore, the maximum average delay at grade crossings caused by the additional rail traffic under the Proposed Action would be about 4 seconds per vehicle, which would represent a very small impact. The level of service on any of the analyzed intersections would not be degraded due to delay at grade crossings from additional rail traffic. Vehicles traveling on U.S. Highway 50A in Hazen, which currently has the lowest level of service (C) in the transportation region of influence, would experience an average delay of 1.8 seconds. The number of vehicles delayed in a day would increase from 10 to 169, and each stopped vehicle would be delayed by an average of 1.36 minutes. Even though the number of vehicles affected would increase substantially, the average daily traffic at this intersection is about 7,900 vehicles per day. Therefore, about two percent of vehicles traveling along U.S. Highway 50A would incur a delay of just above 1 minute.

4.3.9.4.2.5 Impacts to Existing Rail Traffic. DOE examined the impacts of additional rail traffic (including commercial trains) on existing rail traffic along the Union Pacific Railroad Hazen Branchline and Department of Defense Branchlines. These existing branchlines currently operate a few trains per week that would continue after the proposed railroad was constructed. From Hazen to Wabuska, there are approximately two Union Pacific Railroad trains per week that operate on the Hazen Branchline. For purposes of analysis in this Rail Alignment EIS, DOE estimated that approximately two Union Pacific Railroad trains en route to Wabuska and two Department of Defense trains en route to the Hawthorne Army Depot would run from Hazen to Hawthorne per week. During the operations phase, there could be about seven additional trains per day, which is a significant increase in the number of existing trains. Because there is very little traffic currently operating along the existing rail segments, DOE does not expect that existing trains would face long delays, especially because train traffic would be coordinated to avoid delays. Therefore, impacts of new rail traffic on existing rail traffic would be moderate.

Table 4-260. Delay at highway-rail grade crossings during the operations phase – Mina rail alignment Shared-Use Option.

Federal Railroad Administration Crossing ID Number	Road name	County/ Reservation	Number of vehicles delayed per day		Average delay per vehicle (seconds)		Total delay per day (vehicle-minutes)	
			Existing	With proposed rail line	Existing	With proposed rail line	Existing	With proposed rail line
740905S	U.S. Highway 50A	Churchill	10	169	0.04	1.80	5.00	230.00
740906Y	Bango Road	Churchill	0	0	0.03	1.10	0.01	0.49
740907F	City Street	Churchill	0	0	0.03	1.10	0.00	0.02
740912C	U.S. Highway 50	Lyon	3	39	0.03	1.20	1.00	42.00
740914R	Fir Avenue	Lyon	1	17	0.03	1.20	0.47	18.00
740915X	5th Street	Lyon	1	14	0.03	1.20	0.38	15.00
740916E	9th Street	Lyon	1	23	0.03	1.20	0.64	25.00
740918T	U.S. Highway 95A	Lyon	3	51	0.03	1.20	1.40	56.00
740919A	Fort Churchill PA	Lyon	0	4	0.03	1.10	0.11	4.40
740920U	Adrian Valley	Lyon	0	0	0.03	1.10	0.01	0.27
740922H	Church Hill	Lyon	0	2	0.03	1.10	0.06	2.30
740923P	Thompson Smelter	Lyon	0	2	0.03	1.10	0.06	2.20
740925D	U.S. Highway 95A	Lyon	3	51	0.03	1.20	1.40	56.00
740927S	Mason Valley Road	Lyon	0	1	0.02	5.40	0.01	1.50
740945P	Walker Lake North	Mineral	0	0	0.02	5.40	0.00	0.12
740946W	Nolan	Mineral	0	1	0.02	5.40	0.00	1.40
740947D	Near Nolan	Mineral	0	0	0.02	5.40	0.00	0.24
740948K	Walker Lake South	Mineral	0	0	0.02	5.40	0.00	1.20
740951T	Thorne	Mineral	1	7	0.36	4.40	0.86	11.00

4.3.9.5 Summary

Table 4-261 summarizes the potential socioeconomic impacts of constructing and operating the proposed railroad along the Mina rail alignment. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use; however, DOE recognizes the speculative potential for increased economic development.

Potential socioeconomic impacts from construction and operation of the proposed railroad along the Mina rail alignment include the following:

- Population increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in population would be in Esmeralda County (3.1 percent) and Mineral County (1.4 percent).
- Population increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in population would be in Esmeralda County (7 percent) and Mineral County (1.6 percent).

- Employment increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in employment would be in Esmeralda County (14 percent) and Mineral County (6.1 percent).
- Employment increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in employment would be in Esmeralda County (14 percent) and Mineral County (2.6 percent).
- Real disposable income increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in real disposable income would be in Esmeralda County (27 percent) and Mineral County (4.5 percent).
- Real disposable income increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in real disposable income would be in Esmeralda County (10 percent) and Mineral County (2.8 percent).
- Gross regional product increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in gross regional product would be in Esmeralda County (57 percent) and Mineral County (14 percent).
- Gross regional product increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in gross regional product would be in Esmeralda County (24 percent) and Mineral County (1.9 percent).
- State and local government spending increases in all of the counties in the region of influence during the construction phase. The greatest percentage increase in state and local government spending would be in Esmeralda County (4.6 percent) and Mineral County (1.8 percent).
- State and local government spending increases in all of the counties in the region of influence during the operations phase. The greatest percentage increase in state and local government spending would be in Esmeralda County (9.9 percent) and Mineral County (1.5 percent).
- There would be no noticeable impacts to public services during the construction phase.
- There would be small to moderate impacts to some public services during the operations phase (see Table 4-261 for details).
- There would be some impacts to transportation during the construction phase (see Table 4-261 for details).
- There would be some impacts to transportation during the operations phase (see Table 4-261 for details).

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a] (page 1 of 4)

County	Construction	Operations
Walker River Paiute Reservation	Population and housing: Not analyzed	Population and housing: Included in the Mineral County estimates because the forecasting model cannot discriminate impacts to the Reservation
	Employment and income • Assuming one of the construction camps is placed on the Walker River Paiute Reservation: - Up to 20 additional jobs - Up to $1.4 million in gross regional product - Up to $386,000 in real disposable income	Employment and income: Included in the Mineral County estimates because the forecasting model cannot discriminate impacts to the Reservation
	Public Services: Not analyzed	Public Services: Not analyzed
	Transportation Infrastructure: Not analyzed	Transportation Infrastructure: Not analyzed
Washoe County/ Carson City	Population and housing • Population: < 1 percent increase	Population and housing • Population: < 0.1 percent increase
	Employment and income • Employment: < 0.3 percent increase • Real disposable income: < 0.3 percent increase • Gross regional product: < 0.3 percent increase • State and local government spending: < 0.1 percent increase	Employment and income • Employment: < 0.1 percent increase • Real disposable income: < 0.1 percent increase • Gross regional product: < 0.1 percent increase • State and local government spending: < 0.1 percent increase
	Public Services: No noticeable impacts	Public Services: No noticeable impacts
	Transportation: No noticeable impacts	Transportation: No noticeable impacts
Churchill	Population and housing: Not analyzed	Population and housing: Not analyzed
	Employment and income: Not analyzed	Employment and income: Not analyzed
	Public Services: Not analyzed	Public Services: Not analyzed
	Transportation: • Delay impacts on road traffic at grade crossings: less than one percent of vehicles traveling along U.S. Highway 50A in Hazen would incur a delay of less than one minute • Rail impacts on existing rail traffic: moderate	Transportation: • Delay impacts on road traffic at grade crossings: less than one percent of vehicles traveling along U.S. Highway 50A in Hazen would incur in a delay of 0.5 minute • Rail impacts on existing rail traffic: moderate

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a] (page 2 of 4).

County	Construction	Operations
Lyon	Population and housing • Population: 0.01 percent increase Employment and income • Employment: 0.02 percent increase • Real disposable income: 0.03 percent increase • Gross regional product: 0.04 percent increase • State and local government spending: 0.01 percent increase Public Services: No noticeable impacts Transportation: • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate	Population and housing • Population: < 0.01 percent increase Employment and income • Employment: 0.01 percent increase • Real disposable income: 0.01 percent increase • Gross regional product: 0.01 percent increase • State and local government spending: 0.01 percent increase Public Services • Small impacts to health care services due to population increases in a medically underserved area • Small impacts to fire protection services due to population increases Transportation: • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate
Mineral	Population and housing: • Population: 1.4 percent increase Employment and income: • Employment: 6.1 percent increase • Real disposable income: 4.5 percent increase • Gross regional product: 14 percent increase • State and local government spending: 1.8 percent increase • Small impacts to mining Public Services: No noticeable impacts Transportation: • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate	Population and housing: • Population: 1.6 percent increase Employment and income • Employment: 2.6 percent increase • Real disposable income: 2.8 percent increase • Gross regional product: 1.9 percent increase • State and local government spending: 1.5 percent increase • Small impacts to mining Public Services: • Small impacts to health care services due to population increases in a medically underserved area • Small impacts to fire protection services due to population increases Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small • Rail impacts on existing rail traffic: moderate

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a] (page 3 of 4).

County	Construction	Operations
Nye	Population and housing • Population: 0.16 percent increase	Population and housing • Population: 0.3 percent increase • County-wide population increase of 98 could place strain on supply of 1,058 vacant housing units in Pahrump
	Employment and income • Employment: 0.6 percent increase • Real disposable income: 0.4 percent increase • Gross regional product: 1 percent increase • State and local government spending: 0.2 percent increase	Employment and income • Employment: 0.1 percent increase • Real disposable income: 0.1 percent increase • Gross regional product: 0.2 percent increase • State and local government spending: 0.1 percent increase
	Public Services: • Small impacts to health care services due to population increases in a medically underserved area	Public Services: • Moderate impacts to health care services due to population increases in a medically underserved area • Moderate impacts to fire-protection services in Pahrump due to population increases in an underserved area • Addition of 23 school-aged children to overcrowded schools
	Transportation • Traffic impacts to local highways: level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small	Transportation • Traffic impacts to local highways: level of service on U.S. Highway 95 near access to the Yucca Mountain Site would degrade from B to C • Delay impacts on road traffic at grade crossings: small
Esmeralda	Population and housing • Population: 3.1 percent increase	Population and housing • Population: 7 percent increase
	Employment and income • Employment: 14 percent increase • Real disposable income: 27 percent increase • Gross regional product: 57 percent increase • State and local government spending: 4.6 percent increase • Small impacts to mining	Employment and income • Employment: 14 percent increase • Real disposable income: 10 percent increase • Gross regional product: 24 percent increase • State and local government spending: 9.9 percent increase • Small impacts to mining
	Public Services: No noticeable impacts	Public Services • Small impacts to health care services due to population increases in a medically underserved area • Small impacts to fire protection services due to population increases
	Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small	Transportation • Traffic impacts to local highways: no change in level of service • Delay impacts on road traffic at grade crossings: small

Table 4-261. Summary of impacts to socioeconomic conditions – Mina rail alignment[a] (page 4 of 4).

County	Construction	Operations
Clark	Population and housing • Population: 0.04 percent increase Employment and income • Employment: 0.1 percent increase • Real disposable income: 0.1 percent increase • Gross regional product: 0.1 percent increase • State and local government spending: 0.04 percent increase Public Services: No noticeable impacts	Population and housing • Population: < 0.01 percent increase Employment and income • Employment: < 0.1 percent increase • Real disposable income: < 0.1 percent increase • Gross regional product: < 0.1 percent increase • State and local government: < 0.1 percent increase Public Services: No noticeable impacts
Throughout region of influence	Employment and income Up to 326 animal unit months lost, valued at $17,400	Employment and income Continued lack of access to up to 326 animal unit months, valued at $17,400

a. Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use; < = less than.

4.3.10 OCCUPATIONAL AND PUBLIC HEALTH AND SAFETY

This section describes potential nonradiological and radiological health and safety impacts to workers and the public from construction and operation of the proposed railroad along the Mina rail alignment, including ***incident-free transportation*** and transportation accident scenarios. Section 4.3.10.1 describes the impact assessment methodology, Section 4.3.10.2 describes potential impacts associated with the Proposed Action, Section 4.3.10.3 describes potential impacts associated with the Shared-Use Option, and Section 4.3.10.4 summarizes potential impacts.

Incident-free transportation: Routine transportation in which cargo travels from origin to destination without being involved in an accident.

Accident: An unplanned sequence of events that leads to undesirable consequences.

Section 4.3.10.1 describes the region of influence for nonradiological and radiological impacts.

Appendix K, Radiological Health and Safety, describes the methods and data DOE used to assess radiological impacts for this Rail Alignment EIS.

4.3.10.1 Impact Assessment Methodology

4.3.10.1.1 Nonradiological Impact Assessment Methodology

Nonradiological impacts to occupational health and safety would include impacts to workers from exposure to physical hazards and nonradioactive ***hazardous chemicals*** during construction and operation of the proposed rail line and associated facilities. DOE estimated such impacts using occupational incident rates for total ***recordable cases***, lost workday cases, and fatalities. Total recordable cases are defined as the total number of work-related injuries or illnesses that resulted in fatalities, days away from work, job transfer or restriction, or other cases as identified in Occupational Safety and Health Administration (OSHA) Form 300, Log of Work-Related Injuries and Illnesses (DIRS 175488-OSHA [n.d.], all). Recordable cases of work-related injury or illness include fatality; loss of consciousness; injury or illness resulting in one or more days away from work; administration of medical treatment other than first aid; and other workplace injury or illness diagnosed by a physician or other health-care professional. OSHA defines lost workday cases as injuries or illnesses resulting in loss of 1 or more work days, not including the day the injury or illness occurred.

This section also discusses potential exposure of workers to physical (nonradiological) hazards related to transportation accidents and cask-handling accidents. Impacts to occupational and public health and safety from exposures to hazards associated with other resource areas are also discussed separately in this section. These include air quality hazards (potential occupational exposures to criteria and ***toxic air pollutants***, including diesel particulate matter and carbon monoxide, and to nonradiological ***hazardous air pollutants***) and noise hazards (potential occupational exposure to noise). Public exposure to air pollutants and noise are discussed in more detail in Section 4.3.4, Air Quality and Climate, and Section 4.3.8, Noise and Vibration. Hazards associated with other specific resource areas discussed in this section include biological hazards and dust and soils hazards.

DOE estimated nonradiological occupational impacts by multiplying the number of labor hours worked by involved and noninvolved construction workers and operations workers by workplace health and safety incident rates in units of number of occurrences per hour worked for involved workers and noninvolved workers. The workplace incident rates DOE used for this analysis are U.S. Department of Labor, Bureau of Labor Statistics, data for 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).

The nonradiological occupational health and safety impact analysis is based on health and safety incident statistics defined as follows (DIRS 155970-DOE 2002, p. F-17):

- Fatalities, regardless of the time between the injury and death, or the length of the illness
- Lost workday cases, other than fatalities, that result in lost workdays
- Nonfatal cases without lost workdays that result in transfer to another job, termination of employment, medical treatment (other than first aid), loss of consciousness, or restriction of work or motion

DOE estimated the frequency of occurrence of such incidents based on the specific activity (construction or operations) and the number of activity-specific worker labor hours.

Table 4-262 cites U.S. Department of Labor, Bureau of Labor Statistics, incident rate data DOE used to estimate total recordable cases, lost workday cases, and fatalities for involved and noninvolved workers during construction and operation of the proposed railroad. Involved workers are defined for the purposes of this analysis as personnel who would be directly involved in construction or operations activities. Noninvolved workers are defined for the purposes of this analysis as personnel who would be involved in management, administration, and security. The Bureau of Labor Statistics compiled the health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises Sector; Transportation and Warehousing: Rail Transportation Sector; Support Activities for Transportation Sector; Non-Metallic Mineral Manufacturing (Batch Plant Construction and Operation); and Mining and Support Activities for Mining (Quarry Construction and Operation involved and noninvolved workers). Fatality incident statistics are compiled by employment sector, including Construction; Professional and Business Services; Transportation and Warehousing; Mining (Quarry Construction and Operation); and Manufacturing (Batch Plant Construction and Operation.)

The U.S. Department of Labor Mine Safety and Health Administration reports occupational nonfatal incident and fatality incident data for stone, quarry, and mill operations (surface mining). In 2005, a total of nine fatalities were reported in sand and gravel surface mining for 37,258 full-time-equivalent workers and a total of five fatalities were reported in stone surface mining for 34,744 full-time-equivalent workers. This corresponds to a total fatal incident rate of 20.3 fatalities per 100,000 full-time-equivalent workers. This is lower than the fatality incident rate of 25.6 fatalities per 100,000 full-time-equivalent workers reported by the Bureau of Labor Statistics for all mining activities. DOE used the Bureau of Labor Statistics fatality incident rate to estimate the fatalities associated with quarry and ballast site construction, operation, and reclamation for the purposes of maintaining consistency with the Bureau of Labor Statistics incident rate data for other rail line and facilities construction and operations activities (DIRS 178746-MSHA 2006, all; DIRS 178747-MSHA 2006, all; DIRS 178748-MSHA 2006, all).

The statistics for recordable cases and lost workday cases for rail line and associated facility construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector. The statistics for rail line facility operations for involved workers are applicable to the Support Activities for Transportation Sector. The statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers.

Table 4-262. U.S. Department of Labor, Bureau of Labor Statistics, incident rate data for estimating industrial safety impacts common to the workplace.[a]

	Total recordable cases incidents per 100 FTEs[b]		Lost workday cases per 100 FTEs[b]		Fatalities per 100,000 FTEs[b]	
Activity	Involved	Noninvolved	Involved	Noninvolved	Involved	Noninvolved
Construction						
Rail line	5.6	2.4	3.1	1.3	11	3.5
Facilities	5.6	2.4	3.1	1.3	11	3.5
Quarry/ballast site construction and operation	4.1	3.9	2.7	2.2	25.6	3.5
Batch plant construction and operation	9.1		3.8		2.4	
Operations						
Rail line	2.5	2.4	1.9	1.3	17.6	3.5
Facilities	5.5	2.4	3.4	1.3	17.6	3.5

a. Sources: DIRS 179129-BLS 2007, Table 1. Incidence rates (1) of nonfatal occupational injuries and illnesses by selected industries and case types, 2005; DIRS 179131-BLS 2006, Number of fatal work injuries, 1992-2005, Number and rate of fatal occupational injuries by major occupation groups, 2005.
b. One full-time-equivalent worker is defined as 2,000 labor hours worked.

All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005. These statistics are summarized in Table 4-262 and are applied to estimate the total recordable cases, lost workday cases, and fatalities for the construction and operation of the rail line and associated facilities.

DOE performed the following steps as part of the nonradiological occupational health and safety impact calculations:

1. DOE obtained full-time-equivalent data for each phase of construction and operation of the proposed rail line and associated facilities from the following documents: The numbers of full-time-equivalent worker years for each rail line construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input Mina Rail Corridor*, Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007), and the Personnel Breakdown Per Camp shown as Table 4-2 and the schedule shown as Figure 7-A, MRC Construction Schedule, from the Construction Plan, Rev 00, April 30, 2007 (DIRS 180875-Nevada Rail Partners 2007). The numbers of full-time-equivalent worker years for each rail line facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input – Mina Rail Corridor*, Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007). A "full-time-equivalent" is defined as 2,000 labor hours worked per year. It is not necessarily the case that all 2,000 hours of an annual full-time-equivalent would be worked by the same individual. For example, train engineers operate on a crew schedule based on the number of train trips. Therefore the 2,000 hours per year worked for one full-time-equivalent for the labor category "train engineer" may comprise several individual train engineers.

2. DOE categorized full-time-equivalent workers for construction and operations workers as either "involved" workers or "noninvolved" workers depending on the specific activity of the worker identified. For purposes of this analysis, involved workers are defined as workers directly involved in construction or operations activities. Noninvolved workers are defined as workers performing management, administration, or security functions.

   The incident statistics used in the calculation are reported by the Bureau of Labor Statistics for calendar year 2005 (DIRS 179129-BLS 2007, all; DIRS 179131-BLS 2006, all).

   Incident rate statistics for total recordable cases, lost workday cases, and fatalities differ for involved and noninvolved workers.

   - All rail line workers are categorized as involved workers.
   - Facilities operations workers in job categories including "management," "administration," "clerical," and "security" are categorized as "noninvolved" workers.
   - Facilities operations workers in other job categories are categorized as "involved" workers.

   The Bureau of Labor Statistics compiles health and safety statistics by employment sector, including the Heavy and Civil Engineering Construction Sector; Management of Companies and Enterprises Sector; Transportation and Warehousing: Rail Transportation Sector; and Support Activities for Transportation Sector. The statistics for total recordable cases and lost workday cases for rail line and associated facilities construction for involved workers are applicable to the Heavy and Civil Engineering Construction Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. The statistics for total recordable cases and lost workday cases for rail line operations for involved workers are applicable to the Transportation and Warehousing: Rail Transportation Sector, statistics for railroad facility operations for involved workers are applicable to the Support Activities for Transportation Sector, and statistics for noninvolved workers are applicable to the Management of Companies and Enterprises Sector. Statistics for fatalities are applicable to the Construction Sector and Transportation and Warehousing Sector for involved workers and to the Professional and Business Services Sector for noninvolved workers. All Bureau of Labor Statistics data used in this Rail Alignment EIS are for 2005.

3. Full-time-equivalent workers for construction of the rail line include the following activities.

   - Rail line construction

4. Full-time-equivalent workers for construction of railroad facilities include the following facilities.

   - Concrete batch plant construction
   - Concrete batch plant operation
   - Water-well drilling
   - Construction camp construction
   - Construction camp operation
   - Quarry construction
   - Quarry operation
   - Staging Yard
   - Maintenance-of-Way Facility
   - Nevada Railroad Control Center and National Transportation Operations Center

- Cask Maintenance Facility
- Rail Equipment Maintenance Yard
- Facility access roads

5. Full-time-equivalent workers for operation of the railroad facilities include the following facilities.

    - Staging Yard
    - Maintenance-of-Way Facility
    - Nevada Railroad Control Center and National Transportation Operations Center
    - Cask Maintenance Facility
    - Rail Equipment Maintenance Yard

6. DOE identified construction full-time-equivalent workers for each year of the construction schedule for the rail line and each facility. The full-time-equivalent workers for each year are summed to calculate the total involved full-time-equivalent workers and total noninvolved full-time-equivalent workers for the rail line and each facility.

7. Full-time-equivalent worker data for involved workers and noninvolved workers are multiplied by incident rates published by the U.S. Department of Labor, Bureau of Labor Statistics, for various employment sector categories applied to involved and noninvolved construction workers and operations workers to estimate the number of incidents for construction and operation of the rail line and associated facilities for the Proposed Action and Shared-Use Option. Employment sector categories for the Bureau of Labor Statistics incident rate data applied to involved and noninvolved workers are described above in Step 2.

Sections 4.3.10.2 and 4.3.10.3 discuss nonradiological impacts to the public from construction and operation of the proposed rail line and associated facilities under the Proposed Action and the Shared-Use Option. These nonradiological impacts include air quality impacts, noise impacts, and transportation (traffic accident and fatality) impacts. The methodologies for estimating these impacts from specific resource areas are described in the respective sections of this Rail Alignment EIS. Potential impacts from occupational exposure to workplace dust and noise during construction and operation of the Proposed Action and the Shared-Use Option are also discussed in Sections 4.3.10.2 and 4.3.10.3.

4.3.10.1.2 Radiological Impact Assessment Methodology

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called photons, or in the form of high-energy subatomic particles. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. Humans are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation (which heats material when the material and the radiation interact), and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (more penetrating) includes ultraviolet radiation (which causes sunburn), X-rays, and gamma radiation.

Ionizing radiation is radiation that has sufficient energy to displace ***electrons*** from atoms or molecules to create ions. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, alpha, beta, or ***neutron*** radiation). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called ***radioactive decay***, is the transformation of an unstable atom (a ***radionuclide***) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—***alpha particles***, **beta particles**, and ***gamma*** or ***X-rays***. Neutrons emitted during nuclear fission are another type of ionic radiation. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. Some gamma radiation will pass through the body without interacting with it. Shielding from neutrons, which are also highly penetrating, requires materials that contain light elements such as hydrogen.

In a nuclear ***reactor***, heavy atoms such as uranium and plutonium can undergo another process, called ***fission***, after the absorption of a subatomic particle (usually a neutron). In fission, a heavy atom splits into two lighter atoms and releases energy in the form of radiation and the kinetic energy of the two new lighter atoms. The new lighter atoms are called ***fission products***. The fission products are usually unstable and undergo radioactive decay to reach a more stable state.

Some of the heavy atoms might not fission after absorbing a subatomic particle. Rather, a new nucleus is formed that tends to be unstable (like fission products) and undergo radioactive decay.

The radioactive decay of fission products and unstable heavy atoms is the source of the radiation from spent nuclear fuel and high-level radioactive waste that makes these materials hazardous in terms of potential human health impacts.

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials that directly emit radiation, such as radioactive waste or radionuclides in soil. ***Exposure*** to direct radiation can be mitigated by placing shielding, such as lead, between the source of the radiation and the exposed individual. Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once in the body, the ***fate*** of a radioactive material is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

Exposure to ionizing radiation is expressed in terms of ***absorbed dose***, which is the amount of energy imparted to matter per unit mass. Often simply called ***dose***, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the ***rad***. The different types of radiation mentioned above have different effects in damaging the cells of biological systems. ***Dose equivalent*** is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the ***rem***. In quantifying the effects of radiation on humans, other types of concepts are also used. The concept of ***effective dose equivalent*** is used to quantify effects of radionuclides in the body.

It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to cancer. The sum of the products of each affected tissue's estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long ***half-lives*** and long residence time in the body. The result is called the committed effective dose equivalent. The unit of effective dose equivalent is the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of radiation dose in this Rail Alignment EIS, unless specifically noted otherwise, are total effective dose equivalents, which are quantified in terms of rem or millirem (mrem).

More detailed information on the concepts of radiation dose and dose equivalent are in publications of the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993, all) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) or external exposure to radionuclides (by ***groundshine*** or ***cloudshine*** [immersion]) to radiation dose are called dose conversion factors or dose coefficients. The International Commission on Radiological Protection and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors (DIRS 172935-ICRP 2001, all; DIRS 175544-EPA 2002, all). They are based on original recommendations of the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The radiation dose to an individual or to a group of people can be expressed as the total dose received or as a ***dose rate***, which is dose per unit time (usually an hour or a year). ***Collective dose*** is the total dose to an exposed population. ***Person-rem*** is the unit of collective dose. Collective dose is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 persons × 0.1 rem).

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period, typically 24 hours or less. Chronic exposures occur over longer periods (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

The radiation dose estimates discussed in this Rail Alignment EIS are associated with exposure to radiation at low dose rates. Such exposures can be chronic (continuous or nearly continuous), such as those to workers who are security escorts. In some instances, exposures to low levels of radiation would be intermittent (for example, infrequent exposures to an individual from radiation emitted from ***shipping casks*** as they are transported). ***Cancer*** induction is the principal potential risk to human health from exposure to low levels of radiation. However, this cancer induction is a statistical process because exposure to radiation conveys only a chance of developing cancer, not a certainty. Furthermore, other causes, such as exposure to chemical agents, can induce cancer in individuals.

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. Radiological health impacts are expressed as the incremental changes in the number of expected fatal cancers (referred to as ***latent cancer fatalities***) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose-to-health effect conversion factors recommended by the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all). The Interagency Steering Committee on Radiation Standards is comprised of eight federal agencies (the Environmental Protection Agency, the

Nuclear Regulatory Commission, DOE, the Department of Defense, the Department of Homeland Security, the Department of Transportation, the Occupational Safety and Health Administration, and the Department of Health and Human Services), three federal observer agencies (the Office of Science and Technology Policy, the Office of Management and Budget, and the Defense Nuclear Facilities Safety Board), and two state observer agencies (Illinois and Pennsylvania). The Committee estimated that, for the general population and workers, a collective dose of 1 person-rem would yield 6×10^{-4} excess latent cancer fatalities.

Sometimes, calculations of the number of latent cancer fatalities associated with radiation dose do not yield whole numbers, and, especially in environmental applications, can yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total radiation dose of 0.001 rem, the collective radiation dose would be 100 person-rem and the corresponding estimated number of latent cancer fatalities would be 0.06 (100,000 persons × 0.001 rem × 0.0006 latent cancer fatalities per person-rem). How should one interpret a nonintegral number of latent cancer fatalities, such as 0.06? The answer is to interpret the result as a statistical estimate. That is, 0.06 is the average number of latent cancer fatalities that would result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur a latent cancer fatality from the 0.001 rem radiation dose each member would have received. In a small fraction of the groups (about 6 percent), 1 latent cancer fatality would result; in exceptionally few groups, 2 or more latent cancer fatalities would occur. The average number of latent cancer fatalities over all of the groups would be 0.06. The most likely outcome for any single group is 0 latent cancer fatalities.

DOE estimated radiological impacts for incident-free transportation, transportation accident risks and the consequences of severe transportation accidents, and transportation sabotage events.

The analysis of potential radiological occupational and public health and safety impacts in this Rail Alignment EIS includes all of those potentially exposed individuals discussed in Section 3.3.10 of this Rail Alignment EIS. No construction-related radiation dose is anticipated to workers or the public during respository construction activities.

The U.S. Department of Energy (DOE) Department of Environment Safety and Health guidance in *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements*, Second Edition, December 2004 (DIRS 178579-DOE 2004, all), requires that radiological impacts be estimated, no matter how small the population. Therefore, the radiological impact analyses in this Rail Alignment EIS are applied to various populations of potentially exposed individuals.

4.3.10.1.3 Transportation Impact Assessment Methodology

DOE based the transportation impact analysis on guidelines from the American Institute of Chemical Engineers with respect to chemical transportation risk analyses (DIRS 182284-Center for Chemical Process Safety 1995, all). The methodology presented in this section uses both qualitative and quantitative components. The number of fatalities and accidents resulting from vehicular and train travel were based on fatality and accident rates provided by Federal Railroad Administration and Nevada Department of Transportation statistics. The rates were used in combination with the specifics of an operation (for example, total distance traveled, route length, and number of trips) to estimate the likelihood of accidents and fatalities. The estimated number of potential vehicular traffic fatalities was based on assuming a total distance traveled from workers commuting during both the construction and operations phases. The estimates for potential rail traffic fatalities and accidents were also based on assuming total distances traveled from material/equipment transport during construction and shipment during operations. Traffic accidents under the Shared-Use Option were qualitatively analyzed based on a proportional comparison to the Proposed Action. Rail line fatalities associated with the Shared-Use Option were evaluated by revising the analyses for the additional rail traffic levels.

4.3.10.2 Proposed Action

4.3.10.2.1 Nonradiological Impacts

Nonradiological health and safety addresses potential exposure of construction and operations workers to physical hazards, and nonradioactive chemical hazards generated from construction and operations. This section also summarizes impacts associated with nonradiological occupational health and safety from specific resource areas, including biological hazards, dust and soils hazards, air quality hazards, and noise hazards.

4.3.10.2.1.1 Workers. Tables 4-263 and 4-264 summarize nonradiological impacts to workers from industrial hazards associated with construction and operation of the proposed rail line and associated facilities under the Proposed Action. Table 4-263 summarizes impacts for construction and operation of the rail line. Table 4-264 summarizes impacts for construction and operation of facilities. In general, rail line construction would create hazards that are common to heavy construction and earthmoving operations. Accidents that commonly occur at construction workplaces are:

- Trip and fall
- Object falls on worker
- Electrocution
- Asphyxiation (confined space or other)
- Penetrating wounds
- Dermal exposure skin injury
- Jobsite vehicle accident injury
- Hearing injury
- Object in eye
- Welding or laser eye injury
- Injury from trench or slope collapse
- Injury from explosion

Similar types of workplace accidents can occur during operation and maintenance of the proposed rail line and facilities. Workplace incidents also include incidents such as heat stress and workplace exposure to hazardous chemicals. These types of workplace accidents and incidents are included in the Bureau of Labor Statistics incident rate for total recordable cases, lost workday cases, and fatalities summarized in Table 4-262.

DOE would adopt a rigorous safety program that would enable workers to avoid most common accidents as required by DOE Order O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, as codified in 10 CFR Part 851. Chapter 7 of this Rail Alignment EIS describes mitigation measures and safety management practices to address workplace hazards. In accordance with 10 CFR Part 851 DOE would also be required to comply with applicable regulations under 29 CFR Part 1910 *Occupational Health and Safety Standards*, 29 CFR Part 1926, *Safety and Health Regulations for Construction*, and 29 CFR Part 1960, *Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters* (Section 11.4, Table 11-4, pp. 1 to 3). Code of Federal Regulations 29 Part 1926 applies to DOE contractors; 29 CFR 1960 (Basic Elements for Federal Employees OSHA) applies to DOE employees; 10 CFR 851.23 also requires DOE to apply American Council of Government Industrial Hygienist Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices when the Threshold Limit Values are lower (more protective) than permissible exposure limits in 29 CFR 1910.

Table 4-263 includes nonradiological impacts from proposed railroad construction and operations, but does not include facilities construction and operations. Construction impacts are estimated for activities occurring during the minimum 4.5-year construction phase, including construction of the rail line

Table 4-263. Estimated impacts to workers from nonradiological industrial hazards during proposed railroad construction and railroad operations under the Proposed Action.[a,b]

Group and industrial hazard category	Construction			Operations		
	FTEs[c]	Labor hours worked	Incidents	FTEs[c]	Labor hours worked	Incidents
Involved workers	5,233	10.5 million		1,471	2.9 million	
Total recordable cases[d]			292			37
Lost workday cases			162			28
Fatalities			0.60			0.26
Noninvolved workers	1,290	2.6 million		0	0	
Total recordable cases[d]			32			0
Lost workday cases			18			0
Fatalities			0.05			0
Totals[e]	6,523	13.0 million		1,471	2.9 million	
Total recordable cases[d]			324			37
Lost workday cases			179			28
Fatalities			0.65			0.26

a. Calculations are based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4-262 and full-time-equivalent worker year data from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 0, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007) and Table 4-2 and Figure 7-A, MRC Construction Schedule, from the Construction Plan- Rev 0, April 30, 2007 (DIRS 180875-Nevada Rail Partners 2007). All rail line construction workers are considered to be involved workers with the exception of construction camp operating workers.
b. Totals include rail line construction, quarry construction and operation, concrete batch plant construction and operation, construction camp construction and operation, construction train operation, and water-well construction and operation. Totals do not include construction or operation of rail line facilities.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d. Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

Rail line operations impacts include impacts to train crews and escort and security personnel.
The numbers of full-time equivalent workers for each rail line construction and operations activity, summarized in Table 4-263, were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, Appendix D) and the schedule shown as Figure 7-A, MRC Construction Schedule, from the Construction Plan, Rev 00, April 30, 2007 (DIRS 180875-Nevada Rail Partners 2007, Figure 7-A).

Rail line construction support facilities include:

- Construction of the construction camps
- Operation of the construction camps
- Construction of ballast quarries
- Operation of ballast quarries
- Construction of water wells
- Operation of water wells
- Construction of concrete batch plants
- Operation of concrete batch plants

Table 4-264. Estimated impacts to workers from nonradiological industrial hazards during facility construction and facility operations under the Proposed Action.[a,b]

Group and industrial hazard category	Construction			Operations		
	FTEs[c]	Labor hours worked	Incidents	FTEs[c]	Labor hours worked	Incidents
Involved workers	1,340	2.7 million		5,850	11.7 million	
Total recordable cases[d]			75			322
Lost workday cases			41			199
Fatalities			0.01			1.03
Noninvolved workers	0	0		1,650	3.3 million	
Total recordable cases[d]			0			40
Lost workday cases			0			21
Fatalities			0			0.06
Totals[e]	1,340	2.7 million		7,500	15.0 million	
Total recordable cases[d]			75			361
Lost workday cases			41			220
Fatalities			0.01			1.09

a. Source: Calculation based on U.S. Department of Labor, Bureau of Labor Statistics, incident rates in Table 4.3.10-1 and full-time- equivalent worker year data in Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 0, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, Appendix D).
b. Totals include construction and operation of the Staging Yard, Maintenance-of-Way Facility, Cask Maintenance Facility, Nevada Railroad Control Center and National Transportation Operations Center, and Rail Equipment Maintenance Yard. Totals do not include construction or operation of the rail line.
c. FTE = full-time-equivalent worker; one FTE is defined as 2,000 labor hours worked. FTE and labor hours worked values are calculated over the minimum 4.5-year construction phase and 50-year operations phase of the Proposed Action.
d Total recordable cases include injury and illness.
e. Totals might differ from sums of values due to rounding.

Facility construction and operations impacts include impacts to facility construction workers and facility operations workers during the minimum 4.5-year construction phase and 50-year operations phase for the facilities. Table 4-264 summarizes the nonradiological impacts of constructing and operating rail line construction support facilities and rail line operations support facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, the Staging Yard, the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Facility, and the Cask Maintenance Facility. The numbers of full-time-equivalent worker years for each rail line facility construction and operations activity were obtained from Appendix D of the *Air Quality Emissions Factors and Socioeconomic Input-Mina Rail Corridor*, Rev 00, April 20, 2007 (DIRS 180874-Nevada Rail Partners 2007, Appendix D).

Construction and operations workers under the Proposed Action could potentially be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and facility equipment, including maintenance-of-way and management of fleet. Such activities are anticipated to include welding, metal degreasing, painting, and related activities. Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and facilities.

Rail Line Construction Construction of the proposed rail line would involve 13.0 million labor hours corresponding to a total of 6,527 full-time-equivalent construction workers.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with construction of the proposed rail line are reported separately from the nonradiological impacts associated with construction of the facilities. Table 4-263 summarizes nonradiological occupational health and safety impacts associated with construction of the proposed rail line, not including the Rail Equipment Maintenance Yard, Staging Yard, or other facilities.

Facilities Construction Construction of railroad construction support facilities and railroad operations support facilities, including the Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facility, Cask Maintenance Facility, and Rail Equipment Maintenance Yard, would involve approximately 1,335 full-time-equivalent construction workers corresponding to approximately 2.7 million labor hours. Table 4-264 summarizes the nonradiological impacts of construction of the rail line facilities under the Proposed Action.

Rail Line Operations Operation of the proposed rail line would take place over a period of 50 years and involve approximately 50 rail line operations personnel, corresponding to approximately 2.9 million labor hours.

For the purposes of this Rail Alignment EIS, nonradiological impacts associated with operation of the proposed rail line are reported separately from the nonradiological impacts associated with operation of the facilities. Table 4-263 lists nonradiological occupational health and safety impacts associated with operation of the proposed rail line, not including the Rail Equipment Maintenance Yard or Staging Yard, or other facilities.

Overall railroad operations including cask trains, maintenance-of-way trains, and repository construction and supply trains correspond to approximately 8,200,000 train-kilometers over the 50 year period of operation for the 570-kilometer (354-mile) Mina rail alignment based on transporting 9,495 casks and an additional two maintenance-of-way trains and one repository construction and supply train per week. The 37 total recordable cases and 28 lost-workday cases over the 50-year operations phase (Table 4-263) correspond to 4.5 total recordable cases and 3.4 lost-workday cases per million train-kilometers traveled.

Rail Line Facilities Operations Operation of the rail line facilities under the Proposed Action, including the Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facility, Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would take place over a period of 50 years and involve approximately 150 full-time-equivalent operations workers per year of operation, corresponding to approximately 15.0 million labor hours over the 50-year operations phase (DIRS 180874-Nevada Rail Partners 2007; DIRS 180875-Nevada Rail Partners 2007). Table 4-264 summarizes the nonradiological impacts of operation of the facilities under the Proposed Action. The 361 total recordable cases and 220 lost-workday cases over the 50-year operations phase (Table 4-264) correspond to 44 total recordable cases and 27 lost-workday cases per train-kilometer traveled.

Impacts from Specific Resource Areas Workers constructing the proposed rail line and associated facilities could be exposed to a variety of hazards associated with specific resource areas. These include biological hazards, dust and soils hazards, air-quality hazards, transportation accidents, and noise hazards. Transportation hazards include wild horses and burros, and free-range livestock. Biological hazards include potential human health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human health effects from exposure to inhalable soils and dusts containing hazardous constituents and potential occupational encounters with unexploded ordnance. Construction workers could also be exposed to air-quality hazards, including potential human health effects of exposure to fugitive dust, diesel engine exhaust, and other air emissions associated with construction activities. Workers could also be exposed to noise hazards from operation of equipment. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar hazards. Impacts associated with specific resource areas are discussed in the paragraphs that follow.

Biological Hazards Biological hazards are any virus, bacteria, fungus, parasite, or other living organism that can cause a disease or otherwise harm human beings. Biological hazards that may be encountered by workers constructing and operating the proposed rail line and associated facilities include disease-causing organisms and venomous animals. Diseases potentially encountered when performing construction activities include West Nile Virus, Valley Fever, Hantavirus, and rabies. Venomous animals potentially encountered include spiders, snakes, scorpions, bees, wasps, and other insects. These biological hazards are described in the following sections. The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, as cited below. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

- **Venomous Animals –** Nevada is home to five venomous snake species: Sidewinder, Mohave, Speckled, Western Diamondback and Great Basin rattlesnakes (*Crotalus* spp.). These types of rattlesnakes may inhabit the open grasslands and desert habitat in the construction and operations areas. The Gila Monster, a venomous lizard, also occurs in southern Nevada. There are several types of scorpions (such as *paruroctonus* spp.) native to Nevada that may occur in construction and operations areas. Scorpions are venomous and are most active at night. A scorpion sting would require medical treatment, but for the species of scorpions found in Nevada, would not be fatal. Black widow spiders (*Latrodectus mactans*) and brown recluse spiders (*Loxosceles recluse*) may also occur in construction areas. Bites from these spiders would require medical treatment and are potentially fatal if untreated. Other types of spider bites are generally harmless to most people. Spider bites usually occur when someone is reaching into dark, out-of-the way places. Bees, including Africanized Swarming Bees, and wasps also occur in southern Nevada.

- **West Nile Virus –** West Nile virus is a mosquito-borne virus that can cause illness in humans, including meningitis or arboviral encephalitis, a brain inflammation. Mosquitoes acquire the virus from birds and pass it on to other birds, and occasionally to humans. Mosquitoes spread this virus after they feed on infected birds and then bite other birds, people, or certain domestic animals. The virus is not spread by person-to-person contact. West Nile virus occurs primarily in the late summer or early autumn, although the mosquito season is generally April through October. About 80 percent of people who are infected with West Nile virus exhibit no symptoms, or at most, experience symptoms similar to the flu. People with mild infections, referred to as West Nile fever, may experience fever, headache, body ache, skin rash, and swollen lymph glands. More severe infection can result in more serious symptoms, including high fever, headache, disorientation, coma, tremors, occasional convulsions, and paralysis. This form is referred to as West Nile meningitis or encephalitis. In 2004, a total of 44 cases of West Nile virus were reported in Nevada, including 23 cases in Clark County, 15 cases in Churchill County, and one case in Lyon County. Of the 44 West Nile virus cases, 19 involved West Nile fever. In 2005, 31 cases of West Nile virus were reported in Nevada, including eight cases in Clark County and three cases in Nye County (DIRS 177618-USGS 2006, all). No human cases of West Nile virus were reported in Nye, Esmeralda, Mineral, or Storey Counties in 2004 (DIRS 175028-USGS 2005, all; DIRS 175026-Nevada State Health Division 2005, all). In 2006 there were a total of 123 reported cases of West Nile virus, including 12 cases in Churchill County, 16 cases in Lyon County, two cases in Nye County, and three cases in Clark County (DIRS 178696-USGS 2007, all). Incident rates of West Nile Virus are affected by the population density and availability of water.

- **Valley Fever –** The technical name for Valley Fever is *Coccidioidomycosis*. It is caused by *Coddidioides immitis*, a fungus that lives in soil. Fungus spores become wind-borne and may be inhaled into the lungs, where infection can occur. Valley Fever is not contagious from person to person. It appears that after one exposure, the body develops immunity. The Valley Fever fungus is established in the Southern Nevada region of influence. Infection rates, as reflected by positive skin tests, are 2 to 3 percent per year in highly endemic regions, and activities associated with heavy dust exposure (such as excavation, agricultural labor) increase infection rates (DIRS 175021-Barnato, Sanders, and Owens 2001, p. 1). About 60 percent of people who breathe the spores do not develop any symptoms. About one out of every 200 persons infected with Valley Fever develops the disseminated form, in which the disease spreads beyond the lungs through the bloodstream causing meningitis. Meningitis is a potentially fatal inflammation of the membrane around the brain and the spinal cord.

- **Hantavirus –** A 1993 outbreak of fatal respiratory illness on an Indian Reservation in the Four Corners area (where the states of Arizona, New Mexico, Colorado, and Utah meet) led to the identification of Hantavirus as the causative agent. Hantavirus is a rodent-borne disease. The route of exposure is believed to be inhalation of aerosolized virus, and/or ingestion of rodent excreta through contaminated food or water. Rodent bites and direct contact with broken skin or mucous membranes are also potential sources of infection. Symptoms include pneumonia, fever, and other flu-like symptoms. In 24 to 48 hours after symptoms appear, potentially fatal respiratory failure may occur. As of March 2007, there have been 465 recorded cases of Hantavirus in the United States, with 18 of the cases recorded in Nevada (DIRS 181391-CDC 2007, all). DOE has implemented procedures for decontamination of any rodent excreta encountered by construction workers during construction activities at the Yucca Mountain Site to prevent Hantavirus infection of workers.

- **Rabies –** Rabies may be a hazard to construction and operations workers through accidental contact with mammalian species in construction and operations areas. The route of exposure is a bite or scratch from an infected animal, or non-bite exposure through inhalation of aerosolized rabies virus. Rabies has been reported in Nevada in bats but not in terrestrial animals (DIRS 177449-Krebs et al. 2005, p. 1917). The incubation period of rabies is variable, ranging from less than 10 days to greater than 6 years, and post exposure treatment is necessary following true exposure unless the subject has been vaccinated. Absent post exposure treatment, the first symptoms may be noted within 30 to 90 days of exposure. Once symptoms occur, death may occur in less than one week following the development of initial symptoms, usually as a result of respiratory failure. No human cases of rabies were reported in Nevada between January 2000 and September 2005, the latest period for which data are available (DIRS 177449-Krebs et al. 2005, p. 1920).

Dust and Soils Hazards Dust and soils hazards include potential occupational exposure to hazardous inhalable soils and dust, including the minerals crystalline silica, cristobalite, and ***erionite***, and potential occupational encounters with unexploded ordnance. These hazards are discussed below.

- **Inhalable Dust –** Construction activities such as blasting, scarifying, and excavating create dust that can be inhaled by workers.

Some types of rock and associated soils may contain hazardous minerals such as crystalline silica, cristobalite, and erionite. It is unlikely that any fugitive particulates generated in the construction areas would contain a concentration of crystalline silica, eronite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Inhaling dust originating from these types of rock and containing these minerals can lead to disease such as silicosis if adequate precautions are not taken when working in dusty areas. However, DOE recognizes the potential for exposure to crystalline silica, cristobalite, or erionite during the development of quarries for production of hard rock ballast, in ballast placement, rock cuts, and other types of excavation. Of the three mineral dust hazards mentioned above, crystalline silica is the most common in hard rock ballast because it is a material of relative abundance in granite and quartz. DOE would be required to comply with Occupational Safety and Health Administration workplace guidance for mineral dusts (29 CFR 1910-1000, Table Z-3, Mineral Dusts).

DOE would therefore conduct routine monitoring of occupational dust exposure during quarry construction and operation and during rail alignment construction activities, such as ballast placement, with the potential for such exposure. DOE would apply best management practices and engineering controls such as application of water for dust suppression and washing the ballast before placement in order to minimize the potential for occupational exposure to dust, and an industrial hygienist would take mineral dust measurements to identify if any potential exposure hazards are present. In the event that these monitoring activities identify potential occupational exposure at levels exceeding Occupational Safety and Health Administration occupational exposure standards for silica, DOE would implement additional processing and engineering controls to mitigate, prevent, or reduce exposures to silica to below occupational exposure standards. Therefore, impacts associated with occupational exposure to these materials are anticipated to be small.

- **Unexploded Ordnance –** Portions of the construction area may have unexploded ordnance in surface or in subsurface locations. The potential areas of concern for unexploded ordnance are sections west of the Nevada Test and Training Range and within the Nevada Test Site. These include areas south of Goldfield and north of Beatty Wash and the area between the southeastern shore of Walker Lake and the Hawthorne Depot. Unexploded ordnance may include shell casings, projectiles, or fragments, and may include live small arms ammunition, bombs, and rockets. These types of unexploded ordnance may have been generated from historical Air Force and other military training activities in the region. Sections of rail alignment and associated facility locations north and east of Goldfield are considered clear of unexploded ordnance at this time. An unexploded-ordnance specialist would develop a plan, including evaluation of types of unexploded ordnance possible, depths, etc. Unexploded-ordnance technicians would be present and screen ahead of the construction crew in areas where there is potential for unexploded ordnance.

DOE would coordinate with the U.S. Air Force, Army, and Navy concerning proposed construction activities and would follow standard and established procedures for unexploded ordnance.

Air Quality Hazards Construction workers could be exposed to air quality hazards, including potential human health effects of occupational exposure to stationary and area source emissions associated with construction activities. Operations workers, in particular maintenance-of-way workers, could also be exposed to similar air-quality hazards.

Stationary and area source emissions associated with the construction phase include exhaust emissions from on-site vehicles and heavy construction equipment, and fugitive dust from excavation and construction activities. Stationary and area source emissions associated with the operations phase would include emissions from locomotive fueling stations and locomotive rail line maintenance operations. Section 4.3.4, Air Quality and Climate, describes stationary source and area source emissions associated with construction and operation of the rail line and associated facilities.

Exposure of construction and operations workers to vehicle exhaust emissions and other air emissions would be subject to exposure standards, including standards established under 10 CFR Part 851. Threshold Limit Values established by the Occupational Safety and Health Administration and American Council of Government Industrial Hygienists would apply to occupational exposure to vehicle exhaust emissions and other air emissions. DOE would apply administrative controls and conduct workplace monitoring to control exposure to below applicable standards.

Noise Hazards Workers conducting construction and operations activities under the Proposed Action could be exposed to noise from operation of heavy construction equipment, operation of locomotives, or from conducting blasting operations. Potential sources of occupational noise exposure, applicable noise exposure standards, and requirements for controlling noise exposure are described in this section and further described in Section 4.3.8.

- **Roadbed/Track Structure Construction Noise Exposure –** DOE would require employers of construction workers exposed to heavy equipment noise to comply with Occupational Safety and Health Administration regulation 29 CFR 1910.95 to avoid effects of excessive noise exposure. Hearing damage is related to absolute noise level and duration of exposure. Table 4-265 shows Occupational Safety and Health Administration noise level limits that would require hearing protection. Code of Federal Regulations 10 Part 851 requires DOE to use American Conference of Governmental Industrial Hygienists Threshold Limit Values as occupational exposure standards. Table 4-265 also shows the Threshold Limit Values.

Table 4-265. Occupational noise exposure limits.[a]

Duration per day, hours	Sound level (decibels slow response)	ACGIH[b] Threshold Limit Value
8	90	85
6	92	86
4	95	88
3	97	89
2	100	91
1.5	102	92
1	105	94
0.5	110	97
0.25 or less	115	100

a. Sources: 29 CFR 1910.95, 30 CFR 62.130, and 10 CFR 851.
b. ACGIH = American Conference of Governmental Industrial Hygienists.

DOE would be required to administer a continuing, effective hearing conservation program whenever employees would be exposed to noise equal to or exceeding an 8-hour time-weighted average sound level of 85 A-weighted decibels.

- **Railroad Worker Noise Exposure –** Railroad operators are required to comply with Federal Railroad Administration Regulation 49 CFR 229.121 for worker exposure to locomotive cab noise. Applicable noise levels, the exceedance of which would require hearing protection, are shown in Table 4-265.

- **Ballast Quarry Noise Exposure –** Employers of quarry workers supplying ballast for the rail bed would be required to comply with Mine Safety and Health Administration Regulation 30 CFR 62. Applicable Mine Safety and Health Administration noise levels, the exceedance of which would require hearing protection, are shown in Table 4-265. Noise levels above 115 dBA are not permitted under the regulation (30 CFR 62.130).

4.3.10.2.2 Radiological Impacts

For the portion of the Mina rail corridor that originates at Hazen and terminates at the repository, the radiological impacts from incident-free transportation for members of the public were estimated to be 8.2×10^{-4} latent cancer fatality. For workers, these impacts were estimated to be 0.33 latent cancer fatality. The radiological accident risks for this portion of the Mina rail corridor were estimated to be 7.4×10^{-6} latent cancer fatality.

4.3.10.2.2.1 Workers.

Rail Line and Facilities Construction DOE does not anticipate that there would be any radiological occupational health and safety impacts associated with construction of the proposed rail line or facilities for the Proposed Action.

Rail Line and Facilities Operations Occupational radiological impacts associated with incident-free operation of the rail line and rail line facilities are described below. Occupational radiological impacts are quantified in terms of latent cancer fatalities. Occupational radiation doses (effective dose equivalent) are also reported.

Incident-Free Transportation During the shipment of spent nuclear fuel and high-level radioactive waste from Hazen to the Staging Yard at Hawthorne to the repository, workers would be exposed to direct radiation from 9,495 shipping casks. These workers would include rail transportation crew members, security escorts, workers exposed when trains with loaded shipping casks passed the Maintenance-of-Way Facility, and workers exposed when trains with loaded shipping casks passed trains with unloaded casks or other materials at sidings. The methods and data used to estimate the radiation doses for these workers are described in Appendix K. Workers not exposed to shipping casks would not be exposed to radiation in excess of background.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from Hazen to the Staging Yard at Hawthorne to the Rail Equipment Maintenance Yard. For the radiological impacts analyses, four specific alignments were evaluated: 1) the alignment with the highest exposed population, 2) the shortest alignment, 3) the longest alignment, and 4) the alignment with the lowest exposed population. These alignments are described in Table 3-146.

Table 4-266 lists the radiation doses and impacts for these workers along these four alignments. The collective radiation dose for these workers is estimated to be 310 to 320 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.18 to 0.20.

Table 4-266. Estimated radiological impacts for workers along the proposed rail alignment.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker [annual]	0.50 rem per year	0.00030
Maximally exposed worker [50-year operation]	25[a] rem	0.015[a,b]
Worker population	310 – 340 person-rem	0.18 – 0.20[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

> **Risk Terms**
>
> A risk value of 1×10^{-4} is equivalent to 1 in 10,000.
> A risk value of 1×10^{-6} is equivalent to 1 in 1,000,000.
> A risk value of 1×10^{-8} is equivalent to 1 in 100,000,000.

The maximally exposed worker would be a security escort. This worker is estimated to receive a radiation dose of 25 rem over the entire operations phase, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming that a person could work for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Security escort workers and other rail line workers would be subject to a radiation protection program. Workers, including security escort workers, would not be exposed to radiation in excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work as security escorts to less than 2,000 hours per year.

- **Staging Yard at Hawthorne, Rail Workers, Inspectors, and Escorts –** When shipping casks arrived at the Staging Yard, the railcars containing the shipping casks would be removed from the train, an inspection would be conducted, and the railcars would be transferred to the train for transport to the Rail Equipment Maintenance Yard. The escorts that had accompanied the shipping cask from its origin would also be present during this inspection. These rail workers, inspectors, and escorts would be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign. The methods and data used to estimate the radiation doses for these workers are described in Appendix K.

Table 4-267 lists the radiation doses and impacts for the workers involved with these activities. The analysis assumed that noninvolved workers would also be exposed to direct radiation during these activities.

Table 4-267. Estimated radiological impacts for rail workers, inspectors, and escorts at the Staging Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.50 rem per year	0.00030
Maximally exposed worker (50-year operation)	25[a] rem	0.015[a,b]
Worker population (involved workers)	240 person-rem	0.14[c]
Worker population (noninvolved workers)	10 person-rem	0.0063
Worker population (total)	250 person-rem	0.15

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

The collective radiation dose for involved and noninvolved workers is estimated to be 250 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15. The maximally exposed worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and assuming that a person could work for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015. Staging Yard workers and other facilities workers would be subject to a radiation protection program. Workers, including Staging Yard workers, would not be exposed to radiation in excess of the administrative dose limit for repository facilities of 0.5 rem per year. This requirement may in some cases limit the number of hours per year that workers are permitted to work at the Staging Yard to less than 2,000 hours per year.

- **Rail Equipment Maintenance Yard –** Under the Proposed Action, a Rail Equipment Maintenance Yard would be constructed and operated to transfer cask cars to the repository. The workers at this facility would be exposed to direct radiation from handling 9,495 shipping casks over 50 years of shipping. The radiation doses for these workers would be similar to the radiation doses for handling dedicated rail shipments at other rail yards and are described in Neuhauser et al. (2000) (DIRS 155430-Neuhauser, Kanipe, and Weiner, Section 3.5.2).

Table 4-268 summarizes the radiation doses and impacts for workers involved in these activities. The collective radiation dose for these workers is estimated to be 16 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0096.

Table 4-268. Estimated radiological impacts for workers at the Rail Equipment Maintenance Yard.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.013 rem per year	7.6×10^{-6}[c]
Maximally exposed worker (50 years)	0.64[a] rem	0.00038[b]
Worker population	16[a] person-rem	0.0096[c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

The individual radiation dose for workers at this facility was estimated to be 0.013 rem per year. The probability of a latent cancer fatality for this worker is estimated to be 7.6×10^{-6}. If this individual worked at the facility for 50 years, their radiation dose would be 0.64 rem. The probability of a latent cancer fatality for this worker is estimated to be 0.00038.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to workers from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, PA. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in DIRS 181886-NRC 1989, all and DIRS 151227-Blasing et al. 1998, all.

Radiation dose from cask handling and maintenance activities at the Cask Maintenance Facility could result in radiation dose to workers, primarily as a result of exposure to "crud." Crud is the term used to describe contamination on the outside of spent nuclear fuel and would consist of the radionuclides Co-60, Mn-54, Fe-55, and Zn-65. Crud may be present in reactor spent nuclear fuel pools and may contaminate the inside of the cask during loading, even if the spent nuclear fuel has been placed in canisters. For the radionuclides contained in crud, average radionuclide inventories at the Alaron Regional Service Facility would consist of about 4.7 Ci of Co-60, 0.32 Ci of Mn-54, 7.6 Ci of Fe-55, and 0.061 Ci of Zn-65. Not all of this radionuclide inventory would be from the decontamination of spent nuclear fuel casks; some of the radionuclide inventory would be as a result of other services provided at the Alaron Regional Service Facility.

Workers at Alaron were estimated to receive an individual radiation dose of 0.04 rem per month. Over the course of a year, a worker would receive a radiation dose of 0.480 rem. This radiation dose was used to estimate the radiation dose to a worker at the Cask Maintenance Facility. The probability of a latent cancer fatality for this worker is estimated to be 0.00029.

Based on the total number of workers at the Cask Maintenance Facility, the collective radiation dose at the Cask Maintenance Facility would be 14 person-rem per year. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0086. Table 4-269 summarizes these impacts and also presents impacts for the entire duration of operations.

- **Other Rail Line Facility Operations –** Under the Proposed Action, other rail line facilities would be constructed and operated, including the Maintenance-of-Way Facility, and Nevada Railroad Control Center and National Transportation Operations Center. Radiological health impacts to workers operating these facilities are anticipated to be minimal, as casks would not be loaded or unloaded at these facilities.

Table 4-269. Estimated radiological impacts for rail workers, inspectors, and escorts at the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Maximally exposed worker (annual)	0.48 rem per year	0.00029[c]
Maximally exposed worker (50-year operation)	24[a] rem	0.014[b,c]
Worker population (annual)	14 person-rem per year	0.0086[c]
Worker population (50 years)	720[a] person-rem	0.43[a,c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual worker.
c. The estimated number of latent cancer fatalities in an exposed worker population.

Note that the dose calculations for rail facility operations workers in Table 4-269 above include radiological exposure to workers at the Maintenance-of-Way Facility and at sidings who would be exposed when the cask train passes by.

4.3.10.2.2.2 Public.

Construction DOE does not anticipate that there would be any radiological public health and safety impacts associated with construction of the proposed rail line or associated facilities under the Proposed Action.

Operations

Incident-free Rail Transportation

- **Public along the Proposed Rail Line –** During the shipment of spent nuclear fuel and high-level radioactive waste from Hazen to the Staging Yard at Hawthorne to the Rail Equipment Maintenance Yard, people along the proposed rail line could be exposed to direct radiation from 9,495 shipping casks. These people would include people along the transportation route. Because shipments would be made using ***dedicated trains***, there would be no exposures of members of the public sharing the transportation route or members of the public at stops along the route. The methods and data used to estimate the impacts from direct radiation for these people are described in Appendix K.

As discussed in Chapter 2, there are a number of possible combinations of common segments and alternative segments that could make up the rail alignment from Hazen to the Staging Yard at Hawthorne to the Rail Equipment Maintenance Yard. For the radiological impacts analyses, four specific alignments were evaluated. These alignments are described in Table 3-146.

Table 4-270 lists the radiation impacts for these people. The collective radiation dose for members of the public is estimated to be 1.4 person-rem. In the exposed population, the probability of a latent cancer fatality is estimated to be 8.1×10^{-4} to 8.5×10^{-4}.

Table 4-270. Estimated radiological impacts for the public along the proposed rail line.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual (annual)	0.00016 rem	9.4×10^{-8}[a]
Maximally exposed individual (50-year operation)	0.0078[a] rem	4.7×10^{-6}[a]
Population	1.4 person-rem	$8.1 \times 10^{-5} – 8.5 \times 10^{-4}$[b]

a. The estimated probability of a latent cancer fatality for an exposed individual.
b. The estimated number of latent cancer fatalities in an exposed population.

- **Public Near the Staging Yard –** The public surrounding the Staging Yard location at Hawthorne could be exposed to direct radiation from 9,495 shipping casks over the entire shipping campaign.

The methods and data used to estimate the radiation doses for members of the public are described in Appendix K.

Table 4-271 lists the radiation doses and impacts for these people. Based on 2000 Census data, there are no people who reside within 800 meters (2,623 feet) of the Hawthorne Staging Yard. There is, however, a business located 660 meters (2,165 feet) from the Staging Yard. The radiation dose for a person at this business is estimated to be 0.00018, assuming that an individual was exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The probability of a latent cancer fatality for this individual is estimated to be 1.1×10^{-7}.

Table 4-271. Estimated radiological impacts for the public at the Staging Yard at Hawthorne.

Group	Radiation dose	Latent cancer fatality
Maximally exposed individual	0.00018 rem[a]	1.1×10^{-7} [b]
Population[c]		

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual.
c. According to 2000 Census data, there are no people residing within 800 meters (2,623 feet) of the Staging Yard.

- **Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to members of the public from activities at the Cask Maintenance Facility were based on the impacts for a similar facility, the Alaron Regional Service Facility, located in Wampum, PA. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in DIRS 181886-NRC 1989, all and DIRS 151227-Blasing et al. 1998, all.

At the Alaron Regional Service Facility, the maximally exposed member of the public was located 300 meters (984 feet) from the facility. The radiation dose for this individual from emissions through all environmental pathways was estimated to be 2.0×10^{-9} rem per year. The probability of a latent cancer fatality for this individual is estimated to be 1.2×10^{-12}. The radiation dose and latent cancer fatality risk for members of the public from emissions from the Cask Maintenance Facility would be much lower, because the public is located much further from the facility. For example, the nearest site boundary is 11 kilometers (7 miles) from the repository, while at Alaron, the maximally exposed member of the public was located 300 meters (984 feet) from the facility.

The total population within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the maximally exposed member of the public, the resulting collective radiation dose would be 0.00023 person-rem per year. In this exposed population, the probability of a latent cancer fatality is estimated to be 1.4×10^{-7}. Table 4-272 summarizes these impacts and also presents impacts for the entire duration of operations.

Accidents To quantify the potential radiological impacts of transportation accidents, two types of analyses were performed. The first analysis provided an estimate of the radiological accident risks associated with transporting spent nuclear fuel and high-level radioactive waste along the Mina rail alignment. The analysis of radiological accident risks takes into account a spectrum of accidents ranging from higher-probability accidents of low severity to hypothetical high-severity accidents that have a correspondingly low probability of occurrence. Included are accidents in which no release of radioactive material occurred, but where there was a deformation of shielding because of lead shield displacement, and accidents in which radioactive material was released from the shipping cask.

Table 4-272. Estimated radiological impacts for the public from the Cask Maintenance Facility.

Group	Radiation dose	Latent cancer fatality
Individual member of the public (annual)	2.0×10^{-9} rem per year	1.2×10^{-12}[b]
Individual member of the public (50 years)	1.0×10^{-7}[a]	6.0×10^{-11}[a,b]
Collective members of the public (annual)	0.00023 person rem per year	1.4×10^{-7}[c]
Collective members of the public (50 years)	0.012[a] person-rem	7.0×10^{-6}[a,c]

a. Total for 50 years of operation.
b. The estimated probability of a latent cancer fatality for an exposed individual.
c. The estimated number of latent cancer fatalities in an exposed population.

Radiological accident risks were defined as the probability of occurrence of an accident multiplied by the consequences of the accident, summed over a complete spectrum of accidents. This quantity is known as "***dose risk***."

The second analysis provided an estimate of the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents. Historically, maximum reasonably foreseeable transportation accidents were defined as transportation accidents with a frequency of about 1×10^{-7} per year. However, in this analysis, the consequences of severe transportation accidents with frequencies as low as 3×10^{-18} per year are presented.

Accidents in which no release of radioactive material and no deformation of shielding occurred are discussed in Section 4.3.10.2.3 below.

- **Accident Risks –** The methods and data used to estimate radiological accident risks are discussed in Appendix K. The impacts from these accidents are listed in Table 4-273. The risks from accidents where a release of radioactive material or shielding deformation occurred are estimated to be 7.4×10^{-6} to 7.6×10^{-6} latent cancer fatality.

Table 4-273. Estimated radiological accident risks from potential transportation accidents along the proposed rail line.

Risk	Accident dose risk[a]	Latent cancer fatality[a]
Radiological accident risk	$1.2 \times 10^{-2} – 1.3 \times 10^{-2}$	$7.4 \times 10^{-6} – 7.7 \times 10^{-6}$

a. Radiological accident dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents. This sum is converted to latent cancer fatalities using the conversion factor of 0.0006 latent cancer fatality per person–rem.

- **Severe Accidents –** Severe accidents having a frequency of about 1×10^{-7} per year are known as maximum reasonably foreseeable accidents. Accidents with frequencies below 1×10^{-7} per year are generally not reasonably foreseeable. In this Rail Alignment EIS, the maximum reasonably foreseeable transportation accident has a frequency of about 7×10^{-7} per year. This accident involves a long duration, high-temperature fire that would engulf a cask. The methods and data used to estimate the impacts of this accident are discussed in Appendix K.

For the four evaluated rail alignments described in Table 3-146, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Suburban areas are defined as areas with a population density between 139 and 3,326 people per square mile. Rural areas were defined as areas with a population density less than 139 people per square mile. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 589 people per square kilometer (1,525 people per square mile), near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 4.19 to 4.33 people per square kilometer (10.9 to 11.2 people per square mile).

Table 4-274 presents estimates of the impacts of this severe accident. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 2,000 person-rem. In the exposed population, it is estimated that there could be 1.2 latent cancer fatalities. If the maximum reasonably foreseeable accident were to occur in a rural area, the collective radiation dose would be 15 person rem. The probability of a latent cancer fatality in the exposed population is estimated to be 8.9×10^{-3}.

Table 4-274. Estimated radiological impacts from the maximum reasonably foreseeable transportation accident scenarios for suburban and rural areas.[a,b]

Impact	Suburban area[c]	Rural area[c]
Impacts to population		
Population dose (person-rem)	2,000	15
Latent cancer fatalities	1.2	8.9×10^{-3}
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	34	34
Probability of a latent cancer fatality	0.020	0.020
Impacts to first responder		
Maximally exposed responder dose (rem)	0.14 – 2.0	0.14 – 2.0
Probability of a latent cancer fatality	8.2×10^{-5} – 0.0012	8.2×10^{-5} – 0.0012

a. There are no urban areas for the four specific alignments.
b. Accident frequency is estimated to be 7 × 10-7 per year.
c. Radiological impacts were based on low wind speeds and stable atmospheric conditions. These were defined as Class F stability and a wind speed of 0.89 meters per second.

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the maximally exposed individual located 330 meters (1,083 feet) from the accident would be 34 rem. The probability of a latent cancer fatality for that individual is estimated to be 0.020.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of a latent cancer fatality for this first responder is estimated to range from 8.2×10^{-5} to 0.0012.

- **Accidents at the Cask Maintenance Facility –** Under the Proposed Action, Cask Maintenance Facility operations would include testing, inspection, certification, incidental repair, and minor decontamination and modification of the transportation casks. Impacts to members of the public from Regional Service Facility, located in Wampum, PA. This facility provides treatment, decontamination, compaction, and repackaging services for generators of radioactively contaminated materials. One of the services provided by Alaron is the decontamination of spent nuclear fuel casks, which is similar to the activities that would occur at the Cask Maintenance Facility. The activities at Alaron are discussed in DIRS 181886-NRC 1989, all and DIRS 151227-Blasing et al. 1998, all.

A fire at the Alaron Regional Service Facility was estimated to result in a radiation dose of 0.00045 rem to a member of the public at a distance of 50 meters (164 feet) from the facility and a radiation dose of 0.000011 rem to a member of the public at a distance of 300 meters (984 feet) from the facility. The probability of a latent cancer fatality for these individuals is estimated to be 2.7×10^{-7} and 6.5×10^{-9}, respectively.

SEVERE TRANSPORTATION ACCIDENTS: AN OPPOSING VIEWPOINT

The State of Nevada has provided analyses that indicate that the consequences of severe transportation accidents would be much higher than those in this Rail Alignment EIS. For example, the state has estimated that the long-term consequences of a rail accident in a rural area could result in 7 to 614 latent cancer fatalities in the exposed population (DIRS 181756-Lamb et al. 2001, Table 41), while DOE estimates that about 1 latent cancer fatality would occur in the exposed population.

The state estimated these consequences using computer programs that DOE developed and uses. However, the state's analysis used values for parameters that would be at or near their maximum values. DOE guidance for the evaluation of accidents in environmental impact statements (DIRS 172283-DOE 2002, p. 6) specifically cautions against the evaluation of scenarios for which conservative (or bounding) values are selected for multiple parameters because the approach yields unrealistically high results.

DOE's approach to accident analysis estimates the consequences of severe accidents having frequencies as low as 1×10^{-7} per year (1 in 10 million) (DIRS 172283-DOE 2002, p. 9) using realistic yet cautious methods and data. DOE believes that the State of Nevada estimates are unrealistic and that they do not represent the reasonably foreseeable consequences of severe transportation accidents.

For a similar fire at the Cask Maintenance Facility, the impacts would be much lower, because the public is located much further from the facility, about 11 kilometers (7 miles), as opposed to 50 to 300 meters at Alaron.

The total population within 84 kilometers (52 miles) of the Cask Maintenance Facility is estimated to be about 118,000 people in the year 2067. If all of these people were exposed at the same level as the member of the public located 300 meters (984 feet) from the facility, the resulting collective radiation dose would be 1.3 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 7.6×10^{-4}.

- **Sabotage –** In response to the terrorist attacks of September 11, 2001, and to intelligence information that has been obtained since then, the United States Government has initiated nationwide measures to reduce the threat of sabotage. These measures include security enhancements to prevent terrorists from gaining control of commercial aircraft, such as (1) more stringent screening of airline passengers and baggage by the Transportation Security Administration, (2) increased presence of federal air marshals on many flights, (3) improved training of flight crews, and (4) hardening of aircraft cockpits. Additional measures have been imposed on foreign passenger carriers and domestic and foreign cargo carriers, as well as charter aircraft.

Beyond these measures to reduce the potential for terrorists to gain control of an aircraft, DOE has adopted an approach that focuses on ensuring that safety and security requirements are adequate and effective in countering and mitigating the effects of sabotage events that involve transportation casks. The Federal Government has greatly improved the sharing of intelligence information and the coordination of response actions among federal, state, and local agencies. DOE has been an active participant in these efforts; it now has regular and frequent communications with other federal, state, and local government agencies and industry representatives to discuss and evaluate the current threat environment, to assess the adequacy of security measures at DOE facilities and, when necessary, to recommend additional actions. In addition to its domestic efforts, DOE is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of sabotage events and exploring opportunities to enhance the physical protection of casks.

In addition, the Nuclear Regulatory Commission NRC has promulgated rules (10 CFR 73.37) and interim compensatory measures (67 *FR* 63167, October 10, 2002) specifically to protect the public from harm that could result from sabotage of spent nuclear fuel casks. The purposes of these security measures are to minimize the possibility of sabotage and to facilitate recovery of spent nuclear fuel shipments that could come under the control of unauthorized persons. These measures include the use of armed escorts to accompany all shipments, safeguarding of the detailed shipping schedule information, monitoring of shipments through satellite tracking and a communication center with 24-hour staffing, and coordination of logistics with state and local law enforcement agencies, all of which would contribute to shipment security. The Department has committed to following these rules and measures (see 69 *FR* 18557, April 8, 2004).

The Department, as required by the NWPA, would use Nuclear Regulatory Commission-certified shipping casks. Each cask design must meet stringent requirements for structural, thermal, shielding, and criticality performance and confinement integrity for routine (incident-free) and accident events. Spent nuclear fuel is protected by the robust metal structure of the shipping cask, and by cladding that surrounds the fuel pellets in each fuel rod of an assembly. Further, the fuel pellets in each fuel rod of an assembly, and the fuel is in a solid form, which would tend to reduce dispersion of radioactive particulates beyond the immediate vicinity of the cask, even if a sabotage event were to result in a breach of the multiple layers of protection.

Based on this knowledge, the Department has analyzed plausible threat scenarios, required enhanced security measures to protect against these threats, and developed emergency planning requirements that would mitigate potential consequences for certain scenarios. DOE would continue to modify its approach to ensuring safe and secure shipments of spent nuclear fuel and high-level radioactive waste, as appropriate, between now and the time of shipments.

For the reasons stated above, DOE believes that under general credible threat conditions the probability of a sabotage event that would result in a major radiological release would be low. Nevertheless, because of the uncertainty inherent in the assessment of the likelihood of a sabotage event, DOE has evaluated events in which a military jet or commercial airliner would crash into a spent nuclear fuel cask or a modern weapon (high energy density device or) would penetrate a spent nuclear fuel cask.

In the Yucca Mountain FEIS (Appendix J, Section J.3.3.1), DOE evaluated the ability of large aircraft parts to penetrate shipping casks. In that analysis, DOE determined that the parts having the highest probability of penetrating a cask are jet engines and jet engine shafts. Accordingly, DOE undertook a penetration analysis using these parts from military aircraft (F-15/16) and from a commercial airliner (B-767), which found that neither the engines nor the shafts would penetrate a cask and cause a release of radiological materials if an aircraft were to crash into a spent nuclear fuel cask.

To estimate the potential consequences of a sabotage event in which an high energy density device penetrates a rail or truck cask, DOE, in the Yucca Mountain FEIS, referred to *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* to obtain estimates of the fraction of spent nuclear fuel materials that would be released (release fractions) (DIRS 104918-Luna et al. 1999, all). In this Rail Alignment EIS, the Department used the more recent release fraction estimates from *Release Fractions from Multi-element Spent Fuel Casks Resulting from HEDD* [high energy density device] *Attack* (DIRS 181279-Luna 2006, all) to estimate the consequences of such events involving spent nuclear fuel in truck or rail casks. These more recent estimates of release fractions (DIRS 181279-Luna 2006, all) are based on the release fractions estimated in 1999 from *Projected Source Terms for Potential Sabotage Events Related to Spent Fuel Shipments* (DIRS 104918-Luna et al. 1999, all), but they also incorporate data from additional tests sponsored by *Gesellschaft für Anlagen - und Reaktorsicherheit* in Germany and conducted in France in 1994 that were not available for the 1999 report.

The potential impacts of sabotage were assessed for rail shipments from Hazen to the Hawthorne Staging Yard to the Rail Equipment Maintenance Yard. As with the maximum reasonably foreseeable accidents discussed in the Accidents section, four specific rail alignments were evaluated. The methods and data used to estimate the impacts of potential sabotage events are described in Appendix K.

For the four specific alignments there were no urban areas, as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments was 589 people per square kilometer (1,525 people per square mile) near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 4.19 to 4.33 people per square kilometer (10.9 to 11.2 people per square mile).

The impacts of potential sabotage events are listed in Table 4-275. If a sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 4,700 person-rem. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be 2.8. If a sabotage event occurred in a rural area, the collective radiation dose is estimated to be 35 person-rem. The total latent cancer fatalities for people exposed during this sabotage event is estimated to be 0.021.

Table 4-275. Estimated radiological impacts for a sabotage event involving a rail shipping cask for suburban and rural areas.[a]

Impact	Suburban area[b]	Rural area[b]
Impacts to populations		
Population dose (person-rem)	4,700	35
Latent cancer fatalities	2.8	0.021
Impacts to maximally exposed individuals		
Maximally exposed individual dose (rem)	27	27
Probability of a latent cancer fatality	0.016	0.016

a. There are no urban areas for the four specific alignments.
b. Based on neutral atmospheric conditions and moderate wind speeds. These were defined as Class D stability class and a wind speed of 4.47 meters per second.

In either a suburban area or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for the maximally exposed individual is estimated to be 0.016.

4.3.10.2.3 Transportation Impacts

4.3.10.2.3.1 Construction Impacts.

Nonradiological Roadway Accidents During construction, personnel and equipment would be moved initially by truck and other vehicles, and could be moved by rail once portions of the rail line were completed. Such movements of equipment and personnel could lead to roadway accidents.

DOE estimates that the construction phase would involve approximately 2,160 full-time-equivalent workers during the first three years, 750 full-time-equivalent workers in the fourth year, and 370 full-time-equivalent workers in the last year for a total of 7,600 full-time-equivalent workers, not including the Cask Maintenance Facility (DIRS 174083-WPI 2003, all; DIRS 180874-Nevada Rail Partners 2007, Appendix D, Tables 1 and 2). The construction phase would take a minimum of 4 years and 6 months. The Cask Maintenance Facility construction would involve additional 150 workers for 88 weeks.

In total, this suggests that there would be 7,600 full-time workers involved in the construction of the rail line and associated facilities over the minimum 4.5-year construction project and an additional 260 full-time-equivalent workers for construction of the Cask Maintenance Facility. The exact distribution over time is not significant for the traffic safety calculations, which are aggregated over the total construction

TRANSPORTATION SABOTAGE: AN OPPOSING VIEWPOINT

The State of Nevada has provided analyses that assert a sabotage event using a high-energy density device such as an antitank missile would completely penetrate a spent nuclear fuel cask, which would result in consequences 10 times higher than those DOE estimated (DIRS 181892-Lamb, Hintermann, and Resnikoff 2002, p. 19).

Because of DOE classification policy requirements, the Department cannot state specifically the devices that the analyses in Luna, Neuhauser, and Vigil (DIRS 104918-1999, all) and Luna (DIRS 181279-2006, all) considered. However, the analyses encompassed the damage that modern weapons could produce in an optimally successful sabotage event. The assertion that modern weapons can produce full penetration of both cask walls is not confirmed by calculations from Luna, Neuhauser, and Vigil (DIRS 104918-Luna, Neuhauser, and Vigil 1999, all).

In addition, in scoping comments, the State of Nevada recommended that the sabotage analysis address factors such as attacks that involve multiple weapons, attacks that use combinations of weapons designed to maximize release and dispersal of radioactive materials, attacks that involve large groups of well-trained adversaries, suicide attacks, attacks that involve the infiltration of trucking and railroad companies, and attacks at locations with high symbolic value.

Because DOE assumed that the sabotage event would be optimally successful, most of the factors listed by the State could affect the chances of success but not the outcome of the sabotage event. In addition, even though attacks that use multiple weapons and combinations of weapons designed to maximize release and dispersal of radioactive materials are possible, DOE believes that the sabotage event it analyzed encompasses the damage that modern weapons might produce in an optimally successful sabotage event.

time. In other words, if the construction phase were assumed to take place over a 10-year period, this would only mean that fewer workers would be making more trips; this would result in a similar total number of trips as the minimum 4.5-year construction phase.

For each year, it is assumed that each worker would make two trips per day over five days a week for 50 weeks a year (that is 2,000 hours per year full-time-equivalent workers). To provide a conservative upper bound estimate of roadway accidents, DOE assumed that all workers would individually make daily vehicle trips on roadways, even though it is likely that many rail line construction workers would reside in construction camps linked to work sites by access roads. Each trip is assumed to be 80 kilometers (50 miles) in length, which translates to approximately 40,000 kilometers (25,000 miles) per year per worker. While the distances involved for portions of this construction project are obviously much greater, a worker might travel hundreds of miles each way every one to two weeks and stay in the construction camps between these longer trips. This travel pattern would result in approximately the same distance traveled per worker. Collectively, the total number of miles driven by all workers would be approximately 315 million kilometers (190 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2) traveled for light trucks or passenger cars in rural areas in Nevada, approximately six fatalities could occur due to the movement of workers during construction of the rail line and facilities.

These estimates would not vary among the proposed specific alignments, because the number of potential fatalities is based on the total distance traveled and is not dependent on the minor difference in the length or location of the alternative segments. Therefore, the predicted accident rates are the same for each specific alignment.

Nonradiological Rail Line Accidents During the construction phase, there are expected to be up to 368 loaded trains servicing the Schurz area, 1,116 for the Mina common segment 1 and Montezuma areas, and 1,260 for the Mina common segment 2 area (DIRS 180874-Nevada Rail Partners 2007, Appendix A) as the portions of the rail line that had already been completed were used to bring critical materials to the various staging areas (the length of line constructed from a particular staging area would influence the number of trains used on each segment of the partially completed rail line). A shorter construction phase would result in more trains per day, and a more extended construction phase would likely experience the lower end of the range of expected train volume.

Given the variability in the number of trains per day or year, this analysis focuses on the total number of inbound loaded and outbound unloaded construction trains, which is predicted to be 5,488 ([368 + 1,116 + 1,260] × 2). These trains would travel at speeds between 24 and 64 kilometers (15 and 40 miles) per hour depending on both the load carried and the area in which they operate. It is assumed that each train would travel one-half of the total route length (accounting for only new rail segments), or approximately 230 kilometers (144 miles) on average. Therefore, the total number of train-kilometers would be approximately 1.3 million kilometers (787 thousand miles). The total expected number of loaded railcars (including locomotives) during the construction phase are 8,240 for the Schurz area, 25,020 for the Mina common segment 1 and Montezuma areas, and 30,540 for the Mina common segment 2 area. The total number of inbound loaded and outbound unloaded construction rail cars is predicted to be 127,600 ([8,240 + 25,020 + 30,540] × 2), resulting in approximately 29 million railcar-kilometers (18 million railcar-miles).

The transportation safety impacts of concern during construction focus on rail-related accidents and worker and public fatalities. Based on the same rail accident rates described in the operations phase (Section 4.3.10.2.3.2), accidents associated with train-kilometers and railcar-kilometers are calculated. A total of two rail accidents would be expected to occur for the entire set of estimated train and railcar movements during construction.

Based on Federal Railroad Administration statistics, the fatality rate for workers is 3.46×10^{-10} fatality per railcar-kilometer traveled, and the rate for occupants of other vehicles and pedestrians is 1.11×10^{-8} fatality per railcar-kilometer traveled (DIRS 178016-DOT 2005, Chapter 1, all). Rates were derived by considering fatalities associated with freight train operations only (fatalities associated with passenger train operations were omitted for more applicable rates). As a result, the worker category considers worker-on-duty, worker-not-on-duty, contractor-on-duty, and contractor-other. Public fatalities include both trespassers and nontrespassers. Because passenger operations are not relevant to the Proposed Action, there is no consideration of the passengers-on-train category.

Based on these fatality rates, a total of 0.4 fatality (that is, not more than one) would be expected to occur for the entire set of estimated railcar movements during construction. No detectable difference is expected for the specific alignments, as the total variation in route lengths is small (greatest difference would be between Schurz alternative segments 6 and 1, which is a 20-kilometer [13-mile] difference).

Many movements of rail-mounted construction equipment are also anticipated. This equipment would travel fairly short distances each day to conduct such activities as setting out railroad ties or preparing the ballast. These movements have not been included in the count of train-kilometers as they would occur in controlled work areas and in very small increments, rather than at any measurable speed in a publicly accessible area.

4.3.10.2.3.2 Operations Impacts.

Nonradiological Roadway Accidents The assessment of impacts to transportation safety begins with accidents, such as may be experienced by any vehicle, independent of cargo. These accidents typically result in injuries or fatalities to drivers or operators, other motorists, or pedestrians, and could result from the movement of cargo.

Approximately 210 workers would be involved in the operation of the rail line and the facilities. Each year it is assumed that each worker would make two trips per day, over five days a week, for 50 weeks a year. It is assumed that each trip would be 80 kilometers (50 miles). This would result in 40,000 kilometers (25,000 miles) per year per worker. Collectively, over the 50-year operations phase, the total number of kilometers driven by workers would be approximately 420 million kilometers (263 million miles).

Based on a fatal accident rate of 1.65 fatalities per 100 million vehicle-kilometers (2.66 per 100 million vehicle-miles) traveled for light trucks or passenger cars in rural areas in Nevada (DIRS 180484-FHWA 2006, p. 1, Section V, Tables FI-20 and VM-2), approximately seven fatalities would be expected due to the movement of workers during operation of the rail line and facilities over 50 years of operation. These estimates are not specific to the specific alignments, because the small variations in length and location of the alternative segments would not significantly affect the total distance traveled.

Nonradiological Rail Line Accidents The rail transportation safety analysis for the operations phase of the Proposed Action assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The proposed rail line would range from 521 to 571 kilometers (approximately 255 to 285 miles) in length, depending on which alternative segments are chosen. Given the similarities in the lengths of the alternative segments, the longest specific alignment has been selected to conservatively estimate the overall accident risks for the rail line.

This analysis includes both dedicated railcar cask trains and other trains not involving casks from the Staging Yard to the Rail Equipment Maintenance Yard. A typical spent nuclear fuel or high-level radioactive waste train would have two to three locomotives, followed by a buffer car, one to five cask cars, another buffer car, and an escort car. two engines, followed by a buffer car, three cask cars, another buffer car, and an escort car. The actual number of casks per train could vary from one to five, while the number of locomotives could vary from two to three. The total number of casks that would be moved by rail is 9,495. Based on TSM (Total System Model) runs, there would be 2,833 trains carrying loaded casks and an equal number carrying empty casks. Therefore, to determine the impacts of moving cask cars, the analysis considers 5,666 trains (2,833 × 2) involving cask cars. The TSM runs also give the total number of railcars involved in cask trains, with an average of 8.54 cars per train (3.35 cask cars, 2.19 locomotives, two buffer cars, and one escort car). Over the 50-year operations phase, there would be approximately 48,408 railcars associated with cask trains.

In addition to trains involving cask cars, there are also other types of trains that would be operating along the rail line, including maintenance-of-way trains (two one-way trains per week), and repository supply and construction trains (seven one-way trains per week). The total number of trains not involving casks would be 23,400 over 50 years of operation. The total number of railcars not carrying casks would be 58,338, accounting for both loaded and unloaded cars (DIRS 180876-Nevada Rail Partners 2007, Section 4.0, Table 1).

The total number of railcars (all kinds) moved under the Proposed Action would be approximately 106,746 (48,408 + 58,338), considering both directions of travel. Based on the same fatality rates used in the construction analysis, namely 3.46×10^{-10} fatalities per worker per railcar-kilometer, and 1.11×10^{-8} fatalities per pedestrian per railcar-kilometer, 0.7 fatality (that is not more than one) would be expected to occur for the entire set of estimated railcar movements during operation.

The interchange tracks at the Staging Yard would operate like a typical large siding or other similar types of rail yards, so the hazards associated with its operation would be the potential for transport accidents.

However, because the buffer cars, cask cars, and escort car would be separated as a unit from the trains used to transport the casks from their origins, there would be limited changes for derailments involving the cask cars on the Staging Yard tracks. Accidents in yards typically occur as individual cars are handled, not with complete sets of cars. Accidents during the handling of railcars also occur at very low speeds, further limiting the chance of an accident. Because the trains are expected to enter the interchange track from the branchline at normal track speed, the accident rate for the interchange tracks at the Staging Yard would be based on mainline accident rates rather than yard accident rates.

Accident rates for rail transportation are generally presented as either accidents per train-kilometers or a combination of accident rates based on both train-kilometers and railcar-kilometers, considering these two classes of accident causes separately. Review of Federal Railroad Administration statistics and industry data on the distribution of track classes produced the accident rates given in Table 4-276 for Track Class 3 (DIRS 180220-Bendixen and Facanha 2007, all). These rates include derailments and collisions from a variety of causes, including track failures resulting from geological hazards. These accident rates reflect railroad operations involving general freight service. Dedicated train service, which would be used to move cask railcars to the Rail Equipment Maintenance Yard, would follow stringent safety regulations. Additionally, dedicated train service has increased control and command capabilities, since shorter trains allow better visual monitoring from the locomotive and the escort car.

Table 4-276. Estimated rail accident rates.[a]

Accident location	Accident rate per train-kilometer	Accident rate per car-kilometer	Combined accident rate per train-kilometer for 8-car train
Mainline track	7.50×10^{-7}	0.17×10^{-7}	8.95×10^{-7}

a. Source: DIRS 180220-Bendixen and Facanha 2007, all.

Therefore, the accident rates here included provide a conservative estimate of the number of accidents involved in the operations of the rail line.

While not all accidents would lead to derailments of any railcars, any accident is likely to require the train to be inspected and other precautions to be taken. Hence, this analysis conservatively considers all accidents involving cask cars. In addition, a number of design and operating changes for dedicated trains have been predicted to reduce accident rates for dedicated trains, but to maintain conservatism, these potential benefits are not considered here.

Based on the lengths of each alternative segment and common segment, and the combined accident rate for an 8.54-car train (that is, 8.95×10^{-7} accident per train kilometer), the predicted accident counts are given in Table 4-277 for the full set of cask shipments expected during the entire operations phase (that is, the analysis considers the 5,666 trains involving cask cars, which includes both directions). For accidents not involving cask trains, the total number of accidents was calculated by adding the accidents associated with the number of trains and the accidents associated with the number of rail cars. For purposes of this analysis, DOE used the longest specific alignment. Because the upper bound of the accident rate is so small for the specific alignments, there would be no discernable difference.

As shown in Table 4-277, a total of approximately three accidents involving cask trains could occur over the 50-year operations phase. While potential consequences could involve environmental damage, evacuation costs, and human health impacts, the focus of the frequency analysis is on scenarios that could lead to human health impacts as discussed in greater detail elsewhere in this section. The total number of accidents involving trains that do not carry casks would be approximately 11 for 50 years of operation. Therefore, the total number of predicted rail accidents would be approximately 14.

Rail Facilities: The analysis of potential incidents at rail facilities was based on the types of activities and operations that are expected to be carried out at such facilities. The scenarios of concern relate primarily to transportation accidents at the Staging Yard. The likelihoods of accidents are based on both available failure and accident rates, and on the number of switchovers that would need to be made. The results for accident potential at the Staging Yard are included within the calculations for Table 4-277.

The Rail Equipment Maintenance Yard and the geologic repository operations area interface are essentially rail yards in terms of the operations that would occur there: train make-up and car switching. Casks would be removed from the railcars at the geologic repository operations area and empty casks would be placed back onto railcars at the Rail Equipment Maintenance Yard. The results for accident potential at the Rail Equipment Maintenance Yard and the geologic repository operations area interface are also included within the calculations for Table 4-277 (common segment 6).

Table 4-277. Estimated number of predicted rail accidents.[a]

Rail alignment segment	Segment length (longest alternative segment, in kilometers)[b]	Predicted number of accidents	
		Involving cask trains	Not involving cask trains
Union Pacific Hazen Branchline	69	0.35	1.28
Department of Defense Branchline North	8.1	0.04	0.15
Schurz alternative segments	72	0.37	1.34
Department of Defense Branchline South	35	0.18	0.65
Mina common segment 1	120	0.61	2.22
Montezuma alternative segments	140	0.71	2.60
Mina common segment 2	3.4	0.02	0.06
Bonnie Claire alternative segments	21	0.11	0.39
Common segment 5	40	0.20	0.74
Oasis Valley alternative segments	14	0.07	0.26
Common segment 6 (including Rail Equipment Maintenance Yard)	51	0.26	0.95
Total	573	2.91	10.63

a. During 50-year operation.
b. To convert kilometers to miles, multiply by 0.62137.

Grade Crossings: DOE also examined the consequences of the Proposed Action on delay and safety conditions for at-grade crossings along the proposed rail alignment. Delay considerations are discussed in Section 4.3.9. The examination of grade-crossing safety typically considers the expected number and locations of grade crossings, the volume of both vehicle and rail traffic at crossings, the nature of road traffic (for example, trucks versus passenger vehicles), the design and safety features of the crossings, and train and vehicle speeds in the vicinity of any crossings.

Grade-crossing collisions reported as train accidents are included in the number of rail accidents estimated in Table 4-277. Accidents at grade crossings are accounted for in the rail accident estimates included in this analysis.

Grade-crossing safety is influenced by the type of protection installed at each crossing. Most of the crossings for this project would involve very low-usage unpaved roads that would mainly involve passive warning systems (such as cross-bucks and stop signs), or paved roads that might have active warning systems (such as flashing lights and gates). The exception is the existing rail segment between Hazen and Wabuska, which crosses public roads with moderate traffic (that is U.S. Highway 50A in Hazen, U.S. Highway 50 in Silver Springs, and U.S. Highway 95A in Churchill and Wabuska). Even with the additional rail traffic generated by the Proposed Action, these grade crossings would not meet any of the conditions established by the U.S. Department of Transportation to be considered for grade separation (such as maximum highway and train speed, average daily road and rail traffic, crossing exposure, vehicle delay) (DIRS 180695-DOT 2002, all). Although grade-separated crossings are not mandatory for this project, DOE would be providing up to five grade-separated crossings on state and federal highways as identified in Chapter 2. The numbers of crossings with each type of protection are listed in Table 4-278 for each rail line alternative segment and common segment. Table 2-23 provides a detailed list of grade crossings.

Table 4-278. Number of grade crossings with primary roads.[a]

Rail alignment segment	Passive protection	Active protection	Grade separation
Union Pacific Hazen Branchline[b]	7	7	None
Schurz alternative segments	None	None	1
Department of Defense Branchlines	1	None	None
Mina common segment 1	None	None	2
Montezuma alternative segments	None-1[c]	None-1[c]	None-1[c]
Mina common segment 2	None	None	None
Bonnie Claire alternative segments	None	None	None
Common segment 5	None	1	None
Oasis Valley alternative segments	1	None	None
Common segment 6	None	None	None
Totals	9/10	8/9	3/4

a. This list does not include all grade crossings.
b. The Union Pacific Railroad Hazen Branchline is part of the region of influence for the purposes of the transportation impact assessment; however, it is not part of the Mina rail alignment.
c. This depends on the specific alternative segment.

4.3.10.2.3.3 Transportation of Munitions. Under the Mina Implementing Alternative, any of the Schurz alternative segments would route existing rail traffic, including munitions shipments and other shipments to and from the Hawthorne Army Depot, around the town of Schurz, and the existing Department of Defense Branchline through Schurz would no longer be used. A safe distance would be maintained between munitions trains and cask trains at all times at the Staging Yard. Therefore, munitions trains would not represent a hazard to cask trains.

U.S. Army quantity-distance calculations provide an assessment of the distance to public traffic routes and distance to inhabited buildings for storage or transportation of munitions. Public traffic route distances consider the transient nature of the exposure and are calculated as 60 percent of the inhabited building distance (DIRS 181032-Dillingham 2007, all).

According to Department of the Army Pamphlet 385-64, Table 5-1, a distance to public traffic route of 725 meters (2,380 feet) and a distance to inhabited building of 1,210 meters (3,970 feet) apply to munitions shipments of the types made along the existing rail line. The Army has indicated that there should be an easement of at least 725 meters on either side of the tracks (no building) along the entire route. This is based on 60 percent of the inhabited building distance of 1,210 meters (DIRS 181032-Dillingham 2007, all). There are no inhabited buildings identified within this distance for any of the

Schurz alternative segments, as shown in Figure 4-49. As the figure shows, the closest point along any of the four Schurz alternative segments to the town of Schurz is 6.1 kilometers (3.8 miles) for Schurz alternative segment 1, 10.5 kilometers (6.6 miles) for Schurz alternative segment 4, 10.6 kilometers (6.6 miles) for Schurz alternative segment 5, and 12.1 kilometers (7.6 miles) for Schurz alternative segment 6. As also shown in the figure, there are only four grade crossings for Schurz alternative segments 1, 4, and 5, and only three grade crossings for Schurz alternative segment 6, compared with the nine grade crossings in the town of Schurz along the existing Department of Defense Branchline.

4.3.10.3 Shared-Use Option

4.3.10.3.1 Nonradiological Impacts

4.3.10.3.1.1 Impacts to Workers. Rail line construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

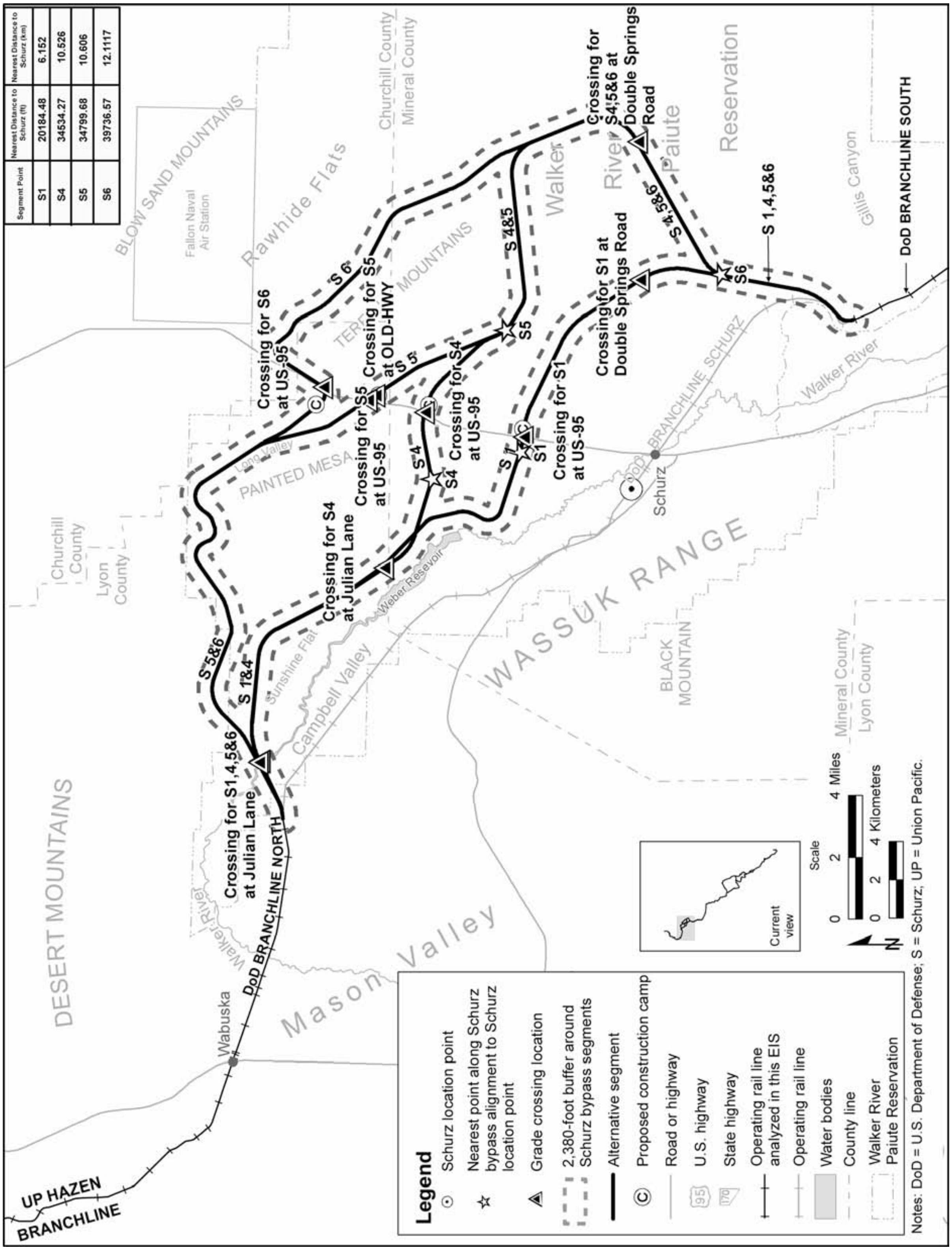
Rail line facility construction and operations nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line and associated facilities. It is assumed that the construction of the railroad facilities under the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the facilities under the Proposed Action, and that the configuration and operation of the facilities, including emergency response systems, would be the same for both the Proposed Action and Shared-Use Option.

4.3.10.3.1.2 Impacts from Specific Resource Areas. Rail line construction and operations nonradiological occupational health and safety impacts related to the specific resource areas discussed in Section 4.3.10.2.1.1 would be approximately the same for the Shared-Use Option as for the Proposed Action, based on the construction and operation of the proposed rail line.

4.3.10.3.2 Radiological Impacts

4.3.10.3.2.1 Impacts to Workers. It is anticipated that worker health and safety impacts from the Shared-Use Option are similar to those for the Proposed Action, with the exception of radiological occupational exposure impacts. One difference would be the number of times a loaded cask train would pass workers at sidings. For the Proposed Action, there could be up to about 30 passes involving loaded cask trains and other trains over the life of the rail shipping campaign. A cask train could pass more than one shared-use train between the Staging Yard and the Yucca Mountain Site boundary (DIRS 180876-Nevada Rail Partners 2007, all). This would result in a collective radiation dose of 0.0013 person-rem for these workers. This is equivalent to a probability of a latent cancer fatality of 7.7×10^{-7}. For the Shared-Use Option, there could be up to about 60 passes involving loaded cask trains and other trains over the life of the rail shipping campaign. A cask train could pass more than one shared-use train between the Staging Yard and the Yucca Mountain Site boundary. This would result in a collective radiation dose of 0.0028 person-rem for these workers. This is equivalent to a probability of a latent cancer fatality of 1.7×10^{-6}.

4.3.10.3.2.2 Impacts to the Public. It is anticipated that radiological health and safety impacts for the Shared-Use Option would be similar to those for the Proposed Action with the exception of radiological occupational exposure impacts.



Segment Point	Nearest Distance to Schurz (ft)	Nearest Distance to Schurz (km)
S1	20184.48	6.152
S4	34534.27	10.526
S5	34799.68	10.606
S6	39736.57	12.1117

Figure 4-49. Inhabited building distance for Schurz bypass segments.

The additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials and therefore there would be no additional exposure to the public.

4.3.10.3.3 Transportation Impacts

4.3.10.3.3.1 Construction Impacts.

<u>Nonradiological Roadway Accidents</u> Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal. The collective impact would be expected to be less than one percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

<u>Nonradiological Rail Line Accidents</u> No commercial rail transports would be conducted during construction of the Shared-Use Option. Under the Shared-Use Option, any increase beyond what is described under the Proposed Action for rail line accidents and fatalities would be minimal. The collective impact would be expected to be less than one percent of the overall risk calculated for construction of the Proposed Action rail line. Therefore, impacts are considered to be the same as those identified for the Proposed Action.

4.3.10.3.3.2 Operations Impacts.

<u>Nonradiological Roadway Accidents</u> Under Shared-Use Option operations, any increase beyond what is described under the Proposed Action for roadway accidents and fatalities would be minimal. Impacts are considered to be the same as those identified for the Proposed Action.

<u>Nonradiological Rail Line Accidents</u> The rail transportation safety analysis for the operations phase of the Shared-Use Option assesses the impacts of transportation, rail facilities, and grade crossings.

Rail Alignment: The Shared-Use Option differs from the Proposed Action only in the amount and type of traffic that would use different portions of the proposed rail line and the composition of some of the trains in terms of both length and materials categories. Up to ten commercial train trips (five round trips) a week would expected along the entire alignment, and up to eight commercial train trips (four round trips) a week would be expected from Hazen to the Schurz area. Each train would consist of up to four locomotives and up to 60 railcars (DIRS 180694-Ang-Olson and Gallivan 2007, all). For comparison, an average total of 17 one-way trains would run between the Staging Yard and the geologic repository per week carrying casks, repository construction and supplies materials, and other materials for Maintenance-of-Way activities. It is anticipated that the trains would travel at 64 kilometers per hour (40 miles per hour). The addition of the commercial trains would have a small impact on the potential for an accident involving a cask car, as operational procedures and controls regarding both scheduling and the use of sidings would restrict the interactions of the two types of trains. Trains carrying cask cars would take precedent. The overall density of trains on the proposed rail line would still be considered low, even with the commercial trains added in, so additional risk of an accident involving cask cars due to increased traffic densities would be minimal.

During the peak level of transportation operations along the rail line, there could be 17 trains servicing the repository each week (8 cask trains, 7 repository construction and supplies trains, and 2 maintenance-of-way trains, or 17 one-way trips), and 18 commercial trains (9 round trips). During these peak years, the transportation safety impacts associated with nonradiological risks might increase by approximately 100 percent. Over the full 50-year operating lifetime of the rail line, the Shared-Use Option could result in an additional 20,800 trains, considering each direction separately (eight one-way trains per week). Assuming that ten trains would travel the full length of the rail line and eight trains would travel from Hazen to Schurz, an additional 17.9 million train-kilometers would be generated over 50 years. Based on a list of potential shippers, demand estimates were developed (DIRS 180694-Ang-Olson and Gallivan

2007, all). A total of 524 weekly carloads are expected to be shipped along different portions of the rail line. According to the location and demand of each potential shipper, it was estimated that each loaded car would travel an average of 188 kilometers (117 miles). Considering both directions of travel, this would result in approximately 512 million car-kilometers over 50 years (524 cars × 52 weeks × 50 years × 188 kilometers × 2). Assuming the same rail fatality and accident rates included in Sections 4.3.10.2.3.1 and 4.3.10.2.3.2, respectively, a total of six additional fatalities and 22 additional accidents would be expected to occur for the entire set of estimated railcar movements during Shared-Use Option operations. Rail accidents are not allocated to specific rail line segments due to the uncertainty of where those accidents will occur.

In general, the operating characteristics of these commercial trains are unknown at this time; therefore, the travel times and operational movements of these trains cannot be described. However, the Nevada Railroad Control Center described under the Proposed Action would control and coordinate commercial rail service movements and would therefore maintain overall safety of operations along the rail line to minimize potential rail accidents.

Rail Facilities: The Rail Equipment Maintenance Yard and the geologic repository operations area interface would not be affected by any shared use of the proposed rail line because commercial shippers would not use the DOE Rail Equipment Maintenance Yard. Many of the commercial railcars would be dropped off along the way at intermittent commercial facilities. As a result, the commercial service end-of-line facility would have significantly less car handling than the Rail Equipment Maintenance Yard, and operations at the commercial facility would have no impact on the number of accidents involving the cask cars.

Grade Crossings: The increased number of trains under the Shared-Use Option would slightly increase the potential for accidents because of the increased number of trains crossing each at-grade crossing (with a maximum of nine round trips per week). However, because this volume of commercial traffic would be low, adverse impacts would be small. Delay considerations were included in Section 4.3.9. Even with the additional rail traffic from the Shared-Use Option, the grade crossings would still not meet any of the conditions established by the U.S. Department of Transportation to be considered for grade separation (DIRS 180695-DOT 2002, all).

4.3.10.4 Summary

This section summarizes nonradiological occupational health and safety impacts, public and occupational radiological impacts, and nonradiological transportation impacts under the Proposed Action and the Shared-Use Option for the Mina rail alignment.

Alignment segments and facility locations are not relevant to the nonradiological transportation impacts analysis or to the nonradiological occupational health and safety impacts analysis. Nonradiological occupational health and safety impacts depend on the number of construction and operations full-time-equivalent workers. Nonradiological transportation impacts depend on the number of construction and operations full-time-equivalent workers and the number of casks transported. Therefore, there are no important differences among alignments or facility locations in relation to nonradiological transportation impacts or nonradiological occupational health and safety impacts.

Radiological impacts for the Mina rail alignment are estimated based on the longest-distance alignment, the shortest-distance alignment, the alignment with the highest population density, and the alignment with the lowest population density. There are no important differences among alignments with respect to radiological impacts for the Mina rail alignment.

All nonradiological transportation impacts for construction and operation, including vehicle-related fatalities, rail-related accidents, and rail-related fatalities, are considered to be long-term impacts. Nonradiological occupational health and safety incidents for construction and operation could be either short term (such as lost workday cases involving short-term disability) or long term (such as lost workday cases involving long-term disability). However, because there is no way to distinguish the duration of a specific lost workday case, for example, all nonradiological occupational health and safety impacts are deemed to be long-term impacts. All radiological impacts from railroad and facility operations are considered long-term impacts because such impacts would be experienced over the 50-year operating life of the railroad. Nonradiological transportation impacts, nonradiological occupational health and safety impacts, and radiological impacts would be direct impacts.

4.3.10.4.1 Nonradiological Impacts

Tables 4-279 and 4-280 summarize nonradiological impacts to workers from industrial hazards associated with railroad construction and operations under the Proposed Action. Impacts to involved workers and noninvolved workers and total impacts are shown in Table 4-263 for rail line construction and operations and in Table 4-264 for associated facility construction and operations. No construction or operations activities would occur under the No-Action Alternative. Therefore, there would be no occupational or public health and safety impacts associated with the No-Action Alternative.

Table 4-279. Estimated impacts to workers from nonradiological industrial hazards during rail line construction and operations under the Proposed Action.

	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	13.0 million		2.9 million	
Total recordable cases		325		37
Lost workday cases		180		28
Fatalities		0.65		0.26

Table 4-280. Estimated impacts to workers from nonradiological industrial hazards during rail line facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	2.7 million		15.0 million	
Total recordable cases		75		361
Lost workday cases		42		220
Fatalities		0.01		1.09

Table 4-279 includes nonradiological impacts of construction and operation of the rail line under the Proposed Action including construction of the rail line, construction and operation of the construction work camps, construction and operation of quarries to produce ballast for construction activities, construction and operation of wells to produce water for construction activities, operation of construction trains, and construction and operation of batch plants to produce concrete for construction activities. Operations impacts include impacts to train crews and escort and security personnel. Table 4-281 summarizes the nonradiological impacts of construction and operation of rail line facilities under the Proposed Action, including the Rail Equipment Maintenance Yard, Staging Yard, Nevada Railroad Control Center and National Transportation Operations Center, Maintenance-of-Way Facilities, and Cask Maintenance Facility.

Table 4-281. Estimated impacts to workers from nonradiological industrial hazards during rail line and facility construction and operations under the Proposed Action.

Group and industrial hazard category	Construction		Operations	
	Labor hours worked	Incidents	Labor hours worked	Incidents
	15.7 million		17.9 million	
Total recordable cases		400		398
Lost workday cases		221		248
Fatalities		0.65		1.35

4.3.10.4.1.1 Workers. Nonradiological occupational health and safety impacts from railroad construction and operations under the Proposed Action involve approximately 800 recordable incidents, approximately 470 lost-workday accidents, and approximately two fatalities. Rail line construction and operation nonradiological occupational health and safety impacts for the Shared-Use Option would be approximately the same as for the Proposed Action, based on the construction and operation of the proposed rail line. It is assumed that construction of the proposed rail line for the Shared-Use Option would require approximately the same number of workers and labor hours, and approximately the same amount of construction materials and equipment as would construction of the proposed rail line for the Proposed Action.

Construction and operations workers under the Proposed Action and Shared-Use Option could potentially be exposed to nonradiological hazardous chemicals related to operation and maintenance of construction equipment and rail line facility equipment, including maintenance-of-way and maintenance of casks. Such activities are anticipated to include welding, metal degreasing, painting, and related activities. Occupational health and safety impacts could also result from worker exposure to fuels, lubricants, and other materials used in construction, operation, and maintenance of the proposed rail line and associated facilities. The recorded incident rates of these exposure hazards during construction work at the Yucca Mountain site has been small and is anticipated to be small for construction and operation of the rail alignment and facilities under the Proposed Action.

Dust and soils hazards include potential occupational exposure to hazardous inhalable dust, including the minerals crystalline silica, cristobalite, and erionite, and potential occupational encounters with unexploded ordnance. It is unlikely that any fugitive particulate generated in the construction areas would contain a concentration of crystalline silica, erionite, or cristobalite that would result in exceedance of occupational exposure limits for these materials. Therefore, impacts associated with occupational exposure to these materials are not anticipated from construction and operation of the railroad and facilities under the Proposed Action.

Impacts to construction or operations workers from unexploded ordnance would be small due to implementation of inspection procedures and mitigation measures if necessary.

Workers may also be exposed to biological hazards including infectious diseases (such as Hantavirus, West Nile Virus) and other biological hazards (such as venomous animals). The recorded incidence rates of these biological hazards in the region of influence in Nevada are small, according to statistics published by state and federal agencies including the U.S. Centers for Disease Control and the Nevada State Health Division, and the recorded incident rates of these biological hazards during construction work at the Yucca Mountain site has also been small. Therefore, DOE would expect small impacts to construction or operations workers from these biological hazards.

4.3.10.4.1.2 Public. Nonradiological impacts to the public from the construction and operation of the rail line and facilities (other than impacts from transportation accidents) are presented in the air quality section and noise section of this Rail Alignment EIS and are therefore not further discussed in Section 4.3.10.

Impacts to the public from transportation accidents (those transportation accidents not involving release of radiation) are discussed in Section 4.3.10.4.3.

4.3.10.4.2 Radiological Impacts

Occupational and public radiological impacts and accident risk of rail line and associated facility operations for the Proposed Action and Shared-Use Option are summarized in Table 4-282. For the radiological impacts analyses, the four specific alignments described in Table 3-146 were evaluated. Table 4-282 summarizes the radiation doses and impacts for these workers along these four alignments.

Table 4-282. Summary of occupational and public estimated radiological impacts for the Proposed Action (expressed as latent cancer fatality units).[a]

Case	Staging Yard	Workers	Public	Accident Risk	Total
Highest population	Hawthorne	0.3	8.5×10^{-4}	7.7×10^{-6}	0.3
Shortest distance	Hawthorne	0.33	8.2×10^{-4}	7×10^{-6}	0.33
Longest distance	Hawthorne	0.35	8.34×10^{-4}	7.6×10^{-6}	0.35
Lowest population	Hawthorne	0.35	8.1×10^{-4}	7×10^{-6}	0.35

a. Radiation doses modeled from the point where the proposed railroad would meet the existing Union Pacific rail line at Hazen.

Radiological occupational and public health and safety impacts to workers and the public for the Shared-Use Option would be approximately the same as those for the Proposed Action, as the additional trains that would be operated for the Shared-Use Option would not involve transportation of radioactive materials that would result in additional occupational or public exposure to radiation.

4.3.10.4.2.1 Workers. For workers, the radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.3.10.4.2.2 Public. Radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.3.10.4.2.3 Accidents. Radiological impacts of the Proposed Action and Shared-Use Option are estimated to result in less than one latent cancer fatality.

4.3.10.4.3 Transportation Impacts

Table 4-283 summarizes impacts from nonradiological transportation accidents, including vehicular-related accidents and rail-related accidents, from construction and operation of the Proposed Action and Shared Use Option. Impacts for the Shared Use Option are considered to be the same as those identified for the Proposed Action for the construction phase.

Table 4-283. Summary of estimated transportation accident impacts.

	Construction	Operations	
	Proposed Action and Shared-Use Option	Proposed Action	Shared-Use Option
Vehicular-related fatalities	6	7	7
Rail-related fatalities	0.4	0.7	7
Rail-related accidents	2	14	36
Rail-related accidents involving cask trains	Not applicable	3	3

4.3.11 UTILITIES, ENERGY, AND MATERIALS

This section describes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.11.1 describes the methodology DOE used to assess potential impacts to utilities, energy, and materials; Section 4.3.11.2 describes potential impacts; Section 4.3.11.3 describes the potential impacts under the Shared-Use Option; and Section 4.3.11.4 summarizes potential impacts.

Section 3.3.11.1 describes the regions of influence for utilities, energy, and materials. To aid reader understanding, the regions of influence are repeated throughout Section 4.3.11 where appropriate.

4.3.11.1 Impact Assessment Methodology

The utilities, energy, and materials impacts analysis considered whether construction and operation of the proposed railroad along the Mina rail alignment would:

- Cause utility service outages as a result of construction activities
- Affect the capacity of ***public water systems***, directly or indirectly
- Require extension of water mains involving off-site construction for connection to a public water source
- Impact water-supply capacity needed for fire suppression
- Affect the capacities of public wastewater treatment facilities, directly or indirectly
- Require extension of sewer mains involving off-site construction for connection with a public wastewater treatment system
- Require extensive expansion of telecommunications systems involving off-site construction for connections with the network (including construction of communications towers)
- Affect the capacity and distribution capabilities of local and regional suppliers of fossil fuel
- Cause new sources of construction materials and operations supplies to be built, such as new mining areas, processing plants, or fabrication plants
- Affect the capacity of existing materials suppliers and industries in the region

4.3.11.2 Construction and Operations Impacts

This section describes potential impacts to utilities, energy, and materials resources from constructing and operating the proposed railroad along the Mina rail alignment. The analysis of impacts to existing utilities considers:

- Potential impacts of constructing the rail line in or near existing utility lines or rights-of-way
- Potential impacts on the capacities of public utilities
- Potential impacts on the availability of fossil fuels (the focus of the energy analysis)
- Potential impacts on the availability of construction materials

4.3.11.2.1 Construction Impacts

4.3.11.2.1.1 Potential Interfaces with Public Utility Corridors and Rights-of-Way. Potential utility conflicts would arise if construction activities could interfere with a public utility's ability to continue service or could prevent future expansion of that utility or its use of a right-of-way. Conflicts could arise in areas where the rail line and its construction and operations support facilities would either cross or overlap an existing utility corridor or right-of-way.

Utility crossings are common to linear projects such as roads, railroads, and pipelines, and they can be accomplished with minimal impact using standard engineering procedures and appropriate design specifications (see Chapter 2).

Utilities that would require the construction of crossings either above or beneath the rail line (new grade crossings) might be subject to temporary interruption as the switch is made from the existing infrastructure to the new routing. Service interruptions for electrical and telephone service, if necessary, could be limited to the time required to throw a transfer switch or to disconnect and reconnect. Service interruptions to pipelines might be longer, but to the greatest extent practicable, would be limited to a few hours.

4.3.11.2.1.2 Public Utility Systems. Potential impacts to public utility systems during the construction phase would be related to the demands on these systems to support construction activity and sustain construction workers. DOE would establish 10 temporary construction camps along the rail alignment within the construction right-of-way to house construction workers, and would fully operate a maximum of six camps at any one time (DIRS 180874-Nevada Rail Partners 2007, Section 2.3). DOE estimates that 2,160 construction personnel would be employed full-time. Each construction camp would have the capacity to house 360 people (254 construction workers and 106 support staff) for such functions as construction administration, utilities, emergency services, and other support. The personnel at each camp would comprise 40 professional staff, 20 clerical staff, and 300 craftsmen (DIRS 180874-Nevada Rail Partners 2007, Table D-1). The utilities sector of each construction camp would include areas dedicated to power, wastewater treatment, water treatment, and trash disposal. DOE expects that most construction workers would live in and spend most of their time in these camps, thereby reducing the impacts that these individuals would have on public water and wastewater systems and the use of fuel for travel.

As described in Section 4.3.9, Socioeconomics, population changes are related to changes in employment. DOE expects that most of the full-time construction workers would live in the construction camps, but the Department estimates 40 construction workers might live in Mineral County, 5 in Esmeralda County, and 15 in Nye County (DIRS 180874 Nevada Rail Partners 2007, Table D-1). There would be some population increases in nearby towns attributable to construction workers and indirect support workers. Because increases in population affect future demand on public utilities in a community, the utilities impacts analysis uses the basic assumptions and expectations regarding population change during the construction phase, as described below.

For purposes of this analysis, and consistent with the methodology described in Section 4.3.9 of this Rail Alignment EIS, DOE assumes that most construction workers would come from outside the region of influence rather than the sparsely populated Lyon, Mineral, Esmeralda, and Nye Counties. Any changes in the populations of Lyon, Mineral, Esmeralda, Nye, and Clark Counties and towns within those counties would be small (see Section 4.3.9). Therefore, associated infrastructure impacts at the county and local levels during the construction phase would be small.

Public Water Systems The region of influence for public water systems is Lyon, Mineral, Esmeralda, and Nye Counties, and communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties. However, water requirements for the project during the construction phase would be met by new wells.

Because DOE does not plan to rely on public water systems as primary sources of water during the construction phase, direct impacts to public water systems would be those related to permanent population increases within the region of influence attributable to the construction phase.

Because, as previously discussed in Section 4.3.9, permanent population increases would be expected to be minor for most areas during the construction phase, DOE expects that existing public water systems in the region of influence could accommodate the increased demand within existing system capacities without adverse impacts.

As discussed in Section 3.3.11, Lyon and Mineral Counties can adequately meet current and future demands for water. Given the level of demand and limited capacity of groundwater in Nye County, further demands could strain the water-supply system. However, future population growth that might occur in Nye County during the railroad construction phase would be less than 1 percent. Goldfield, in Esmeralda County, has the water and infrastructure to triple the number of users served by its water-supply system, and can meet increased demands for water. Section 4.3.6, Groundwater Resources, discusses water requirements by hydrologic basin and indirect impacts associated with groundwater withdrawals.

Wastewater Treatment Systems The region of influence for wastewater transported offsite for treatment and disposal is the existing permitted treatment facilities in Lyon, Mineral, Esmeralda, and Nye Counties, and communities within those counties, and the Walker River Paiute Reservation, the bulk of which lies within Mineral County with smaller portions in Lyon and Churchill Counties.

DOE estimated that up to 609,000 liters (161,000 gallons) per day of sanitary wastewater could be generated during the construction phase, as summarized in Table 4-284. However, because construction activities would be phased, actual daily maximums would be less. The Department estimates that the amount of sanitary wastewater that would be generated at each construction camp would peak at 95,000 liters (25,000 gallons) per day. Most of this wastewater would be generated from flush toilets and showers. Sanitary sewage generated at the construction camps would be treated onsite using portable wastewater treatment facilities, and treated wastewater would be recycled and used for construction purposes (such as soil compaction and dust suppression). DOE would recycle about 90 percent of all construction-generated wastewater. Therefore, there would be no impacts to existing wastewater treatment capacity in the region of influence.

Commercial vendors would provide portable restroom facilities where needed and would transport wastewater offsite for treatment, which could include the use of permitted wastewater treatment facilities in the region of influence. As shown in Table 3-284, permitted wastewater treatment facilities in the region of influence have adequate capacity. Therefore, any impacts to those wastewater treatment facilities during the construction phase would be small.

DOE expects permanent population increases would be small for most areas during the construction phase (see Section 4.3.9); therefore, existing publicly owned wastewater treatment works in the region of influence could accommodate the increased wastewater within existing system capacities without adverse impacts.

Telecommunications Systems The region of influence for telephone and fiber-optic telecommunications systems is the southern Nevada region serviced by Nevada Bell Telephone Company (AT&T Nevada), Citizens Telecommunications Company of Nevada, and Verizon.

During preliminary grading, construction communications would be provided via short-wave radio and satellite telephone (DIRS 180875-Nevada Rail Partners, Section 2.5). Communications systems during construction would be designed to not interfere with other licensed services operating in the same

Table 4-284. Wastewater generation during the construction phase – Mina rail alignment.

Facility	Number of personnel (maximum)	Wastewater generation (liters per day per person)[a,b]	Total wastewater (liters per day)[c]
Construction camps[d]	2,160[e]	265	570,000
Staging Yard at Hawthorne	110[e]	76	8,400
Maintenance-of-Way Facility (Silver Peak or Klondike)	60[e]	76	4,600
Rail Equipment Maintenance Yard	150[e]	76	11,400
Cask Maintenance Facility	150[f]	76	11,400
Concrete batch plant	10[e]	76	800
Total			609,000

a. Sources: Daily wastewater generation rates from DIRS 180921-Nevada Rail Partners 2007, Section 4.4.2; Nevada Administrative Code 444.8312 as an estimated per person wastewater flow from an office (for other facilities).
b. To convert liters to gallons, multiply by 0.26418.
c. Numbers in column are rounded to three significant figures.
d. Six construction camps of a total of 10 would be in operation at one time.
e. Source: DIRS 180874-Nevada Rail Partners 2007, Table D-1.
f. Source: DIRS 181425-MTS, 2007, p. 5.

geographic areas and would remain in place until the communications systems for railroad operations were in place and commissioned. Little or no landline telecommunications service would be required during the construction phase. The installation and use of telecommunications systems would have a small impact on local telecommunications utilities.

Electricity The region of influence for electric power includes areas serviced by the southern Nevada electrical grid operated by Nevada Power Company, Sierra Pacific Power Company, and Valley Electric Association, Inc. Electric energy demand for initial construction activities would be satisfied with portable generators until electrical connections were established. This section discusses energy needs that would be satisfied through the use of existing electrical utilities.

During the construction phase, DOE proposes to lay an underground 25-kilovolt distribution line under the rail roadbed (DIRS 180875-Nevada Rail Partners 2007, Section 4.1.2). The primary purpose of the distribution line would be to provide electric power to facilities and equipment needed for routine railroad operations (such as signals, switches, and radio communication towers), and to be able to provide the capacity to meet expected power needs for support facilities; a secondary purpose would be to provide an alternative to diesel-powered generators or local power sources.

Although power might be required during construction or operations only in specific areas along the rail alignment (such as at sidings, radio communication towers, construction camps, and quarries), for purposes of analysis DOE assumed that an underground 25-kilovolt distribution line would be laid in a trench in an uninterrupted length of approximately 452 kilometers (281 miles) which would include the nominal 409 kilometers (254 miles) of new rail construction, and the approximately 43 kilometers (27 miles) of Department of Defense Branchline between the southern end of the Schurz bypass and Hawthorne (Department of Defense Branchline South). Chapter 2 fully describes these rail segments and explains that different combinations of alternative segments and common segments would produce a rail line of different lengths. At the same time the Department was laying the power distribution line, it would also lay the fiber-optic cable to be used as part of a telecommunications system (encased in a polyvinyl-chloride [commonly referred to as PVC] duct), and would place it in the same trench as the 25-kilovolt distribution line. Once the cables were placed, the trench would be back-filled to grade.

Based on initial planning studies, power to the distribution system would be fed from locations where the rail line would intersect existing high-voltage transmission lines (DIRS 180875-Nevada Rail Partners 2007, Section 4.1.2). At this stage of the design process, DOE has not identified specific locations. DOE would construct substations within the nominal width of the construction right-of-way to feed the 25-kilovolt distribution line from the higher-voltage transmission lines at such intersections. At locations along the rail line where lower-voltage power was required for railroad systems, DOE would place step-down transformers from the 25-kilovolt distribution line on the trackside.

Construction camps would be powered one of three ways: (1) from existing transmission or distribution lines where they run alongside the camp sites, (2) from the 25-kilovolt distribution line, or (3) from diesel-powered generators. Option (1) would require access to pre-existing nearby transmission or distribution lines at construction-camp sites and their contracted use. Option (2) would depend on the availability of an energized 25-kilovolt distribution line during the period in which a construction camp would be operated. For options (1) and (2), DOE would place a substation at the construction camp. If neither option (1) nor (2) was available, DOE would select option (3). In addition, for options (1) and (2), the Department would use backup diesel-powered generators at each camp during unexpected power outages. Energy use at each camp during the peak output year would approach 54,000 kilowatt-hours per day, or 20 million kilovolt-hours per year.

Quarry sites would require electric power for conveyor belts, machinery, lighting, and support services. That need would be met by either of three options: (1) from nearby transmission or distribution lines if available, (2) from diesel-powered generators, or (3) from the 25-kilovolt distribution line. DOE would build a substation at each quarry site. Temporary power lines would distribute power at the quarry facility. If DOE selected option (1) or (3), diesel-powered backup generators would always be available at each quarry site for emergencies. Each quarry would be expected to use 27,600 kilowatt-hours of power per day. Energy use at each quarry site during the peak output years would approach 10 million kilowatt-hours per year (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.3).

DOE plans to have 24-meter (80-foot)-long rails delivered by rail from manufacturing plants to Hawthorne. DOE would set up a portable welding plant at Hawthorne and would later relocate the plant along the rail alignment at 80- to 160-kilometer (50- to 100-mile) increments to weld 24-meter-long rail into 438-meter (1,440-foot)-long strings to be distributed along the rail alignment by dedicated welding trains (DIRS 180875-Nevada Rail Partners 2007, Section 3.3). Typically, such welding units are powered by diesel generators generating 375 kilowatts of electrical power. DOE might build a substation connected to existing transmission lines to supply this need at Hawthorne, but this is conceptual at this stage of design. Yard and siding areas would be likely candidate relocation sites. At these sites, the Department would use portable diesel-powered generators, or conceptually, the 25-kilovolt distribution line if available and energized. (Alternatively, off-line welding of the rail would be possible, but would require dedicated welding trains to support track construction activities.)

The major electrical providers in the project region, including Nevada Power Company, Sierra Pacific Power Company, and Valley Electric Association, Inc., would have adequate generating capacity or power-purchase capabilities (see Section 3.3.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. As discussed in Section 3.3.11, demand is expected to remain relatively stable in the serviced areas, increasing at about 1 to 2 percent annually, and is not expected to impact the capacity of service providers. In cooperation with the affected utilities, DOE would perform electrical-capacity analyses to ensure adequate capacity exists, including evaluation of the conditions of existing electric facilities and determination of appropriate interface equipment to meet the needs of both parties, prior to any connection to a transmission or distribution line; therefore, any impact on electric services would be small.

For purposes of analysis, DOE assumed that electricity requirements for construction of the railroad operations support facilities would be met with portable generating equipment, but could later be met through substations connected to the 25-kilovolt distribution line when it was completed. As described in Chapter 2, these facilities would include the Staging Yard at Hawthorne, which would incorporate a Satellite Maintenance-of-Way Facility and possibly the Nevada Railroad Control Center and National Transportation Operations Center, and where designated tracks would serve as interchange tracks for Union Pacific Railroad trains; the Maintenance-of-Way Facility located either in the vicinity of Silver Peak or Klondike; and the Rail Equipment Maintenance Yard, which would incorporate a Satellite Maintenance-of-Way Facility, the Cask Maintenance Facility, and possibly the Nevada Railroad Control Center and National Transportation Operations Center.

4.3.11.2.1.3 Fossil Fuels. At this point in project planning, DOE has not identified specific providers of fossil fuels. However, for purposes of analysis, DOE expects that regional supply systems and suppliers could economically supply the project.

Fossil-fuel consumption during the construction phase would primarily consist of diesel fuel for construction equipment and vehicles. Heavy construction equipment would be diesel-powered, as would electric generators. Fuel would be transported by truck and stored at the hazardous materials storage areas at the construction camps. These materials would be stored in accordance with applicable state and federal regulations (DIRS 180875-Nevada Rail Partners 2007, Section 6.2). DOE estimated that annual consumption of diesel fuel would be 109 million liters (28.8 million gallons) (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 5b). The annual consumption of diesel fuel for the region of influence, as represented by the State of Nevada, is approximately 1.8 billion liters (480 million gallons) (DIRS 176397-EIA 2005, Table 4, 2004 data). Construction fuel consumption would represent 6 percent of diesel fuel used annually in Nevada, and could be met by existing regional supply systems and suppliers.

Construction of the proposed railroad would have a small impact on the capacity of regional suppliers or the availability of fuel resources. The fuel supply system is such that it can flexibly respond to changes in demand. Fuel consumption for construction of the railroad operations support facilities would be lower; therefore, fuel consumption during construction of those facilities would have a small impact on the capacity of regional suppliers or the availability of fuel resources.

4.3.11.2.1.4 Materials. As described in Section 3.3.11, the region of influence for necessary raw materials is limited to the distribution networks and suppliers that can economically service the general project area. For cast-in-place concrete, ballast, and subballast, the region of influence is limited to the State of Nevada. DOE would need a ***free-use permit*** from the BLM to use common varieties of sand, stone, and gravel from BLM-administered public lands during the construction phase, pursuant to the regulations implementing the Materials Act of 1947 (30 U.S.C. 601 through 603) as codified in 43 CFR Part 3600. As described in Chapter 2, the Department could obtain ballast materials from two of the five potential quarry sites within Nevada that would be close to the Mina rail alignment construction right-of-way. Therefore, the region of influence for obtaining ballast would be limited to the immediate area in Nevada. Other materials, including steel, steel rail, concrete ties, and other precast concrete could be procured and shipped on a national level. Therefore, the region of influence for these materials is considered to be national.

Material needs for construction of the proposed rail line along the Mina rail alignment would vary among the alternative segments roughly in proportion to their lengths. The primary materials that would be consumed during rail line construction include steel; concrete, principally for rail ties, bridges, and drainage structures; and rock for ballast and subballast. Table 4-285 lists the rail line construction material requirements and current production rates within the respective regions of influence.

Table 4-285. Rail line construction material requirements – Mina rail alignment.

Material	Total requirements	Annual requirements over a 4- to 10- year construction period	Region of influence	Region of influence annual production	Percent of region of influence production
Steel rail	63,000 metric tons[a]	16,000 to 6,000 metric tons	U.S. (all steel)	86,000,000 metric tons	0.02 to 0.007
			U.S. (steel rail)	518,000 metric tons	3.4 to 1.4
Concrete, cast-in-place	120,000 metric tons	30,000 to 12,000 metric tons	Nevada	16,000,000 metric tons[d]	0.2 to 0.08
Concrete, precast (including concrete ties)	373,000 metric tons	94,000 to 37,000 metric tons	U.S.	15,000,000 metric tons[d]	0.6 to 0.02
Concrete ties	776,000 ties	194,000 to 77,600 ties	U.S.	1,000,000 ties	19 to 7.6
Ballast	2.5 million metric tons	625,000 to 250,000 metric tons	Nevada	24,000,000 metric tons [b,c,d]	2.6 to 1.0
Subballast	2.2 million metric tons	550,000 to 220,000 metric tons	Nevada	9,200,000 metric tons [b,c,d]	6.0 to 2.4

a. To convert metric tons to tons, multiply by 1.1023.
b. Based on use of concrete ties only.
c. Includes granite and traprock production only, 2003 data. Some data withheld to avoid disclosing company proprietary information (DIRS 173393-Tepordei 2003, Table 9).
d. Includes crushed stone of all types, 2003 data (DIRS 173393-Tepordei 2003, Table 6).

Steel DOE has calculated that construction of the proposed rail line along the nominal 409 kilometers (254 miles) of the Mina rail alignment, including sidings and yard tracks, would require 2,176 strings of ***136 RE*** welded rail, each string being 439 meters (1,440 feet) long (DIRS 180875-Nevada Rail Partners 2007, Section 3.3). This would correspond to a requirement for 63,000 metric tons (69,000 tons) of steel over an estimated construction period of 4 to 10 years. DOE would acquire the sections of rail from national commercial sources.

Because DOE would purchase steel rail from national suppliers in staggered preordered phases over a 2- to 3-year period, the impact on availability of steel rail would be small.

DOE would need additional steel for rail hardware, bridges, and facility structures. Existing commercial fabricators would supply the steel required for the bridges. The designs of bridges and rail facilities are not sufficiently advanced to tabulate materials needs; however, the quantities required would be much less than required for rail line construction.

Concrete DOE has estimated that 50,000 cubic meters (65,000 cubic yards) of cast-in-place concrete would be required for Mina rail alignment structures (DIRS 180874-Nevada Rail Partners 2007, p. B-19). Concrete weighs approximately 2.4 metric tons per cubic meter (145 pounds per square foot) and 50,000 cubic meters would translate to an approximate requirement of 120,000 metric tons (132,000 tons) over the 4- to 10-year construction phase. Cast-in-place concrete for the Mina rail alignment would be required primarily for bridge abutments. As described in Chapter 2, DOE would obtain concrete for site placement activities at proposed bridges and other structures from a portable batch plant set up near the construction sites. DOE would truck all aggregate and cement from the portable batch plant to the construction sites. Annual production of cast-in-place concrete in Nevada equals approximately 16 million metric tons (18 million tons) per year (DIRS 173400-NRMCA 2004, p. 2).

The primary use of precast concrete would be for concrete ties. Concrete ties would be placed at 0.61-meter (2-foot) intervals along the constructed rail line (DIRS 180875-Nevada Rail Partners 2007, Section 3.2). DOE estimates that approximately 776,000 concrete ties would be required for the nominal 409 kilometers (254 miles) of new rail line construction, and an additional 64 kilometers (40 miles) of track at sidings, the Staging Yard at Hawthorne, and the Rail Equipment Maintenance Yard. Using 318-kilogram (700-pound) ties would require 247,000 metric tons (272,000 tons) of concrete to produce the ties. Precast concrete ties would either be supplied through national manufacturers or potentially through a dedicated tie production facility a commercial manufacturer would establish in Hawthorne or another area. Additional precast concrete requirements would include manufactured elements such as culverts, bridge beams, and overpass components. These precast concrete elements would be obtained from commercial sources nationally. At this stage of the design process, DOE has extrapolated that these additional precast concrete requirements would be broadly similar to an estimate documented in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section 6.3.2.1.10) of approximately 126,000 metric tons (139,000 tons) for the rail line along the Caliente corridor. DOE has estimated that total precast concrete requirements (that include concrete ties) for the Mina rail alignment would be approximately 373,000 metric tons (411,000 tons) over a 4-year construction period.

Annual national production of concrete railway ties has been increasing from about 620,000 ties in 2000 (DIRS 173572-RTA 2000, p. 22) to about 720,000 ties in 2004, and is projected to grow to about 1.2 million ties in 2007 (DIRS 173573-Gauntt 2004, p. 17). The 247,000 metric tons (272,000 tons) of concrete ties that would be required to construct the rail line along the Mina rail alignment represent 19 percent of the annual national production of concrete ties. Although this might seem like a significant requirement, the national production volume for concrete ties does not reflect manufacturing capacity. Concrete tie production is a very scaleable industry, and recent data suggests that, if needed, the industry has the capacity to increase concrete tie production rapidly (DIRS 173573-Gauntt 2004, p. 17). For example, the current national production of concrete ties represents only approximately 0.3 percent of all manufactured (precast) concrete production, which is 15 million metric tons (17 million tons) per year (DIRS 173392-van Oss 2003, Table 15). Because DOE would purchase precast concrete components from national suppliers in staggered preordered phases, and because construction would involve a small amount of cast-in-place concrete via the use of an onsite batch plant, the impact on availability of concrete would be small.

Ballast and Subballast Ballast and subballast are essentially crushed rock such as that required for the development of the rail roadbed. DOE has estimated that a total of approximately 2.5 million metric tons (2.8 million tons) of rail roadbed ballast would be required for track construction along the Mina rail alignment (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.2). As discussed in Chapter 2, the Department has identified five potential quarry sites along the Mina rail alignment and would develop only two on an as-needed basis. Each of the potential quarries could produce approximately 3,100 metric tons (3,400 tons) of useable ballast per day. Therefore, the impact to availability of ballast from constructing the rail line along the Mina rail alignment would be small.

> **Ballast:** Gravel or broken stone laid in a rail roadbed to distribute train weight uniformly across the bed.
>
> **Subballast:** Gravel or broken stone that does not have to meet the ballast specifications, layered beneath the ballast as a transition between the ballast and the compacted subgrade.

DOE has estimated that a total of approximately 2.2 million metric tons (2.4 million tons) of subballast would be required for track construction along the Mina rail alignment (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.2). Some of the remaining material from each ballast quarry might be suitable for subballast. Remaining subballast requirements would be obtained either from cuts made for constructing the roadbed or from existing borrow sites and quarries along the alignment. The Mina rail alignment would not incorporate enough cut sections to generate the required 2.2 million metric tons of subballast; therefore, DOE would develop sources approximately 16 kilometers (10 miles) apart along the alignment during construction. Approximately 55 surplus borrow-site locations are available adjacent to Nevada Department of Transportation materials sources and additional nearby sites could be developed (DIRS 180875-Nevada Rail Partners 2007, Section 3.1.2). Impacts on the availability of subballast materials would be small.

DOE would construct 7.3-meter (24-foot)-wide gravel access roads parallel to the rail line and within the construction right-of-way. The rail line and the alignment access roads would be accessed via existing public roads where the rail line would cross an existing roadway. DOE would construct additional access roads to reach features like wells and quarries that are not immediately accessible to the rail alignment. The quarry sites identified would be within 3 kilometers (2 miles) of the alignment, thereby minimizing access-road construction requirements.

Materials for access-road construction or improvement would be obtained primarily from locally available materials such as stone, and gravel resulting from cuts and fills along the alignment and overburden at quarries. Access roads would likely have gravel surfaces. The native material would be supplemented by crushed rock screenings as necessary to provide a serviceable roadway surface.

Sand and Gravel There is a high likelihood DOE would find sand and gravel on the alluvial fans along cuts for the rail line that would be suitable for construction purposes and road making. Sand and gravel also would be generated from overburden at quarry and borrow sites. Approximately 55 surplus pit locations are available adjacent to Nevada Department of Transportation materials sources and additional nearby sites could be developed. DOE would use some natural sand and gravel excavated from cuts and crushed rock from the quarries to make concrete aggregate (DIRS 180881-Shannon & Wilson 2007, pp. 20, 21, 25, 26, 30, 31, 36, 41, and 42). The Department would determine the prime sand and gravel deposits needed before beginning construction. Using locally available sand and gravel would result in the consumption of a nonrenewable resource that could be used as a supply of construction materials for other construction projects in the area. However, alluvial deposits of sand and gravel are commonplace in the Mina rail alignment region of influence, and their use to construct the rail line would not substantially reduce the area's resources. Therefore, impacts would be small.

Other Materials Requirements In addition to the aforementioned materials needed for the rail line, DOE would also need construction materials for railroad operations support facilities. An estimated total of approximately 9,300 square meters (100,000 square feet) of building space would be required for operations support facilities (DIRS 180873-Nevada Rail Partners 2007, Sections 3, 4, and 5); DIRS 181425-MTS 2007, p. 1). By comparison, the Las Vegas market alone had over 186,000 square meters (2 million square feet) of industrial space under construction in 2004 (DIRS 173390-Colliers International Partnership 2004, p. 1) and 160,000 square meters (1.7 million square feet) of office space completed in the 12-month period ending in March 2004 (DIRS 173391-Colliers International Partnership 2004, p. 1). Materials for the construction of rail yards at the operations support facilities are included in the rail line material estimates described in this section. Materials requirements for buildings would not be substantial in comparison to regional demand and would have a small impact on the regional supply system.

4.3.11.2.2 Operations Impacts

4.3.11.2.2.1 Utility Systems. None of the potential utility interfaces identified in Section 4.3.11.2.1.1 would prevent the future expansion of a utility service area. Impacts on infrastructure at the county level associated with railroad operations would be small because regional population projections anticipate modest growth (see Section 4.3.9.3.2). However, there could be some impacts on infrastructure in towns near the proposed railroad operations support facilities. Areas that would be likely to experience the greatest impacts include:

- Hawthorne (Mineral County), where the Staging Yard, the Maintenance-of-Way Satellite Facility, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center would be located
- Tonopah (Nye County) and Goldfield (Esmeralda County), the towns that would be closest to the Maintenance-of-Way Facility located either at Silver Peak or Klondike
- Southern Nye County, the location of the Rail Equipment Maintenance Yard, Cask Maintenance Facility, train crew quarters, and possibly the Nevada Railroad Control Center and National Transportation Operations Center

Public Water Systems DOE would need water for railroad operations, particularly at operations support facilities. Because they would be reclaimed after the construction phase was completed, there would be no water demands associated with the quarries.

DOE estimates water consumption at the Rail Equipment Maintenance Yard would be about 23,000 liters (6,000 gallons) per day for personnel and an additional 11,000 liters (3,000 gallons) per day for building and rail yard uses, including irrigation and vehicle washing. At the Rail Equipment Maintenance Yard, water needs would be met by using the repository's well system, which would eliminate the need for service by any local public water system. DOE estimates water consumption at the Maintenance-of-Way Facility that would be located either in the vicinity of Silver Peak or Klondike would be about 11,000 liters (3,000 gallons) per day, and 21,000 liters (5,500 gallons) per day at the Staging Yard at Hawthorne, where water would be obtained from locally drilled wells (DIRS 180873-Nevada Rail Partners 2007, Table 2-2, Section 3.6, and Section 4.6).

Public water systems in Lyon, Mineral, Esmeralda, and Nye Counties could be affected by incremental changes in population attributable to railroad operations. As discussed in Section 3.3.11, Lyon and Mineral Counties are able to meet current and future demands for water. Goldfield, in Esmeralda County, has the groundwater resources and infrastructure available to triple the number of users served by its public water system and thus has the potential to meet increased demand for water by additional residential and commercial users.

In Nye County, given the level of demand and the limited capacity of groundwater resources (particularly in the Pahrump Valley hydrographic area), water needs could strain supply. Although the Cask Maintenance Facility would be collocated with the Rail Equipment Maintenance Yard and the geologic repository operations area interface in Nye County, the estimates for population increase attributable to the employees at the Yucca Mountain Site (see Section 4.3.9.3.2) would represent a small incremental increase. Therefore, impacts to the public water systems in Nye County from the demands associated with these potential new residents would be small.

Wastewater Treatment Facilities DOE would dispose of sanitary wastewater in accordance with State of Nevada regulations. Under the Statutory Authority of Nevada Revised Statutes (NRS) 445A.300 through 445A.730, and pursuant to the Nevada Administrative Codes (NAC) 445A.810 through

445A.925, and NAC 444.750 through 444.828, the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, issues wastewater discharge permits, administers loans to publicly owned treatment works, and oversees the certification program for sewer-treatment plant employees. In most cases, DOE would construct onsite sanitary wastewater treatment systems within the railroad operations right-of-way and they would be permitted by the State of Nevada. These would likely be ***package plants***, as described in Section 3.3.11.2.3. If access to nearby existing permitted wastewater treatment facility capacity was available to any on-site facilities, DOE would discharge sanitary waste to those existing facilities. Impacts to existing wastewater treatment capacities of jurisdictions in the region of influence during the operations phase would be small.

Table 4-286 lists the rates of wastewater generation that would be associated with railroad facilities during the operations phase.

Table 4-286. Wastewater generation during the operations phase – Mina rail alignment.

Facility	Number of personnel (maximum)	Total wastewater generation (liters per day)[b]
Staging Yard at Hawthorne	40[b]	21,000
Maintenance-of-Way Facility	40[b]	11,000
Rail Equipment Maintenance Yard, including the Nevada Railroad Control Center and National Transportation Operations Center	70[b,c]	23,000
Totals	150	55,000

a. To convert liters to gallons, multiply by 0.26418.
b. Source: DIRS 180873-Nevada Rail Partners 2007, Section 2.1.3.
c. Source: DIRS 181425-MTS 2007, p. 1.

Wastewater from the Staging Yard at Hawthorne would be disposed of at the permitted wastewater treatment facility in Hawthorne, the capacity of which is approximately 1.5 million liters (0.6 million gallons per day (see Table 3-152) (DIRS 180873-Nevada Rail Partners 2007, Section 4.6). The Rail Equipment Maintenance Yard would provide a staging area for delivery of loaded cask cars to the repository, construction materials, and fuel. The facility would include office space, and train crew and escort personnel quarters, all of which would generate sanitary wastewater. Sanitary wastewater disposal at this facility would consist of septic systems or wastewater treatment facilities at the Yucca Mountain Site (DIRS 180919-Nevada Rail Partners 2007, p. 3-5).

The numbers of employees projected to reside in the communities near railroad operations support facilities would represent small fractions of the existing populations (see Section 4.3.9). Also, as shown in Table 3-152, most of the existing wastewater treatment facilities are operating well below their capacities, and these facilities would be capable of accommodating any increases in wastewater attributable to railroad facility employees. Goldfield has recently been awarded a Water Resource Development Act grant of approximately $3 million for renovations and upgrades. Therefore, the impact to public wastewater systems from operating railroad support facilities would be small.

Telecommunications Systems The communication system required to support railroad operations would utilize four distinct communication technologies: synchronous optical network fiber-optic backbone, very high frequency (VHF) land mobile radio, geosynchronous satellite dispatch radio, and possibly satellite telephone service (DIRS 180876-Nevada Rail Partners 2007, Section 6). The fiber-optic cable laid along the length of the nominal 409 kilometers (254 miles) of DOE-constructed rail line and the approximately 43 kilometers (27 miles) of Department of Defense Branchline South (between the southern end of the Schurz bypass and Hawthorne) would allow the installation of a VHF land mobile radio system consisting of a series of base stations located at points approximately 16 to 32 kilometers (10 to 20 miles) apart along the rail alignment to provide full radio coverage communications with locomotive and maintenance crews. Base stations would consist of an equipment room that would house the radio and fiber-optic electronics and a monopole radio tower to mount an elevated VHF antenna. The Nevada Railroad Control Center would also have a private branch exchange telephone system. In the event of a failure of all or part of the primary VHF radio system, operations would continue via a geosynchronous satellite dispatch radio system. As a backup, DOE could utilize satellite telephone hand sets.

At the Nevada Railroad Control Center, the system would be configured to allow the dispatcher easy access to all of the various communication modes available, including the ability to patch communication modes together if required. However, for external communications, the Staging Yard at Hawthorne, the Nevada Railroad Control Center and National Transportation Operations Center, the Maintenance-of-Way Facility, the Cask Maintenance Facility, and the Rail Equipment Maintenance Yard would each require digital subscriber line and telephone service. The Rail Equipment Maintenance Yard would require the greatest telecommunications capacity, with approximately 75 conventional telephone lines, 50 broadband internet connections, five secure telephone lines, a fiber-optic line for closed-circuit television and data communication, and radio communications for railroad operations in conjunction with the centralized traffic control rail signal system (DIRS 180919-Nevada Rail Partners 2007, Section 6.6). The radio communication systems would be designed not to interfere with other licensed systems operating in the same area. The radio communication systems would be designed not to interfere with other licensed systems operating in the same area. The levels of commercially provided service would be small, and would not adversely affect the capacities of commercial telecommunications providers.

Electricity Impacts associated with the underground 25-kilovolt distribution line would be related to utility interfaces, as discussed in Section 4.3.11.2.1.1, and in Section 4.3.2, Land Use and Ownership.

Operation of the proposed railroad would require electricity for buildings, signaling, communications, and control. Twelve-kilovolt electrical service would be required for each facility. Depending on the distance from available power sources, larger distribution lines and intermediate substations might be needed. In addition to commercial sources, electric power could be supplied from the installed power distribution system. Each facility site would require a 12-kilovolt/480-volt transformer with a 480-volt distribution system to power industrial equipment and feed each building where a 480-volt/120-volt transformer would supply the building power (DIRS 180873-Nevada Rail Partners 2007, Section 2.1.5). Additional transformers could be required for other site requirements such as site lighting, power to yard switches and signals, or power for communications equipment. Each site would require a diesel-powered emergency generator to supply electrical power in case of an outage.

DOE estimates that the Staging Yard at Hawthorne would have a normal power demand of 386 kilowatts with the Nevada Railroad Control Center and National Transportation Operations Center (or 290 kilowatts without) (DIRS 180873-Nevada Rail Partners 2007, Section 3.6). DOE would build a substation connected to existing transmission lines to service this power need or make use of the 25-kilovolt distribution line. Diesel-powered generators would provide backup power.

DOE estimates that the Maintenance-of-Way Facility would have a normal power demand of 484 kilowatts (DIRS 180873-Nevada Rail Partners 2007, Section 4.6). DOE has made separate estimates of power demand at the Rail Equipment Maintenance Yard that range between 722 and 815 kilowatts (DIRS 180919-Nevada Rail Partners 2007, p. 6-20). The Department has established an 8-megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray, 2007, all). DOE could obtain power from a newly constructed substation connected to the existing transmission line providing power to the Yucca

Mountain Site, or from a new 138-kilovolt transmission line DOE plans to build to the geological repository operations area.

The 2003 peak load for the Nevada Power Company was 4,808 megawatts (DIRS 172302-Nevada Power Company 2004, all), whereas there would be approximately a 3-megawatt demand to operate the proposed railroad. The Department would perform an electrical capacity analysis before connecting into local transmission or distribution lines, and consistent with the demonstration of available capacity. Therefore, impacts to other regional needs for electric power during the railroad operations phase would be small.

4.3.11.2.2.2 Fossil Fuels. DOE has estimated that 119 million liters (31.5 million gallons) of diesel fuel would be consumed over an anticipated 50-year operations phase, and that the annual consumption rate would peak at 4.3 million liters (1.1 million gallons) (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 5a), a rate that would be less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Therefore, potential impacts to capacities of national and regional fuel producers and distributors during the operations phase would be small.

4.3.11.2.2.3 Materials. Materials use during the operations phase would be limited to materials for repair and maintenance of the railroad, including the locomotives, railcars, casks, and operations support facilities. The annual rate of material use over the 50-year operations phase would be substantially less than during the construction phase, and materials requirements would be expected to remain well below available capacity.

DOE would reclaim the quarries developed during the construction phase and would not use them during operations. Therefore, the relatively minor amounts of ballast required for repairs and replacements during the operations phase would be met through existing commercial sources that at this stage of the design process have been identified as quarries in Milford, Utah, and Oroville, California, as described in Section 3.3.11.4. The impacts to available supplies of ballast at these quarries would be small.

4.3.11.3 Impacts under the Shared-Use Option

Railroad construction under the Shared-Use Option would include all of the features described in Section 4.3.11.2, but would include the construction of commercial sidings and support facilities. All such construction would occur on lands immediately adjacent to the rail alignment within the rail line construction right-of-way and would have impacts related to interfaces with utility corridors and rights-of-way similar to those under the Proposed Action without shared use.

The incremental demands on public water systems, wastewater systems, telecommunications systems, electric power systems, fossil fuels, and materials for construction of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Railroad operations under the Shared-Use Option would be the same as described in Section 4.3.11.2 for the Proposed Action without shared use, but commercial shippers would add to traffic on the rail line.

The incremental demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and materials for the operation and maintenance of commercial sidings and support facilities would be sufficiently small that the anticipated impacts on these resources would be effectively the same as those for the Proposed Action without shared use. Therefore, potential impacts to local, regional, or national suppliers of such resources under the Shared-Use Option would be small.

Fossil-fuel requirements for transporting general freight under the Shared-Use Option would depend on the volume and distance of shared-use traffic. DOE estimated that the incremental annual diesel consumption for commercial shared-use traffic would be 4.6 million liters (1.2 million gallons), a rate that is less than 0.3 percent of current annual diesel fuel usage in Nevada (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table 5a). Most, if not all, of this fuel consumption would be offset by diesel fuel that would otherwise be used if the goods or materials were shipped by truck. Therefore, impacts to the capacities of national and regional fuel producers and distributors with shared used would be small.

4.3.11.4 Summary

Table 4-287 summarizes potential impacts to utilities, energy, and materials from constructing and operating the proposed railroad along the Mina rail alignment. DOE determined that those impacts would be small.

Table 4-287. Summary of potential impacts to utilities, energy, and material resources – Mina rail alignment.[a]

Resource	Construction impacts	Operations impacts
Utility interfaces	Potential for short-term interruption of service. No permanent or long-term loss of service or prevention of future service-area expansions.	None.
Public water systems	Most water would be supplied by new wells; small effect on public water systems from population increase attributable to construction employees.	Most water for operations would be supplied by new wells; small effect on public water systems from population increase attributable to operations employees.
Wastewater treatment systems	Dedicated treatment systems would be provided at construction camps; small impact on public systems from population increase attributable to construction employees.	Dedicated treatment systems would be provided at operations facilities; small impact on public systems from population increase attributable to operations employees.
Telecommunications systems	Dedicated systems; minimal reliance on communications providers.	Dedicated system along rail line; minimal reliance on communications providers.
Electricity	Peak demand would be within capacity of regional providers.	Peak demand would be within capacity of regional providers.
Fossil fuels	Demand would be approximately 6 percent of statewide use and can be met by existing regional supply systems and suppliers. Under the Shared-Use Option, demand would be less than 0.3 percent of statewide use during operations. Demand would be met by existing regional supply.	Demand would be less than 0.25 percent of statewide use.
Materials	Requirements generally would be very small in relation to supply capacity.	Requirements would be very small in relation to supply capacity.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use, except as noted for fossil fuels.

4.3.12 HAZARDOUS MATERIALS AND WASTES

This section describes potential impacts of the use of hazardous materials and the management of nonhazardous wastes, ***hazardous wastes***, and ***low-level radioactive wastes*** that would be generated during construction and operation of the proposed railroad along the Mina rail alignment. The section identifies the types of hazardous materials DOE would use and the hazardous, nonhazardous, and low-level radioactive wastes that would be generated during the construction and operations phases. The applicable guidelines, regulations, and available methods for treatment or ***disposal*** are identified for each waste. DOE evaluated the potential impacts of hazardous materials, hazardous wastes, nonhazardous wastes, and low-level radioactive wastes based on this information.

Section 4.3.12.1 describes the methodology DOE used to assess potential impacts; Section 4.3.12.2 describes potential construction impacts; Section 4.3.12.3 describes potential operations impacts; Section 4.3.12.4 describes potential impacts under the Shared-Use Option; and Section 4.3.12.5 summarizes potential impacts related to the use of hazardous materials and the generation of wastes.

DOE could purchase hazardous materials necessary for railroad construction and operations, such as engine coolant and solvents, through the federal supply chain or through local vendors. The Department anticipates local distributors in Nevada would supply propane and natural gas. The required hazardous materials would consist primarily of products consumers could purchase at most hardware, building-supply, or home-improvement stores. Therefore, DOE does not expect the supply of such products to be limited. As a consequence of using hazardous materials, associated hazardous wastes would be generated.

Section 3.3.12.1 describes the region of influence for hazardous materials and wastes.

4.3.12.1 Impact Assessment Methodology

DOE developed a list of anticipated types of hazardous materials and wastes to evaluate potential impacts from the use of hazardous materials or generation of wastes (see Table 4-288). To avoid or limit adverse impacts, DOE emphasizes adhering to applicable laws, regulations, policies, standards, and directives. The ***storage*** and disposal of hazardous and nonhazardous wastes is largely governed by the Resource Conservation and Recovery Act of 1976 (42 U.S.C. 6901 *et seq.*) and State of Nevada waste regulations (see Chapter 6, Statutory, Regulatory, and Other Applicable Requirements).

4.3.12.2 Construction Impacts

This section summarizes the types of hazardous materials DOE would use and the wastes that would be generated during construction of the proposed railroad. DOE would handle all wastes in accordance with applicable federal, state, and local environmental, occupational safety, and public health and safety requirements to minimize the possibility of adverse impacts to plants, animals, soils, and water resources inside or outside the region of influence. Because DOE would manage the use of hazardous materials and the disposal of wastes in accordance with applicable regulations and would implement best management practices (see Chapter 7), adverse impacts to environmental resources would be small.

4.3.12.2.1 Nonhazardous Waste

A total of approximately 2,300 metric tons (2,500 tons) per year of ***solid waste*** (such as general trash from kitchens and dormitories) would be generated during the construction phase, for a daily rate of

Table 4-288. General considerations for assessing potential impacts from the use of hazardous materials and the generation of hazardous and nonhazardous wastes.

Material	Basis for assessing adverse impacts
Hazardous materials	Determine if the use of hazardous materials would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous materials resulting from not adhering to storage and use standards set in applicable guidelines and regulations.
Hazardous waste	Determine if the quantity of hazardous wastes generated would adversely affect the capacity of hazardous-waste collection and disposal services.
Nonhazardous waste	Determine if the volume of solid and industrial and special wastes generated would adversely affect the capacity of solid-waste collection service and landfills.
Low-level radioactive waste	Determine if the quantity of low-level radioactive wastes generated would adversely affect the capacity of available disposal facilities.

approximately 6.3 metric tons (6.9 tons). Most of the solid waste would be generated at construction camps. DOE would dispose of all solid waste in permitted landfills. Table 4-289 summarizes the solid waste generation rate during the construction phase.

Construction activities would generate approximately 12,000 metric tons (13,100 tons) of ***industrial and special wastes*** (such as construction debris, used tires, and other materials with specific management requirements) per year, for an approximate daily rate of 33 metric tons (36 tons) (DIRS 180875-Nevada Rail Partners 2007, p. 6-3). (This estimate includes rail, ballast, and rail tie materials from the dismantling of the Department of Defense Branchline through Schurz, which would either be reused for the new rail line or recycled.) DOE would minimize the amount of these wastes as much as possible by ordering construction materials in correct sizes and amounts, reusing leftover materials, and recycling appropriate types of materials (DIRS 152540-Hoganson 2000, all).

Almost 1.8 million metric tons (2 million tons) of industrial and special wastes were disposed of in Nevada in 2002, which was 90 percent of the total solid waste (all categories) generated state-wide (DIRS 174663-State of Nevada 2005, slide 8). Nevada has 23 operating municipal landfills that combined accept more than 12,700 metric tons (14,000 tons) of waste per day (DIRS 174663-State of Nevada 2005, slide 5; DIRS 181625-Simpson 2007, all). However, most of this capacity is available through the Apex Landfill, which serves the Las Vegas Valley, and receives an average of 8,000 metric tons (8,800 tons) per day (DIRS 174041-State of Nevada 2004, pp. 6 and 7). Some of the landfills in Mineral, Esmeralda, and Nye Counties are quite small by comparison, and receive less than 2.7 metric tons (3 tons) of waste per day (DIRS 174041-State of Nevada 2004, p. 6).

It is likely that while some of the larger landfills would not see an appreciable change in the amount of waste received if they were utilized, some of the smaller landfills might see a substantial, although manageable, change in daily receipt of solid and industrial and special wastes if utilized during the construction phase.

As shown in Table 3-154, landfills in Mineral, Nye, Esmeralda, and Clark Counties accept more than 8,100 metric tons (9,000 tons) of waste per day combined. The addition of about 6.3 metric tons (6.9 tons) per day of solid waste anticipated during the construction phase (see Table 4-289) would raise the total amount disposed of in the four-county area by approximately 0.077 percent. DOE anticipates that about 33 metric tons (36 tons) per day of industrial and special wastes would need to be disposed of due to construction activities, which would result in an increase of approximately 0.41 percent in waste receipt to local landfills (DIRS 180875-Nevada Rail Partners 2007, p. 6-3). Therefore, impacts to local

Table 4-289. Solid waste generation during the construction phase – Mina rail alignment.

	Number of personnel (maximum)	Solid-waste generation (kilograms per day per person)[a,b]	Total solid waste (metric tons per day)[c,d]	Total solid waste (metric tons per year)[d]
Workforce	2,160[e]	2.9	6.3	2,300

a. Source: DIRS 174041-State of Nevada 2004, p. 13.
b. To convert kilograms to pounds, multiply by 2.2046.
c. To convert metric tons to tons, multiply by 1.1023.
d. Numbers are not exact due to rounding.
e. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D.

landfills from the disposal of solid and industrial and special wastes would be small (for the relatively large Apex Landfill) to moderate (for the smaller landfills).

The geotechnical exploration program would include drilling approximately 2,100 boreholes at depths of 15 to 60 meters (50 to 200 feet). These borings would generate more than 1,000 cubic meters (1,300 cubic yards) of drill cuttings (DIRS 181867-Holder 2007, all). DOE would not dispose of these drill cuttings in landfills, but would dispose of them through land application, which would involve spreading the drill cuttings on the land surface. All drilling fluids would meet the requirements for standard land disposal. Therefore, there would be no impacts to waste treatment or disposal facilities as a result of the generation of drill cuttings.

Construction activities would include dismantling the existing Department of Defense Branchline through Schurz, which would involve the removal of 44 kilometers (27 miles) of rail, ballast, and rail ties (DIRS 180875-Nevada Rail Partners 2007, p. 2-3). Culverts, bridges, and the roadbed would be left in place. The rail, ballast, and rail tie materials from the Department of Defense Branchline through Schurz would either be reused for the proposed new rail line or recycled to the extent practicable.

Construction activities would include some clearing of land. Wastes generated from this activity, including soil and plant material, would be used to construct fill slopes and contours within the rail line construction right-of-way; therefore, no waste would need to be disposed of and there would be no impacts to local waste disposal facilities from clearing of land (DIRS 180875-Nevada Rail Partners 2007, p. 6-1).

Earthwork fill requirements for rail line construction would be expected to outweigh cut requirements (DIRS 180872-Nevada Rail Partners 2007, Appendix D). In the event that more cut material was generated than would be needed as fill, DOE would use the excess to strengthen access roads and rail embankments. Therefore, no excess cut material would need to be disposed of and there would be no impacts to disposal facilities from the generation of excess cut material.

4.3.12.2.2 Hazardous-Materials Use and Hazardous-Waste Generation

DOE would store and use hazardous materials such as oil, gasoline, diesel fuel, and solvents during the construction phase primarily for the operation and maintenance of equipment and cleaning of equipment and facilities. The Department would implement an Environmental Management System and a Pollution Prevention/Waste Minimization Program during the construction and operations phases, which would include an evaluation of alternatives to eliminate, reduce, or minimize the amounts of hazardous materials used and hazardous wastes generated. As part of the Environmental Management System, DOE would regularly perform assessments to identify opportunities to reduce the generation of waste (DIRS 182385-Burns 2007, all). The Department would formulate and implement Spill Prevention Control and Countermeasures plans, including the use of secondary containment, to prevent releases of hazardous materials, such as diesel fuel, to the environment.

Table 4-290 lists the anticipated hazardous materials and the waste types that could be generated. The Department expects some materials (such as diesel fuel, lubricants, and hydrocarbons) would be used at each of the construction support facilities. However, most materials used and wastes generated would be specific to certain activities and facilities.

Hazardous wastes, such as used lubricants and solvents, would be accumulated, shipped, and disposed of in accordance with Resource Conservation and Recovery Act regulations. Hazardous wastes would be shipped in accordance with 49 CFR Parts 171 and 172 and U.S. Department of Transportation Hazardous Materials 215D regulations. The disposal capacity for hazardous wastes in western states has been estimated at 50 times the demand for landfills and 7 times the demand for incineration until at least 2013 (DIRS 103245-EPA 1996, pp. 32, 33, 36, 46, 47, and 50); thus, there would be ample capacity available to dispose of any hazardous wastes. Through compliance with applicable state and federal regulations, adverse impacts from the use of hazardous materials, generation of hazardous waste, and the disposal of hazardous waste would be small.

DOE could use explosives during quarry, access-road, and rail line construction, and would develop a safety program specifically for the storage, transportation, and handling of these materials. The Department would adhere to the requirements of DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees* (as described in Chapter 6), which specifies that explosives operations must comply with the DOE Explosives Safety Manual (DOE M 440.1-1A). The manual provides guidance on the storage and transportation of explosives and refers to Occupational Safety and Health Administration safety requirements for routine construction and tunnel-blasting operations.

There could be impacts if hazardous materials, such as fuels, lubricants, and antifreeze, were released and spread. DOE would store such materials at construction camps, and supply trucks would routinely bring new materials and remove used lubricants and coolants from the construction sites. These activities could result in local spills and releases of contaminants. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (see Chapter 6).

4.3.12.2.3 Low-Level Radioactive Waste

No low-level radioactive waste would be generated during the construction phase.

4.3.12.3 Operations Impacts

DOE would purchase hazardous and nonhazardous products and materials during the operations phase. The use of hazardous materials and products would lead to the generation of hazardous wastes. Table 4-290 lists the anticipated hazardous materials and the waste types that could be generated during the railroad operations phase.

4.3.12.3.1 Nonhazardous Waste

Railroad operations would generate solid wastes, which DOE would dispose of at facilities along the rail line. Amounts of such wastes would be very small and would not impact disposal capacity in Clark, Esmeralda, Nye, and Mineral Counties.

Amounts of industrial and special wastes generated during maintenance of fixed equipment such as signals and rail crossings would be very small (DIRS 155560-Hoganson 2001, all). Crossties, ballast, rails, and bridges would not be likely to require replacement before 2033 (DIRS 152540-Hoganson 2000, all). However, when these materials do require maintenance or replacement, they would be reused wherever possible or recycled if reuse was not an option. Therefore, no impacts to local landfills would be anticipated from the disposal of industrial and special wastes during the operations phase.

Table 4-290. Summary of anticipated types of hazardous materials that would be used and wastes that would be generated during railroad construction and operations – Mina rail alignment.[a,b]

	Railroad construction	Construction camps	Concrete batch plants	Asphalt plants	Railroad operations[c]
Materials					
Fuel	X	X	X	X	X
Lubricants	X	X	X	X	X
Hydrocarbons (oils, greases)	X	X	X	X	X
Solvents	X	X		X	X
Compressed gas (flammable and nonflammable)	X	X	X	-	X
Batteries (such as lead, acid, nickel-cadmium)	X	X	X	-	X
Battery acid	X	X	-	-	X
Reactive (magnesium welding/fusing)	X	X	-	-	X
Explosives	X	X	-	-	-
Flammables (such as paints, coatings)	X	X	X	X	X
Herbicides/pesticides	X	X	-	-	X
Cleaning supplies (such as bleach ammonia)	X	X	X	-	X
Lithium lubricants	X	-	-	-	X
Wastes					
Refuse	X	X	X	X	X
Industrial/construction waste	X	X	X	-	X
Hazardous waste	X	X	-	X	X
Recyclable/biodegradable	X	X	-	X	X
Universal waste (such as fluorescent lighting)	X	X	X	X	X
Tires	X	X	X	X	X
Asphalt	X	-	-	X	-
Antifreeze	X	X	X	X	X
Hydrocarbon-contaminated soils	X	X	X	X	X
Sewage	X	X	X	X	X
Gray water	-	X	-	-	X
Low-level radioactive waste	-	-	-	-	X

a. Source: DIRS 176750-Bishop 2006, all.
b. An X indicates that the listed material would be used or the listed waste would be generated during that specific activity or at that specific facility; a dash indicates that the listed material would not be used or the listed waste would not be generated during that specific activity or at that specific facility.
c. Includes only the proposed railroad activities; does not include DOE facilities at the Yucca Mountain Repository.

The anticipated quantity of solid waste generated at all railroad operations support facilities is 170 metric tons (190 tons) per year or 0.45 metric ton (0.5 ton) per day (Table 4-291). DOE would transport solid waste to permitted solid-waste landfills. As shown in Table 3-154, landfills in Mineral, Nye, Esmeralda, and Clark Counties accept more than 8,100 metric tons (9,000 tons) of waste per day combined. The addition of about 0.45 metric ton (0.5 ton) of solid waste anticipated during the operations phase (Table 4-291) would raise the total amount disposed of in the four-county area by less than 0.01 percent. Nevada has enough landfill capacity to accommodate this additional solid waste; therefore impacts to landfill capacities would be small.

Table 4-291. Solid waste generation at proposed railroad operations support facilities – Mina rail alignment.

Facility	Number of personnel (maximum)	Solid waste generation (kilograms[a] per day per person)[b]	Total solid waste (metric tons per day)[c]	Total solid waste(metric tons per year)
Cask Maintenance Facility	30[d]	2.9	0.09	33
Staging Yard at Hawthorne	40[d,e]	2.9	0.12	44
Rail Equipment Maintenance Yard (including the Nevada Railroad Control Center and the National Transportation Operations Center)[f]	40[d,e]	2.9	0.12	44
Maintenance-of-Way Facility	40[e]	2.9	0.12	44
Totals[g]	150		0.45	170

a. To convert kilograms to pounds, multiply by 2.2046.
b. Source: Per person solid waste generation rate is from DIRS 174041-State of Nevada 2004, p. 13.
c. To convert metric tons to tons, multiply by 1.1023.
d. Includes four rail-crew members.
e. Source: DIRS 180874-Nevada Rail Partners 2007, Appendix D.
f. The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard at Hawthorne and the National Transportation Operations Center could be anywhere in the continental United States; for purposes of analysis, DOE assumed these centers would be at the Rail Equipment Maintenance Yard.
g. Totals might not equal sums of values due to rounding.

4.3.12.3.2 Hazardous-Materials Use and Hazardous-Waste Generation

Maintenance of rolling and stationary railroad equipment and track would generate some hazardous wastes, including: lubricants from equipment and machinery, solvents, paint, and other hazardous materials typical of railroad operations.

The Staging Yard at Hawthorne, including the collocated Interchange Yard, would use limited quantities of hazardous materials, such as oils, solvents, and lubricants, and associated wastes would be generated. An off-site contractor would perform diesel fueling at the Staging Yard using a tank truck to service the yard switcher locomotive. DOE would also store propane and natural gas at the Staging Yard in tanks (DIRS 180873-Nevada Rail Partners 2007, pp. 3-1 and 3-2).

The Maintenance-of-Way Facility would include maintenance work areas, office space, and a material-storage area. Limited quantities of hazardous materials such as lubricants, solvents, and possibly pesticides (for example, herbicides and rodenticides), would be stored and used there, and associated wastes would be generated. DOE would also store propane or natural gas onsite in tanks (DIRS 180873-Nevada Rail Partners 2007, pp. 4-1, 4-4, and 4-7).

DOE would store and use hazardous materials, including diesel fuel, gasoline, propane, oils, paints, and solvents, at the Cask Maintenance Facility and associated hazardous wastes (such as oily rags and solvent wastes) would be generated (DIRS 174083-WPI 2003, pp. 30, 39, and 52). Compressed flammable gas and oxygen would also be stored at the Cask Maintenance Facility.

The Nevada Railroad Control Center could be at either the Rail Equipment Maintenance Yard or the Staging Yard and the National Transportation Operations Center could be anywhere in the continental United States, although for purposes of analysis, DOE assumed these Centers would be at the Rail Equipment Maintenance Yard. The Centers would consist primarily of office space (DIRS 180873-Nevada Rail Partners 2007, p. 5-1). DOE would store general cleaning supplies at these facilities.

There would be a diesel fuel storage tank with a 190,000-liter (50,000-gallon) capacity (a 1-month reserve) and a diesel fueling depot at the Rail Equipment Maintenance Yard (DIRS 181033-Hamilton-Ray 2007, all). There would also be a staging area where fuel oil and construction materials could be delivered to the repository. DOE would store and use hazardous materials, including lubricating oil, diesel fuel, natural gas or propane, and solvents, at the Rail Equipment Maintenance Yard and associated hazardous wastes would be generated (DIRS 180873-Nevada Rail Partners 2007, p. 5-1). Locomotive maintenance activities would generate approximately 420 liters (110 gallons) of used oil for each locomotive maintained (DIRS 155970-DOE 2002, p. 6-89). During peak operations, a maximum of 442 locomotives would travel on the rail line each year (DIRS 175036-BSC 2005, Table 4.2), which would generate approximately 190,000 liters (50,000 gallons) per year of used oil from locomotive maintenance. The used oil would be reclaimed rather than disposed of (DIRS 155970-DOE 2002, p. 6-89).

There could be small spills of hazardous materials such as oils and fuel along the rail line during the operations phase. DOE would immediately remediate any areas affected by such spills in accordance with applicable regulations (See Chapter 6).

DOE would manage the use of hazardous materials and would follow all federal, state, and local regulations, and would transport hazardous wastes to appropriately permitted disposal facilities that have ample capacities to receive such wastes, as discussed in Section 4.3.12.2.2. Therefore, impacts from the use of hazardous materials and the disposal of hazardous waste during the operations phase would be small.

4.3.12.3.3 Low-Level Radioactive Waste

Activities at the Cask Maintenance Facility would generate from 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) of Class A low-level radioactive waste throughout the operations phase (DIRS 181425-MTS 2007, p. 6). The Department would control and dispose of site-generated low-level radioactive waste in a DOE low-level waste disposal site, a site in an ***Agreement State***, or in a U.S. Nuclear Regulatory Commission-licensed site.

The Nevada Test Site accepts low-level radioactive waste for disposal and has an estimated disposal capacity of 3.7 million cubic meters (130 million cubic feet). DOE has estimated that approximately 1.1 million cubic meters (39 million cubic feet) of low-level radioactive wastes will be disposed of at the Nevada Test Site by 2070 from all potential sources, but not including Cask Maintenance Facility-generated wastes (DIRS 155970-DOE 2002, Section 3.1.12.4). Commercial disposal capacity for low-level radioactive wastes is currently available in the United States.

Relatively small amounts of low-level radioactive wastes would be generated and the aforementioned potential disposal options would have ample capacities to accept these wastes; therefore, impacts to low-level radioactive waste disposal facilities would be small.

4.3.12.4 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be similar to those described for the Proposed Action without shared use. The only difference would be the construction and operation of additional sidings and a slight increase in overall rail traffic. Waste characteristics, generation rates, and disposal requirements would vary only slightly. Therefore, any additional adverse impacts associated with the Shared-Use Option would be small.

4.3.12.5 Summary

Table 4-292 summarizes potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad along the Mina rail alignment. Chapter 7 describes mitigation measures DOE could employ to reduce impacts.

Impacts from nonhazardous waste (solid and industrial and special waste) disposal listed in Table 4-292 represent the degree to which potentially affected landfills could be affected by increased waste receipt rates as a result of railroad construction and operation along the Mina rail alignment. Construction of the proposed railroad along the Mina rail alignment would raise the disposal rate of nonhazardous waste to landfills in the region of influence by about 0.49 percent. Overall, impacts during the construction phase would be small, for the relatively large Apex Landfill, to moderate for smaller landfills. During the operations phase, impacts to landfills would be small.

Impacts from the use of hazardous materials listed in Table 4-292 represent the likelihood that railroad construction and operation along the Mina rail alignment would create reasonably foreseeable conditions that would significantly increase the risk of a release of hazardous material. Overall, impacts during the construction and operations phases would be small, considering that DOE would implement proper planning measures in relation to the storage and handling of hazardous materials and would adhere to all applicable regulations.

Impacts from hazardous-waste disposal listed in Table 4-292 represent the degree to which potentially affected hazardous-waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operation along the Mina rail alignment. Overall, impacts during the construction and operations phases would be small because adequate disposal capacity would be available.

Impacts from the disposal of low-level radioactive waste disposal listed in Table 4-292 represent the degree to which potentially affected low-level radioactive waste disposal facilities could be affected by increased waste receipt rates as a result of railroad construction and operation along the Mina rail alignment. No low-level radioactive waste would be generated during the construction phase. During the operations phase, low-level radioactive wastes would be generated during cask maintenance activities at the Cask Maintenance Facility. Impacts to low-level radioactive waste disposal facilities during the operations phase would be small because adequate disposal capacity would be available.

Table 4-292. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Mina rail alignment (page 1 of 2).[a]

Rail line segment/facilities(county)	Construction impacts	Operations impacts
Common to all alternative segments and common segments (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste dispos	Small impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.

Table 4-292. Summary of potential impacts related to the use of hazardous materials and the generation of waste from constructing and operating the proposed railroad – Mina rail alignment (page 2 of 2).[a]

Staging Yard at Hawthorne (Mineral County)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste dispos	Small impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.
Maintenance-of-Way Facility; Rail Equipment Maintenance Yard; Cask Maintenance Facility; and Nevada Railroad Control Center and National Transportation Operations Center at the Rail Equipment Maintenance Yard (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	Small impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal. Small impacts from low-level radioactive waste disposal for wastes that would be generated at the Cask Maintenance Facility.
Construction camps (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. There would be no construction camps during railroad operations.
Access roads (including alignment access roads) (Mineral, Nye, and Esmeralda Counties)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. Use of access roads during railroad operations would not involve the use of hazardous materials or the generation of wastes.
Quarries (common to all potential quarry locations)	Small (Apex Landfill) to moderate (smaller landfills) impacts from nonhazardous waste (solid and industrial and special waste) disposal. Small impacts from use of hazardous materials. Small impacts from hazardous-waste disposal.	No impact. DOE would not operate quarries after the end of the construction phase.

a. Impacts under the Shared-Use Option would be similar to those under the Proposed Action without shared use.

4.3.13 CULTURAL RESOURCES

This section describes potential impacts to cultural resources from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.13.1 describes the methods DOE used to assess potential impacts; Section 4.3.13.2 describes potential construction and operations impacts; Section 4.3.13.3 describes potential impacts under the Shared-Use Option; and Section 4.3.13.4 summarizes potential impacts to cultural resources. This section also incorporates American Indian perspectives to assess the potential direct and indirect impacts to important American Indian prehistoric and historic resources.

Section 3.3.13.1 describes the region of influence for cultural resources. Unless specified otherwise, this section describes impacts within 3.2-kilometer (2-mile)-wide area centered on the rail alignment.

4.3.13.1 Impact Assessment Methodology

Because of the length of the proposed rail line along the Mina rail alignment, DOE is using a phased cultural resource identification and evaluation approach, as described in 36 CFR 800.4(b) 2, to identify specific cultural resources along the alignment. Under this approach, DOE would defer final field surveys (an intensive BLM ***Class III inventory***) of the actual construction right-of-way, as provided in the programmatic agreement between DOE, the BLM, the STB, and the Nevada State Historic Preservation Office (see Appendix M).

> A **Class II inventory** is a sample-oriented field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area to make possible an objective estimate of the nature and distribution of cultural resources in the entire defined area.
>
> A **Class III inventory** is an intensive field survey designed to locate and record all cultural resource sites within a specified area. Upon completion of such an inventory, no further cultural resource inventory work is normally needed in the area.

The programmatic agreement states that an appropriate level of field investigation – including on-the-ground intensive surveys; evaluations of all recorded resources listed on the *National Register of Historic Places*; assessments of adverse effects; and applicable mitigation of identified impacts – be completed before any ground-disturbing construction activities could begin. This programmatic agreement also stipulates that there be proper tribal consultation activities, and treatment (mitigation) guidelines and measures designed to cover unanticipated discoveries and impacts during the construction and operations phases. The BLM administers most of the potentially affected land along the Mina rail alignment. Relevant provisions of another programmatic agreement between the BLM, the State of Nevada, and the Nevada State Historic Preservation Office (DIRS 174690-Abbey & Baldrica 2005, all) would apply, along with cultural resources procedures outlined in the BLM *Cultural Resource Inventory Guidelines* (DIRS 174691-BLM 1990, all).

The region of influence for the Class III inventory would include all potential direct and indirect effects to cultural resources and all properties of traditional religious and cultural importance from any construction activities associated with the proposed railroad. Before beginning any ground-disturbing activities, DOE would conduct a Class III inventory for the following specific region of influence for project activities (DIRS 176912-Wenker et al. 2006, p. 2):

> The APE [Area of Potential Effect, referred to in this Rail Alignment EIS as the region of influence] for the rail line will be 200 feet [61 meters] from the centerline of the alignment or the actual ROW [right-of-way] application submitted to BLM, whichever is greater. The APE for access roads outside of the alignment will be a minimum of 100 feet [30.5 meters] wide with at

least 50 feet [15 meters] on either side of centerline. The minimum APE for any construction areas or other temporary use areas, outside of the alignment, will be the footprint of the area plus 100 feet outward in all directions from the perimeter of each area. The APE for assessing indirect effects on historic properties outside of the rail line alignment will extend at least one mile in all directions from the perimeter of the direct effects APE.

Cultural resource requirements for the portion of Mina rail alignment within the Yucca Mountain Site boundary and at the Rail Equipment Maintenance Yard would be covered by a separate programmatic agreement prepared to address development of a geologic repository at Yucca Mountain, Nevada, underway between the DOE Office of Civilian Radioactive Waste Management, the Advisory Council on Historic Preservation, and the Nevada State Historic Preservation Office.

The present evaluation of impacts depends on a comprehensive review of existing literature and site-file databases, sample archaeological inventory, and discussions with responsible federal agencies, State of Nevada agencies, and American Indian groups, which have identified many known and potential archaeological, historical, and American Indian sites and features along the Mina rail alignment. Section 3.3.13.3 provides pertinent baseline information. DOE acquired additional information for potential cultural resources during ***Class II*** (sample-oriented) field surveys of the Mina rail alignment. American Indian viewpoints for potential impacts to sites and resources important to regional tribes and organizations in the southern portion of the Mina rail alignment are expressed in *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project* (the American Indian Resource Document) (DIRS 174205-Kane et al. 2005, all). However, the American Indian Writers Subgroup prepared that document to address the Caliente rail alignment; therefore, it does not necessarily fully capture the views of the Walker River Paiute Tribe and other Northern Paiute groups.

4.3.13.2 Railroad Construction and Operations Impacts

Nearly all potential direct physical impacts to cultural resources, including those that would physically damage, alter, or disturb a historic property, would occur during the construction phase, specifically within the designated rail construction right-of-way. There could be additional construction-related ground disturbances at quarry sites, road crossings, temporary access roads, borrow sites, ***spoils areas*** or piles, and temporary construction camps. Each camp would have a construction footprint of about 0.1 square kilometer (25 acres). There would be other ground disturbances at the locations of the railroad operations support facilities, including the Staging Yard at Hawthorne (0.2 square kilometer [50 acres]); the Maintenance-of-Way Facility (0.06 square kilometer [15 acres]), which would be near Goldfield; the Rail Equipment Maintenance Yard (about 0.41 square kilometer [101 acres]), which would be within the Yucca Mountain Site boundary; and the Cask Maintenance Facility, which would be collocated with the Rail Equipment Maintenance Yard.

There could be various forms of indirect impacts during both the construction and operations phases, such as visual intrusions or increased access and visitation. During construction, large numbers of workers in the vicinity of the construction camps could increase the potential for both intentional and unintentional impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that, based on previous archaeological surveys, were either thought to occur only at the surface or were previously undetected because they were completely buried. Improved access to remote areas could also increase the likelihood of looting or other damage to archaeological properties during the construction and operations phases.

Another indirect impact that would be unavoidable from construction in remote areas would be visual intrusion effects to a variety of resources designated as potential cultural resource landscapes. These resources include potential ***ethnographic landscapes***, rural historic landscapes, and historic mining landscapes, and incorporate geographic areas, including both cultural and natural resources associated with historic events or activities. In some instances, the literature reviews, known-site file searches, and the Class II inventory conducted for this Rail Alignment EIS have identified potential areas of specific impacts for some of the alternative segments and common segments. In addition, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) provides other relevant information.

4.3.13.2.1 Construction Impacts along Mina Rail Alignment Alternative Segments and Common Segments

The following sections outline both the direct and indirect construction-related impacts within each of the Mina rail alignment alternative segments and common segments. Each section begins with a discussion of the direct impacts to cultural resources, which is followed by a discussion of the indirect impacts. These sites include those listed on the *National Register of Historic Places*, those eligible for listing on the National Register, and those known to have cultural significance but are not listed on the National Register.

4.3.13.2.1.1 Union Pacific Railroad Hazen Branchline. The Class I site-file search identified 21 previously recorded cultural resources within the Level I region of influence of the existing Union Pacific Railroad Hazen Branchline. These resources include seven prehistoric sites, 10 historic sites, one site with both prehistoric and historic components, and three unknown site types. Six of the cultural properties are considered eligible or probably eligible for the National Register of Historic Places, including several that are part of the National Register-listed Lahontan Dam historic district (DIRS 182290-Desert Research Institute 2007, all). Eligible or potentially eligible resources include a large prehistoric residential base camp, a portion of the Overland Stage Road, the Newlands Waterworks at Lahontan City, a Lahontan City construction townsite and railroad station, a railroad ***berm*** and debris scatter, and a multi-component site with eligible historic elements including a telephone line and debris scatter. In addition, the existing rail line passes through Fort Churchill State Historic Park, site of an important 1860-1869 U.S. Army post. No direct or indirect impacts to these resources are anticipated due to the lack of planned construction activities.

The presence of 21 archaeological sites indicates a known site frequency of 0.5 site per mile within the Level I region of influence for this segment.

4.3.13.2.1.2 Department of Defense Branchline North. The Class I site-file search did not identify any cultural resources recorded within the Level I region of influence. No Class II survey has been conducted. No direct or indirect impacts to these resources are anticipated due to the lack of planned construction activities.

Previous archaeological studies do not indicate the presence of any archaeological sites within the Level I region of influence for this segment.

4.3.13.2.1.3 Schurz Alternative Segments. The Class I site-file search revealed that five cultural resources are recorded along Schurz alternative segment 1, including two within the Level I region of influence and three within the Level II region of influence. Previously recorded sites include one prehistoric site, three historic sites, and one multi-component prehistoric and historic site. None of the five resources has been evaluated for eligibility to the *National Register of Historic Places*.

DOE surveyed 15 sample units during the Class II effort, totaling 12 kilometers (7.5 miles) or 23 percent of the segment. Eight resources were recorded, including five prehistoric sites, all characterized by ***lithic scatters***, and three historic sites, including two railroads and one trash deposit. One prehistoric lithic scatter and one historic railroad are potentially eligible for listing on the *National Register of Historic Places*. The other six resources appear ineligible for listing. Construction activities along this segment could result in direct and indirect impacts to these eligible or potentially eligible prehistoric and historic resources. Sample inventory indicates that approximately 34 resources could be present within the Level I region of influence.

The Class I site-file search revealed that one historic cultural resource, the Rawhide Western Railroad grade, has been recorded along Schurz alternative segment 4, within the Level I region of influence. National Register-eligibility of this resource has not been determined. Construction activities along this segment could result in direct and indirect impacts to this grade.

DOE surveyed four sample units during the Class II effort along Schurz alternative segment 4, totaling 3.2 kilometers (2 miles) or 5 percent of the segment. Eight prehistoric resources were recorded, including lithic and groundstone scatters, and a quarry. Three of the sites are considered potentially eligible for listing on the *National Register of Historic Places*, two are considered not eligible, and three of the sites have not been evaluated. Construction activities along this segment could result in direct and indirect impacts to these eligible or potentially eligible prehistoric and historic resources. Sample inventory indicates that approximately 160 resources could be present within the Level I region of influence.

The Class I site-file search revealed that four cultural resources are recorded along Schurz alternative segment 5, including two within the Level I region of influence and two within the Level II region of influence. These include three historic sites and one multi-component prehistoric and historic site. The multi-component site, Double Spring, is considered eligible for listing on the *National Register of Historic Places* and is in the Level II region of influence; the historic sites have not been evaluated.

DOE surveyed 10 sample units during the Class II effort along Schurz alternative segment 5, totaling 8 kilometers (5 miles) or 11 percent of the segment. Four resources were recorded, including three prehistoric lithic scatters, all unevaluated for eligibility, and one historic site, a trash deposit that is recommended not eligible for listing on the *National Register of Historic Places*. Construction activities along this segment could result in direct and indirect impacts to these eligible or potentially eligible prehistoric and historic resources. The National Register-eligible Double Spring, located outside of the Level I region of influence, would not be directly impacted. Sample inventory indicates that approximately 35 resources could be present within the Level I region of influence.

The Class I site-file search revealed that nine cultural resources are recorded along Schurz alternative segment 6, including five within the Level I region of influence and four within the Level II region of influence. Of these nine, seven are prehistoric or have a prehistoric component, and two are historic resources. Prehistoric resources include one isolate, two lithic scatters, one rock alignment with possible burials, one ***petroglyph*** site, and one site considered eligible for listing on the *National Register of Historic Places* that has a medicine rock, cairns, hunting blinds, and petroglyphs. The isolate and one of the lithic scatters are considered not eligible; eligibility status of the remaining prehistoric sites has not been determined. The sites within the Level I region of influence include a lithic scatter, the isolate, and the rock alignment. The two historic sites that would fall along Schurz alternative segment 6 are found within the Level I region of influence and include the Rawhide Western Railroad grade and the Reese River Road stage route. Eligibility status of these resources has not been determined.

DOE surveyed two sample units during the Class II effort, totaling 1.6 kilometers (1 mile) or 2 percent of the segment. One resource, a prehistoric lithic scatter, was recorded. This site has not been evaluated for listing on the *National Register of Historic Places*. Construction activities along this segment could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources. Sample inventory indicates that approximately 45 resources could be present within the Level I region of influence.

4.3.13.2.1.4 Department of Defense Branchline South. The Class I site-file search revealed that three cultural resources are recorded within 152 meters (500 feet) of the existing rail line, including an historic pier piling, the historic Nolan Station rail siding, and a boulder containing cupule-style rock art (DIRS 182290-Desert Research Institute 2007, all). The historic pier piling is considered not eligible, and the other two sites have not been evaluated for eligibility. No direct or indirect impacts to these resources are anticipated due to the lack of planned construction activities.

4.3.13.2.1.5 Mina Common Segment 1 (Soda Spring Valley Area). The Class I site-file search revealed that 56 cultural resources are recorded along Mina common segment 1, including 18 within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include two prehistoric lithic scatters (one site is considered not eligible, one site has not been evaluated), 14 historic sites (five sites are considered eligible, two sites are considered not eligible, and seven sites have not been evaluated), and two multi-component sites (one site is not eligible, one site has not been evaluated). Types of eligible resources falling within the Level I region of influence include the Sodaville to Tonopah Freight Road, railroad workers' camps, and a railroad grade. Within the Level II region of influence, there are 24 prehistoric sites (15 sites are considered not eligible, and nine have not been evaluated), and 14 historic sites (four are considered eligible, six are considered not eligible, and four have not been evaluated). The prehistoric sites consist of a rockshelter, lithic scatters, and isolates. Most of the historic sites are associated with railroad construction and operation, including camps, stations, and grades. Mining sites and the townsites of Redlich and Mina also fall within the region of influence of Mina common segment 1.

DOE surveyed 29 sample units during the Class II effort, totaling 23 kilometers (15 miles) or 20 percent of the segment. A total of 19 resources were recorded, including 14 prehistoric sites (13 lithic scatters and one quarry), three historic trash deposits, and two historic railroads. One historic railroad and the prehistoric quarry site are both considered eligible for listing on the *National Register of Historic Places*. Seven of the prehistoric lithic scatters are considered not eligible, and six have not been evaluated for eligibility. The three historic trash deposits and the additional historic railroad are considered not eligible. Given the high density of resources along this segment, construction activities could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 94 resources could be present within the Level I region of influence.

4.3.13.2.1.6 Montezuma Alternative Segments.

<u>Montezuma Alternative Segment 1</u> The Class I site-file search revealed that 43 cultural resources are recorded along Montezuma alternative segment 1, including five within the Level I region of influence and 38 within the Level II region of influence. Within the Level I region of influence, two prehistoric sites, including a quarry site of unknown eligibility status and a small lithic scatter that is considered not eligible, and three historic sites (two sites, a railroad grade and telephone line, are considered eligible and one site, a trash dump, has not been evaluated) are present.

Within the Level II region of influence, previously recorded resources include 27 prehistoric sites (one site is considered eligible, 17 sites are considered not eligible, and nine have not been evaluated), 10 historic sites (three are considered eligible, four are considered not eligible, and three have not been evaluated), and one multi-component site that is considered not eligible. The majority of the prehistoric sites consist of lithic scatters and isolates, though cave and quarry sites are also present; historic sites include railroad grades, a dump, a wagon road, mining sites, and the townsite of Blair.

DOE surveyed 25 sample units during the Class II effort, totaling 20 kilometers (13 miles) or 17 percent of the segment. Twenty resources were recorded, including 17 prehistoric lithic scatters, two historic trash deposits, and one historic mining site. One lithic scatter is considered eligible for listing on the

National Register of Historic Places; three scatters are considered not eligible, and the remaining 13 prehistoric sites have not been evaluated for eligibility. Of the historic sites, one trash deposit and the mining site are considered not eligible; the other trash deposit has not been evaluated. Construction activities along this segment could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 117 resources could be present within the Level I region of influence.

Montezuma Alternative Segment 2 The Class I site-file search revealed that 226 cultural resources are recorded along Montezuma alternative segment 2, including 39 within the Level I region of influence and 187 within the Level II region of influence. Within the Level I region of influence, previously recorded resources include 11 prehistoric sites (10 are considered not eligible, one has not been evaluated), 17 historic sites (one site, the townsite of Goldfield, is listed on the *National Register of Historic Places*, nine sites are considered eligible, and seven are considered not eligible), and 11 multi-component sites (one site is considered eligible, nine are considered not eligible, and one has not been evaluated). Eligible site types include railroad grades, Millers townsite, a mining camp and miner's cabin, the Goldfield Junction Station and Goldfield Dump, a feed lot with corrals, and a multi-component site having mining structures and rock art. An unrecorded American Indian settlement is also reported along Montezuma alternative segment 2.

Within the Level II region of influence, recorded resources include 112 prehistoric sites (four sites are considered eligible, 73 are considered not eligible, and 35 have not been evaluated), 58 historic sites (14 sites are considered eligible, 42 are considered not eligible, and two have not been evaluated), and 17 multi-component sites (14 are considered not eligible, and three have not been evaluated). The majority of the prehistoric sites consist of small lithic scatters and isolates; a variety of historic sites is found, primarily associated with mining and railroad activities. Historic sites also include the townsite of Millers, cemeteries, historic dumps, and military encampments, as well as sites and features potentially contributing to the *National Register of Historic Places*-listed Goldfield townsite.

DOE surveyed 24 sample units during the Class II effort, totaling 19 kilometers (12 miles) or 16 percent of the segment. A total of 39 resources were recorded, including 28 prehistoric lithic scatters and one quarry, four historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and seven are considered not eligible; 19 lithic scatters and the quarry have not been evaluated for eligibility. The four historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated. Given the high density of resources along this segment, construction activities could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 241 resources could be present within the Level I region of influence.

Montezuma Alternative Segment 3 The Class I site-file search revealed that 84 cultural resources are recorded along Montezuma alternative segment 3, including eight within the Level I region of influence and 76 within the Level II region of influence. Within the Level I region of influence, there is one prehistoric site (considered not eligible) and seven historic sites (six are considered eligible, and one is considered not eligible). The eligible resources include two railroad grades, Millers townsite, the Goldfield Junction Station, a mining camp, and a feed lot with corrals.

Within the Level II region of influence, previously recorded resources include 55 prehistoric sites (35 sites are considered not eligible, and 20 have not been evaluated), 18 historic sites (four sites are considered eligible, 12 are considered not eligible, and two have not been evaluated), and three multi-component sites that are considered not eligible. The majority of the prehistoric sites consist of small lithic scatters and isolates; a rockshelter is also present. Historic sites are primarily associated with mining and railroad activities, and include camps, dumps, mining features, and railroad grades and stations.

DOE surveyed 30 sample units during the Class II effort, totaling 24 kilometers (15 miles) or 17 percent of the segment. A total of 46 resources were recorded, including 36 prehistoric lithic scatters and one quarry, three historic trash deposits, three historic railroad sites, one historic homestead site, one historic mining site, and one multi-component site.

Two of the lithic scatters are considered eligible for listing on the *National Register of Historic Places*, and eight are considered not eligible; 26 lithic scatters and the quarry have not been evaluated for eligibility. The three historic trash deposits, two of the railroads, and the mining site are considered not eligible; one railroad, the homestead, and the multi-component site have not been evaluated. Given the high density of resources along this segment, construction activities could result in direct and indirect impacts to the eligible or potentially eligible prehistoric and historic resources.

Sample inventory indicates that approximately 270 resources could be present within the Level I region of influence.

4.3.13.2.1.7 Mina Common Segment 2 (Lida Junction Area). The Class I site-file search revealed that one prehistoric cultural resource, the Twin Buttes Rockshelters, is recorded along Mina common segment 2 within the Level II region of influence. This site has not been formally evaluated for eligibility, but is likely to be considered eligible. No cultural resources are previously identified within the Level I region of influence.

No Class II effort has been conducted along this short segment, which is between regular sample intervals; archaeological site distribution can be anticipated to reflect that noted along adjoining segments. The Twin Buttes Rockshelters would not be affected by construction of this segment.

4.3.13.2.1.8 Bonnie Claire Alternative Segments.

Bonnie Claire Alternative Segment 2 The Class I site-file search identified one cultural resource in the Level I region of influence. The site includes both prehistoric and historic components (a lithic scatter and mining prospects and debris). The prehistoric component was evaluated as being eligible for listing on the *National Register of Historic Places*.

The Class II sample survey examined five sample units, a total of 4 kilometers (2.5 miles) or 19 percent of the segment. Two sites and five isolates were recorded. The sites include a prehistoric campsite with a lithic and ground stone scatter, evaluated as being eligible for listing on the *National Register of Historic Places*, and a lithic scatter for which eligibility is under review.

Potential direct and indirect impacts along this alternative segment include the National Register-eligible prehistoric lithic and ground stone scatter identified during the Class II survey. This area also reveals the potential for the existence of prehistoric lithic scatters, obsidian nodule source areas, and rockshelters that, if present, would be directly affected by the construction of this alternative segment. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify any known areas of importance to American Indians along this alternative segment.

The sample inventory indicates that approximately 10 resources could be present within the Level I region of influence.

Bonnie Claire Alternative Segment 3 The Class I site-file search identified four cultural resources within the Level I region of influence. These resources include four previously recorded but unevaluated prehistoric sites. One of these is a rockshelter, and the other three are extractive sites located in areas of obsidian cobble occurrences.

The Class II survey inspected four sample units along this segment, a total of 3.2 kilometers (2 miles) or 17 percent of the segment. One site and 24 isolates were recorded. The site is an historic rail line construction camp along the abandoned combined Bullfrog and Goldfield/Las Vegas and Tonopah rail bed, recommended as eligible for listing on the *National Register of Historic Places*. The American Indian Resource Document (DIRS 174205-Kane et al. 2005, all) does not identify specific resources for this alternative segment.

Construction along this alternative segment could result in direct and indirect impacts to the historic railroad camp along the abandoned Bullfrog and Goldfield/Las Vegas and Tonopah Railroad.

Sample inventory indicates that approximately 6 resources could be present within the Level I region of influence.

4.3.13.2.1.9 Common Segment 5 (Sarcobatus Flat Area). The Class I site-file search identified 33 cultural resources along common segment 5, including seven within the Level I region of influence and 26 within the Level II region of influence. These resources include 20 prehistoric sites (14 lithic scatters and six quarry extractive sites), four historic sites (a Tolicha mining district campsite, two debris scatters, and a railroad segment), seven isolates, and two unknown sites. Of these sites, one lithic scatter has been recommended as eligible for listing on the *National Register of Historic Places*, 11 are not eligible, and 14 remain unevaluated.

DOE surveyed 10 sample units along this segment for the Class II effort, a total of 8 kilometers (5 miles) or 20 percent of the segment. Four prehistoric sites (three lithic scatters and one campsite) and 33 isolates were recorded. Of these sites, the campsite was recommended as eligible for listing on the *National Register of Historic Places*, and the tree lithic scatters are not eligible.

Common segment 5 would pass about 2.4 kilometers (1.5 miles) east of the Timbisha Shoshone Trust Lands at Scottys Junction. However, no specific cultural resource properties are identified on those lands that would be indirectly affected by construction of the proposed railroad. There is a high probability for direct and indirect impacts along common segment 5. Previous cultural resources inventories in the Sarcobatus Flat area indicate a relatively high potential for lithic scatters and extractive quarries (obsidian nodules). The sample inventory indicates that approximately 15 resources could be present within the Level I region of influence.

4.3.13.2.1.10 Oasis Valley Alternative Segments. The Class I site-file search identified three cultural resources along Oasis Valley alternative segments 1 and 3, within the Level II region of influence. These resources include one prehistoric campsite (recommended as eligible for nomination to the *National Register of Historic Places*) and two sites with both prehistoric and historic components (unevaluated ethnographic village sites).

Oasis Valley Alternative Segment 1 The Class II survey looked at three sample units along Oasis Valley 1, a total of 2.4 kilometers (1.5 miles) or 25 percent of the segment. Two prehistoric sites (lithic scatters) and one historic mine site were recorded, all recommended not eligible for nomination to the *National Register of Historic Places*.

This alternative segment would cross the culturally sensitive Oasis Valley, where potential ethnographic and historic ranching cultural landscapes are present. There could be direct and indirect impacts to sites in the Oasis Valley, particularly the unrecorded historic Beatty Cattle Company Ranch and an unevaluated Western Shoshone winter camp.

The American Indian Resource Document notes the presence of the early Western Shoshone camp and also states that, because of its abundant water supply and large variety of culturally important plants and animals, American Indian people extensively used the entire valley (DIRS 174205-Kane et al. 2005, Section 2.3). Recent ethnographic studies on the nearby Nevada Test and Training Range revealed cultural links to Oasis Valley. The Oasis Valley area is both a potential ethnographic and historic ranching cultural landscape. In later historic times, these landscapes overlapped, as American Indian people collocated and supplied labor for the ranches.

Rail line construction could directly and indirectly affect sites in the Oasis Valley, particularly the historic Beatty Cattle Company Ranch and a known Western Shoshone winter camp.

The sample inventory indicates that approximately 20 resources could be present within the Level I region of influence.

Oasis Valley Alternative Segment 3 The Class II sample survey inspected four sample units, a total of 3.2 kilometers (2 miles) or 22 percent of the segment; five sites and 28 isolated artifacts were recorded. These resources include five prehistoric sites (four lithic scatters and one campsite with a lithic scatter and cleared rock rings). The campsite has been determined eligible for listing on the *National Register of Historic Places.*

Oasis Valley 3 also would cross the culturally sensitive Oasis Valley. It would pass just east of another historic ranch, the Colson or Indian Camp Ranch, which also has an early Western Shoshone winter camp adjacent to the ranch buildings. While both the ranch and Western Shoshone camp are unevaluated, rock lines (geoglyphs) were observed at the Indian camp area during field reconnaissance. These resources would be additional components of the potential Oasis Valley ethnographic and historic ranching cultural landscapes. Construction of the alternative segment could result in a visual intrusion to these cultural landscapes.

The sample inventory indicates that approximately 23 resources could be present within the Level I region of influence.

4.3.13.2.1.11 Common Segment 6 (Yucca Mountain Approach). The Yucca Mountain area has been heavily analyzed in conjunction with repository ***site characterization*** studies. Intensive cultural resource studies related to the development of the repository site have been completed. Consequently, a large number of archaeological sites have been found along common segment 6. This is due more to the intensive nature of past studies than actual site density characteristics.

A Class I site-file search identified 204 cultural resources along common segment 6. These resources include 152 prehistoric sites, three historic sites, one site with both prehistoric and historic components, and 49 isolates. Prehistoric sites include eight rockshelters (four eligible), two eligible rock-art sites, 13 campsites (five eligible), six quarry sites (two eligible), four rock features and two rock rings, and 117 lithic scatters (one eligible). Historic sites include two debris scatters and one rail segment.

The Class II survey for common segment 6 did not extend inside the Yucca Mountain Site boundary. DOE inspected 13 sample units, a total of 11 kilometers (7 miles) or 22 percent of the segment. Seven sites (two prehistoric lithic scatters, four eligible sites with both prehistoric and historic components, and one historic debris scatter) and 52 isolates were recorded.

To provide additional information on cultural resources along common segment 6 within the Yucca Mountain Site boundary, Desert Research Institute conducted a Class III supplementary field survey along the section of proposed rail alignment inside the Yucca Mountain Site boundary. This survey investigated a 150-meter (500-foot)-wide corridor centered on the rail alignment for an approximate length of 5.9 kilometers (3.7 miles). This land comprised acreage that was previously surveyed during repository site characterization activities. Desert Research Institute identified eight cultural resources (two prehistoric sites, five isolates, and one historic site) during the Class III survey. All were evaluated as ineligible for National Register listing.

Given the large number of resources in the area, construction of common segment 6 could result in direct and indirect impacts to prehistoric and historic sites. Three National Register-eligible prehistoric quarry sites are in this area within the Level I region of influence. The Beatty Wash Petroglyphs Site, listed on the National Register, is in the vicinity of a proposed bridge over Beatty Wash. Direct and indirect impacts from construction activities would include vibration of the rock matrix exhibiting the rock-art panels, and a potential for inadvertent or deliberate adverse impacts due to increased access and worker presence. The site holds important cultural value for American Indians. Over the long term, American Indians would likely view the bridge and operating trains as a visual and noise impact to the rock-art cultural landscape site.

After common segment 6 crossed onto the Yucca Mountain Site, it would cross an area that has undergone earlier intensive archaeological inventory and has been the subject of previous American Indian studies during repository characterization. As discussed in Section 4.2.13.1, DOE would consider identification, evaluation, and mitigation of potential impacts to these resources under a separate programmatic agreement with those along the proposed rail alignment.

Based primarily on previous ethnographic studies, the American Indian Resource Document (DIRS 174205-Kane et al. 2005, Section 2.3) identifies several areas of cultural significance for American Indians along this common segment. Several of these fall inside the Yucca Mountain Site boundary, including the Busted Butte rock-art site, Fortymile Wash, and Alice Hill. The American Indian Writers Subgroup also notes the cultural importance of the Beatty area rock-art site and Crater Flat, specifically the Black Cone geological feature in Crater Flat, which would be within 0.8 kilometer (0.5 mile) of common segment 6.

The sample inventory of the segment outside the Yucca Mountain Site boundary indicates that approximately 32 sites could be present within the Level I region of influence.

4.3.13.2.2 Railroad Operations Impacts

After the construction phase, there would be no additional direct or indirect impacts at cultural resource sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes. American Indians would continue to view operation of the rail line as an intrusion on their holy lands.

4.3.13.3 Impacts under the Shared-Use Option

Impacts under the Shared-Use Option would be the same as those under the Proposed Action without shared use. Although under the Shared-Use Option there would be a slight increase in train traffic from the addition of commercial users, construction and operation of the proposed railroad would not differ and the slight increase in train traffic under the Shared-Use Option would not result in additional impacts. Construction of any additional commercial-use sidings would have the potential to impact cultural resources.

4.3.13.4 Summary

DOE would be obligated to complete intensive cultural resource inventories of the Mina rail alignment alternative segments and common segments. Because of the length of the rail alignment and the complexity associated with engineering a feasible alignment, DOE is using a phased cultural resource identification and evaluation approach, described in 36 CFR 800.4(b)2, to identify specific cultural resources. Under this approach, DOE would complete an inventory of the construction right-of-way, evaluate all recorded resources in accordance with criteria established for listing on the *National Register of Historic Places*, assess adverse impacts, and apply mitigation measures for identified impacts before it started any ground-disturbing construction activities.

Table 4-293 summarizes the potential for impacts to cultural resources within the region of influence for each Mina rail alignment alternative segment and common segment. At present, DOE cannot fully characterize potential effects on cultural resources and the magnitude of those impacts. The potential for impacts is based primarily on the relationship between the density of cultural resource sites associated with each alternative segment and common segment (that is, the greater the likely density of sites along a particular alternative segment or common segment, the higher the potential of affecting one or more of these sites). Sample inventory indicates that approximately 527 archaeological sites could be present within the Mina rail alignment Level I region of influence. Based on this sample, DOE expects that most of these sites will be characterized as prehistoric sites (77 percent), primarily lithic scatters, followed by historic sites (20 percent) and sites with both prehistoric and historic components (3 percent). Data currently available indicate that many of these sites (43 percent or more) will not meet eligibility criteria for listing on the *National Register of Historic Places*.

Based on preliminary information and sample surveys conducted to date, the magnitude of these impacts would likely range from small to moderate due to the extensive effort to avoid or mitigate impacts in accordance with the regulatory framework and with the terms of the cultural resources programmatic agreement (see Appendix M). To the extent feasible, DOE would avoid cultural resources identified within the construction areas. Where appropriate, temporary barriers would be used to isolate resources during construction. Monitoring and data recovery through excavation would also be used where necessary to mitigate impacts to archaeological sites. If the additional future inventory work described above indicated the presence of National Register-eligible sites, the magnitude of impacts could be greater.

Table 4-293. Summary of impacts to cultural resources – Mina rail alignment (page 1 of 2).

Location	Construction impacts[a]	Operations impacts[b]
Rail line segment		
Union Pacific Railroad Hazen Branchline	No potential for impacts.	No additional direct or indirect impacts.
Department of Defense Branchline North	No potential for impacts.	No additional direct or indirect impacts.
Schurz alternative segments	Potential direct and indirect impacts at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Department of Defense Branchline South	No potential for impacts.	No additional direct or indirect impacts.
Mina common segment 1	Potential direct and indirect impacts at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Montezuma alternative segments	Potential direct and indirect impacts at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Mina common segment 2	Potential direct and indirect impacts at archaeological sites identified along segments of alignments subject to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Bonnie Claire alternative segments 2 and 3 (Nye County)	Potential direct and indirect impacts at two National Register-eligible archaeological sites and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 5 (Nye County)	Potential direct and indirect impacts at two National Register-eligible archaeological sites and 20 additional resources recorded within the region of influence.	No additional direct or indirect impacts.
Oasis Valley alternative segments 1 and 3 (Nye County)	Potential direct and indirect impacts at archaeological sites identified along segments subjected to sample inventory, and at other sites that might be identified during the complete survey.	No additional direct or indirect impacts.
Common segment 6 (Nye County)	Potential direct and indirect impacts at archaeological sites recorded in the region of influence, including three National Register-eligible resources.	No additional direct or indirect impacts.

Table 4-293. Summary of impacts to cultural resources – Mina rail alignment (page 2 of 2).

Location	Construction impacts[a]	Operations impacts[b]
Proposed facilities		
Access roads (including alignment access roads)	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Staging Yard at Hawthorne	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Maintenance-of-Way Facility; Rail Equipment Maintenance Facility; Cask Maintenance Facility; and Railroad Control Center and National Transportation Operations Center	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Construction camps	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Wells	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Potential quarries		
Malpais Mesa	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
North Clayton Valley	Potential direct and indirect impacts at sites that might be identified during the complete survey. Significant resources likely avoidable.	No additional direct or indirect impacts.
Gabbs Valley	Small potential for impacts; significant resources likely avoidable.	No additional direct or indirect impacts.
Garfield Hills	Possible obsidian source; impacts would require mitigation.	No additional direct or indirect impacts.

a. Impact assessment based on sample inventory only; actual impacts cannot be identified until completion of field studies.
b. After the proposed rail line was constructed, no additional direct or indirect impacts would be anticipated at archaeological, historical, and cultural sites, other than the potential visual intrusion of operating trains on the character of potential cultural landscapes.

4.3.14 PALEONTOLOGICAL RESOURCES

This section describes potential impacts to paleontological resources ***fossils*** from constructing and operating the proposed railroad along the Mina rail alignment. Section 4.3.14.1 describes the methodology DOE used to assess impacts to such resources; Section 4.3.14.2 describes potential impacts during the construction phase; Section 4.3.14.3 describes potential impacts during the operations phase; Section 4.3.14.4 describes impacts under the Shared-Use Option; and Section 4.3.14.5 summarizes potential impacts.

Section 3.3.14.1 describes the region of influence for paleontological resources along the Mina rail alignment.

4.3.14.1 Impact Assessment Methodology

Any project activity involving land disturbance could have an adverse impact on the physical environment that could contain paleontological resources. Paleontological resources could be disturbed or destroyed by ground excavation, cuts and fills, surface-disturbing activities such as road building and blasting, or vandalism or theft of the resources.

DOE used the BLM system (DIRS 176084-BLM 1998, all; DIRS 176085-BLM 1998, all) to identify and classify paleontological resource areas along the Mina rail alignment according to their potential for containing vertebrate (animals with backbones) fossils or noteworthy occurrences of invertebrate or plant fossils. The BLM uses these paleontological resource classifications (***Condition 1***, ***Condition 2***, and ***Condition 3***; see the text box in Section 3.3.14) to identify areas that might warrant special management or special designation for paleontological resources.

The BLM steps to evaluate the potential for impacts to fossil resources are outlined in *General Procedural Guidance for Paleontological Resource Management* (DIRS 176084-BLM 1998, Chapter III), and include identification by a qualified paleontologist and protection of any paleontological area uncovered during field surveys. Educating the public about the value of paleontological resources is also an important part of BLM resource management.

To assess potential impacts to paleontological resources along the Mina rail alignment, DOE considered whether unique or scientifically important vertebrate, invertebrate, or plant fossils could be damaged, destroyed, or removed during construction and operation of the proposed railroad, quarries, water wells, and access roads.

4.3.14.2 Construction Impacts

Neither the rail line nor its construction and operations support facilities would be constructed at or near known or likely fossil beds. There is a known vertebrate bed between Hawthorne and Luning in the Garfield Hills area, just south of existing rail line along Mina common segment 1, but there would be no new construction in this area. Therefore, DOE would expect no impacts to paleontological resources during the construction phase.

However, the Department could encounter currently unknown paleontological resources during the construction phase. The BLM would continue to manage all identified paleontological resources in accordance with its management plans, and if DOE discovered new paleontological resources during the construction phase, the BLM would take appropriate action (DIRS 179560-BLM 2001, p. CUL-5).

4.3.14.3 Operations Impacts

The most likely source of potential impacts to paleontological resources would be from land disturbance during the construction phase, as discussed in Section 4.3.14.2. DOE expects there would be no impacts to paleontological resources resulting from railroad operations.

4.3.14.4 Construction and Operations Impacts under the Shared-Use Option

As for the Proposed Action without shared use (see Sections 4.3.14.2 and 4.3.14.3), DOE expects there would be no impacts to paleontological resources along the Mina rail alignment under the Shared-Use Option.

4.3.14.5 Summary

Although DOE could discover currently unknown paleontological resources along the Mina rail alignment during the construction phase, at present there are no known resources. The Department would expect impacts to paleontological resources during construction and operation of the proposed railroad to be small. Though there could be a potential to uncover previously unknown fossils during the construction phase, if paleontological resources were uncovered, DOE would consult with the BLM to develop appropriate measures to minimize damage to these resources.

Chapter 7, Best Management Practices and Mitigation, describes the best management practices DOE would implement as part of the Proposed Action and the mitigation measures the Department would consider to reduce or eliminate the potential for impacts to paleontological resources.

4.3.15 ENVIRONMENTAL JUSTICE

This section describes the DOE analysis of ***environmental justice*** (the potential for impacts to be ***disproportionately high and adverse*** to ***minority*** or ***low-income populations***) under the Proposed Action along the Mina rail alignment. Section 4.3.15.1 describes the DOE methodology for analyzing environmental justice; Section 4.3.15.2 describes the assessment of impacts to environmental resources; Section 4.3.15.3 describes the potential for disproportionately high and adverse impacts; and Section 4.3.15.4 summarizes any environmental justice impacts.

Section 3.3.15.1 describes the region of influence for environmental justice.

4.3.15.1 Impact Assessment Methodology

For this analysis, DOE uses the terms minority and low-income in the context of environmental justice (DIRS 155970-DOE 2002, Section 3.1.13.1; DIRS 174625-Bureau of Census 2005, all).

DOE performed the analysis of potential environmental justice impacts in accordance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, and Council on Environmental Quality guidance (DIRS 103162-Council on Environmental Quality 1997, all). Using information from Sections 4.3.1 through 4.3.14, this section assesses whether any high and adverse impacts could fall disproportionately on minority or low-income populations.

As a starting point, DOE determined whether there would be minority or low-income populations in the Mina rail alignment region of influence for environmental justice. Next, DOE determined whether there would be any potential for high and adverse impacts to environmental resources as evaluated in Sections 4.3.1 through 4.3.14. Finally, DOE determined whether any potential high and adverse impacts would fall disproportionately on minority or low-income populations.

According to the Council on Environmental Quality, a minority population exists where either (a) the minority population of the affected area exceeds 50 percent; this calculation includes federally recognized American Indian lands, because American Indians are included in the definition of minority populations; or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. In addition to the 50-percent threshold, DOE used both the United States and the State of Nevada minority populations as bases for comparison.

The Council on Environmental Quality defines low-income by using the annual statistical poverty thresholds from the U.S. Census Bureau. A low-income community exists when the low-income population percentage in the area of interest is "meaningfully greater" than the low-income population in the general population. For purposes of the analysis of low-income communities, DOE used both the United States and the State of Nevada low-income populations as the bases for comparison. DOE assumed a 20-percent threshold above state low-income percentages in accordance with U.S. Nuclear Regulatory Commission guidance.

DOE also considered whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources.

If there would be no high and adverse impacts to environmental resource areas, or if any identified high and adverse impacts would not fall disproportionately on minority or low-income populations, then there would be no environmental justice impacts.

4.3.15.2 Assessment of Impacts to Environmental Resources

Results of the impacts analyses described in Sections 4.3.1 through 4.3.14 indicate that there would be moderate to large impacts in the following environmental resource areas:

- Land use. Construction and operation of the proposed railroad along the Mina rail alignment would result in impacts to land use and ownership along the entire alignment. There would be changes in land uses on public lands within the operations right-of-way and impacts to patented mining claims.
- Aesthetic resources. During the construction phase, there would be small to large impacts with weak to strong contrasts in the short term from visible construction equipment, either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads along all segments of the Mina rail alignment. There would be small to large, but temporary, impacts from moderate to strong contrast in the short term for rail-over-road crossing of U.S. Highway 95 by Schurz alternative segment 6, which would not meet BLM Class III management objectives, and weak to moderate contrast in the short term for other rail line sections and structures, which would meet Class III objectives. There would also be moderate impacts from moderate contrast due to proximity to viewers on State Route 265 and in some parts of the town of Silver Peak that would meet BLM Class III and IV management objectives, and impacts from moderate contrast in the short term from quarrying, ballast production facilities, and a conveyor close to viewers that would be compatible with BLM Class III management objectives.

  During the operations phase there would be small to moderate impacts as a result of no to moderate contrast in the long term from the installation of linear track, signals, communications towers, power poles connecting to the grid, and access roads along the entire Mina rail alignment. There would also be small to moderate impacts from weak to moderate contrast as rail line and crossing structures would, in places, attract the attention of viewers, but would meet BLM Class III management objectives. There would be moderate impacts from moderate contrast from a new linear feature adjacent to State Route 265 and in Clayton Valley that would meet BLM Class III and IV management objectives.
- Air quality. Air pollutant concentrations would not exceed the National Ambient Air Quality Standards for construction or operation of the railroad or any associated facilities, with the exception of the 24-hour standards for both PM_{10} and $PM_{2.5}$ that could be exceeded near the construction right-of-way at Mina and Schurz during the relatively short construction period, and at the Staging Yard at Hawthorne and the potential Garfield Hills quarry. The highest increase in emissions would be for NO_x emissions in Esmeralda County during the construction phase, where emissions could be as high as 25 times greater than 2002 county-wide NO_x emissions. The Shared-Use Option impact would result in a slightly higher increase in air pollutant emissions and air pollutant concentrations than would the Proposed Action without shared use.
- Noise and vibration. Eight receptors (individuals who could be affected) would be included in the 65 ***day-night average noise level*** contours in Silver Springs and one receptor would be included in Wabuska. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase.
- Biological resources. There would be potential adverse impacts related to noxious and invasive species, which would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. There would be the potential for impacts to threatened or endangered species during the construction phase. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from construction and operation of the proposed railroad. Direct impacts to wildlife and wild horses and burros from railroad operations would consist of potential collisions of wildlife with trains

and temporary disruption of activities (such as foraging, nesting, and resting) due to the disturbance from noise caused by passing trains and from noise and presence of humans at facilities and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

Although there are many historic and archaeological sites along the Mina rail alignment (see Section 3.3.13), and construction and operation of the proposed railroad could directly and indirectly affect those resources (see Section 4.3.13), that analysis did not determine that potential impacts to cultural resources would be high and adverse.

4.3.15.3 Potential for Disproportionately High and Adverse Impacts

To determine whether potential environmental impacts identified in Sections 4.3.1 through 4.3.14 could be disproportionately high and adverse to minority or low-income populations, DOE considered the following factors:

- Whether there would be an impact on the natural or physical environment that would adversely affect a minority population, low-income population, or American Indian tribe (such effects could include ecological, cultural, human health, economic, or social impacts on minority communities, low-income communities, or an American Indian tribe when those impacts are interrelated with impacts on the natural or physical environment)
- Whether environmental effects could have an adverse impact on minority populations, low-income populations, or an American Indian tribe that would be meaningfully greater than or be likely to be meaningfully greater than the impact on the general population or other appropriate comparison group
- Whether minority or low-income populations would be affected by an alternative in different ways than the general population, such as through unique exposure pathways or rates of exposure, special sensitivities, or different uses of natural resources
- Whether the environmental effects could occur in a minority population, low-income population, or American Indian tribe affected by cumulative or multiple adverse exposures from environmental hazards

Based on these factors, DOE identified the following potential impacts to land use, aesthetic resources, air quality, biological resources and from noise and vibration:

- Land use. To implement the Proposed Action along the Mina rail alignment, DOE would need to gain access to some private land, the amount of which would be very small (about 0.2 percent) compared to the total land required for the project. The Schurz alternative segments would cross the Walker River Paiute Reservation, utilizing between 0.3 and 0.5 percent of the Reservation's land, depending on the segment. The Tribe's concurrence would be necessary to secure a right-of-way for the rail line. However, the Tribe's current position (as stated in an April 29, 2007 [DIRS 181604-Williams 2007, all] letter from the Tribal Council) is that the Tribe will not allow nuclear waste to be transported across their Reservation. Under the Mina Implementing Alternative, DOE would remove the existing Department of Defense rail line through Schurz, providing a perceived benefit to the town's residential land uses; the Tribe could use the existing roadbed as a recreational trail. Most of the local mining activity is outside the rail-line construction right-of-way. However, Montezuma alternative segment 2 would intersect some patented mining claims and DOE would need to acquire access to this land. Mina common segment 1, all the Montezuma alternative segments, the Oasis Valley alternative segments, and common segment 6 would cross several Township and Range

Sections that contain many unpatented mining claims. The actual number of claims that would intersect the construction right-of-way would need to be determined through additional record searches and field verification. Nevertheless, there would be moderate impacts to patented and unpatented mining claims along these segments where they would fall within the construction right-of-way. There is also the possibility that the rail line could be affected by or affect underground mining tunnels or shafts. During the final engineering design phase, DOE would need to survey these underground features to avoid adverse impacts.

Although the Schurz population center and the Walker River ***Census County Division*** exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 20 percent over the state average of 11 percent established by the Nuclear Regulatory Commission and the Council on Environmental Quality, the impacts to land use that would be felt on the Walker River Paiute Reservation are not large or adverse. The moderate impacts to patented and unpatented mining claims would be felt all along the Mina rail alignment and not just in the areas where the minority population threshold of 50 percent or the low-income threshold of 20 percent over the state average of 11 percent is exceeded. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Aesthetic resources. During the construction phase, there would be small to large impacts with weak to strong contrast in the short term from visible construction equipment either operating or in storage, and from scars on soil and vegetated landscape from cuts, fills, and well pads. There would be small to large impacts with weak to strong contrast in the long term from scars on rock from cuts, and from access roads along the entire Mina rail alignment. Also, there would be small to large, but temporary, impacts with a moderate to strong contrast in the short term for the Schurz alternative segment 6 rail-over-road crossing of U.S. Highway 95, which would not meet BLM Class III management objectives. There would be weak to moderate contrasts in the short term for other rail line sections and structures, which would meet Class III objectives.

  Along the Mina rail alignment, the Schurz population center and the Walker River Census County Division, both in Mineral County, are the two extreme cases with the widest percentage difference of 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in section 3.3.15.2. Also, there is one Census County Division with a poverty rate of more than 20 percent above the state average of 11 percent – the Walker River Census County Division, with a 32-percent poverty rate.

  Although the Schurz population center and the Walker River Census County Division exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 20 percent over the state average of 11 percent established by the Nuclear Regulatory Commission and the Council on Environmental Quality, the large, permanent impacts to aesthetic resources would be felt all along the Mina rail alignment and not just in these areas. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Air quality. Annualized emissions for all air pollutants projected to be released during the construction phase would be greater than during the operations phase. Projected ambient concentrations of all air pollutants would be below the National Ambient Air Quality Standards, except for particulate matter during the construction phase, which could exceed the 24-hour standard under some conditions. Therefore, the projected impacts throughout the region of influence, during both construction and operation, would be small, except immediately adjacent to the potential Garfield Hills quarry and the Staging Yard at Hawthorne, and segments of the rail line during construction. Under the Shared-Use Option, there would be in an increase in emissions over those of the Proposed Action without shared use, but impacts to air quality would still be small.

Along the Mina rail alignment, the Schurz population center and the Walker River Census County Division, both in Mineral County, are the two extreme cases with the widest percentage difference of 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in section 3.3.15.2. Also, there is one Census County Division with a poverty rate of more than 20 percent above the state average of 11 percent – the Walker River Census County Division, with a 32-percent poverty rate.

Although the Schurz population center and the Walker River Census County Division exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 20 percent over the state average of 11 percent established by the Nuclear Regulatory Commission and the Council on Environmental Quality, the impacts to air quality would be felt all along the Mina rail alignment and not just in these areas. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Biological resources. Potential adverse impacts related to noxious and invasive species would include increased risk of these species becoming established in disturbed areas and encroaching on adjacent undisturbed habitat. DOE would implement best management practices (see Chapter 7) and BLM-prescribed and -approved methods to prevent the establishment of noxious weeds or invasive plant species. There would be the potential for impacts to threatened or endangered species during rail line construction. Habitat for several special status species would be disturbed and individuals of several of the species could be disturbed, injured, or killed from the construction and operation of the proposed railroad and associated facilities. Potential impacts to federally listed species would likely require consultation with the U.S. Fish and Wildlife Service in accordance with Section 7 of the Endangered Species Act. Direct impacts to wildlife and wild horses and burros during the operations phase would consist of potential collisions of wildlife with trains; temporary disruption of activities (foraging, nesting, resting, etc.) due to the disturbance from noise caused by passing trains and from noise and presence of humans at railroad facilities; and potential contamination of forage, prey species, nesting, and spawning habitat, and sources of drinking water in the rare event of train derailment and associated spill of diesel fuel. Indirect impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

  Along the Mina rail alignment, the Schurz population center and the Walker River Census County Division, both in Mineral County, are the two extreme cases with the widest percentage difference of 89-percent and 80-percent minority populations, respectively, compared to a 30-percent minority population for Mineral County as a whole. These two areas exceed the 50-percent threshold described in section 3.3.15.2. Also, there is one Census County Division with a poverty rate of more than 20 percent above the state average of 11 percent – the Walker River Census County Division, with a 32-percent poverty rate.

  Although the Schurz population center and the Walker River Census County Division exceed the minority population threshold of 50 percent and the Walker River Census County Division exceeds the low-income threshold of 20 percent over the state average of 11 percent established by the Nuclear Regulatory Commission and the Council on Environmental Quality, the impacts to biological resources would be felt all along the Mina rail alignment and not just in these areas. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

- Noise and Vibration. There would be eight receptors included in the 65 DNL contours in Silver Springs and one receptor in Wabuska. There would be no receptors included in the 65 DNL contours for Mina, Silver Peak, or Goldfield. These nine receptors would experience an adverse noise impact because they would be exposed to 65 DNL and a 3 dBA increase. These impacts would not occur within the Schurz population center or the Walker River Census County Division. The Schurz population center and the Walker River Census County Division are the only locations along the Mina rail alignment where the minority populations exceed the threshold of 50 percent, and the Walker River Census County Division is the only location along the Mina rail alignment where the low-income population exceeds the threshold of 20 percent over the state average of 11 percent established by the Nuclear Regulatory Commission and the Council on Environmental Quality. DOE has concluded that low-income and minority populations in these areas would not be disproportionately affected.

Seventeen tribes and organizations have formed the Consolidated Group of Tribes and Organizations, which is a forum consisting of tribally approved representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. The Consolidated Group of Tribes and Organizations has provided DOE with valuable insights into American Indian cultural and religious values and beliefs.

Section 3.4 summarizes the interests and concerns expressed by various American Indian tribes and organizations within or near the Mina rail alignment region of influence. Sections 3.2.13 and 3.3.13, Cultural Resources, provide additional information on American Indian cultural resources. Perceptions about the types and magnitudes of potential impacts to American Indian interests along the Mina rail alignment vary among the various stakeholders with interests in the proposed railroad because of different beliefs, goals, responsibilities, and values. American Indians are concerned that the proposed railroad could cause substantial and high adverse effects to a number of American Indian interests within and adjacent to the Mina rail alignment region of influence. DOE acknowledges the concerns of the American Indians and has consulted with the tribes. The Department would continue to consult with the Consolidated Group of Tribes and Organizations throughout the life of the project. Under the Mina Implementing Alternative, DOE would work closely with the American Indians to develop a mitigation action plan and ensure compliance with Section 106 of the National Historic Preservation Act (16 U.S.C. 470).)

The environmental justice analysis for the Shared-Use Option is the same as that described for the Proposed Action without shared use.

4.3.15.4 Conclusion

The Schurz population center and the Walker River Census County Division are the only locations along the Mina rail alignment where the minority populations exceed the threshold of 50 percent, and the Walker River Census County Division is the only location along the Mina rail alignment where the low-income population exceeds the threshold of 20 percent over the state average of 11 percent established by the Nuclear Regulatory Commission and the Council on Environmental Quality. Because there are no large and adverse impacts in these areas, DOE concluded that low-income and minority populations in these areas would not be disproportionately affected. Constructing and operating the proposed railroad along the Mina rail alignment would not result in high and adverse impacts to minority or low-income populations and no special pathways were identified. DOE has concluded that there would be no disproportionately high and adverse impacts to minority or low-income populations.

Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor

DOE/EIS-0250F-S2D

and

Draft Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada

DOE/EIS-0369D

Volume IV

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

October 2007

5. CUMULATIVE IMPACTS

This chapter presents the results of the DOE analysis of potential cumulative impacts under the Proposed Action for the Caliente rail alignment and the Mina rail alignment. The analysis considers impacts associated with past, present, and reasonably foreseeable future and continuing actions along with potential impacts from each of the rail alignments.

Glossary terms are shown in ***bold italics***.

5.1 Introduction

Cumulative Impact: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR 1508.7).

The U.S. Department of Energy (DOE or the Department) combined potential ***impacts*** reported in Chapter 4 of this Rail Alignment EIS with the potential impacts of other relevant past, present, and ***reasonably foreseeable future actions*** in the ***region of influence*** for each rail alignment. These combined impacts are called ***cumulative impacts***. Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500 to 1508) that implement the procedural requirements of the National Environmental Policy Act (42 United States Code [U.S.C] 4321 *et seq.*) (NEPA) require a cumulative impacts analysis as part of the environmental impact statement (EIS) process. In conducting this analysis, DOE followed the guidelines in CEQ handbook *Considering Cumulative Effects Under the National Environmental Policy Act* (DIRS 103162-CEQ 1997, all).

5.1.1 REGIONS OF INFLUENCE

The regions of influence for this cumulative impacts analysis encompass the potentially affected areas specific to the Caliente and Mina rail alignments. For the cumulative impacts analysis, the resource-specific regions of influence would generally be the same as those for the resource areas described in Chapter 3 and used for impact analysis reported in Chapter 4 of this Rail Alignment EIS. Table 3-1 and Table 3-78 list the regions of influence for each resource area within the Caliente and Mina rail alignment areas, respectively. The Caliente and Mina rail alignments share the same region of influence between Goldfield and the Yucca Mountain Repository, in Esmeralda and Nye Counties. The Caliente rail alignment region of influence also includes Lincoln County, while the region of influence for the Mina rail alignment also includes the Walker River Paiute Reservation and Lyon and Mineral Counties. Clark County, Churchill County, and Washoe County are generally excluded from the cumulative impacts regions of influence except as needed to maintain consistency with individual resource analyses, such as socioeconomics or air quality. Because the Caliente and Mina rail alignment regions of influence are different for much of their routes, some of the past, present, and reasonably foreseeable activities and projects affecting cumulative impacts for each rail alignment are also different, as described in this chapter.

5.1.2 APPROACH AND ANALYTICAL PERSPECTIVE

DOE used the following approach, analytical perspective, and considerations to perform this cumulative impacts analysis:

- Where analysis indicated a potential for cumulative impacts, information is quantified to the extent feasible (for example, land disturbance and water demand); however, the analysis is primarily ***qualitative***.
- The analysis considers federal, state and local government, and private activities.
- Projects included in the analysis have potential interaction in time (the foreseeable future) or space with the effects from implementation of the ***Proposed Action*** or the ***Shared-Use Option***.
- Effects from past and existing projects and activities are primarily considered in the Chapter 3 and Chapter 4 discussions for each resource area (such as mining and grazing).
- DOE considers reasonably foreseeable actions as those future actions for which there is a reasonable expectation that the action could occur, such as a Proposed Action under analysis, a project that has already started, or a future action that has obligated funding.
- Assessment of whether potential impacts would be beneficial or adverse would in many cases depend on individual and group values, beliefs, and goals, and would vary from location to location within the cumulative impacts regions of influence.

DOE has assessed potential cumulative impacts under the Proposed Action qualitatively and quantitatively to the extent available information allows. Not all quantitative information is additive because of different methodologies or conflicting regions of influence.

DOE identified activities relevant to the cumulative impacts analysis from reviews of information available from government agencies, such as environmental impact statements, land-use and natural resource management plans, and from private organizations. DOE reviewed this information for relevance to this cumulative impacts analysis based on potential geographical and temporal relationships with construction and operation of the proposed rail line along either the Caliente or Mina rail alignment. Not all actions identified in this analysis would have cumulative impacts on all resource areas.

This section describes some future actions only in general terms because the projects are in an early stage of planning or development, or they are broad concepts of activity (for example, BLM resource management planning). This analysis focuses more on geographic interaction of projects than timing of interactions because the actual timeframes for many of the reasonably foreseeable future actions are uncertain.

The approach taken for this cumulative impact analysis is consistent with the intent of CEQ regulations at 40 CFR 1502.22, *Incomplete or Unavailable Information*. This regulation directs agencies how to proceed when evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information. While information describing the characteristics and potential effects of other projects and activities within the regions of influence is primarily qualitative and, in some cases is incomplete or unavailable, there is sufficient information to complete a fair disclosure and hard look at potential cumulative impacts in the Caliente and Mina regions of influence.

5.1.3 RELATIONSHIP OF THIS ANALYSIS TO THE YUCCA MOUNTAIN REPOSITORY CUMULATIVE IMPACTS ANALYSIS

The Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (the Yucca Mountain FEIS) (DIRS 155970-DOE 2002, all) provided an analysis of potential cumulative impacts associated with construction and operation of a repository at Yucca Mountain. The portion of that analysis relevant and still valid to the Caliente and Mina rail alignments (DIRS 155970-DOE 2002) is incorporated in this cumulative impacts analysis for the proposed railroad, as appropriate.

To evaluate the potential environmental impacts, including cumulative impacts, of the revised repository design and operational plans, DOE has prepared *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0250F-S1) (Repository SEIS), which includes an analysis of cumulative impacts as they relate to the Yucca Mountain Repository. Sections 5.2.1.2.1 and 5.3.1.2.1 include a description of the repository, as currently proposed, and additional context about the repository as a reasonably foreseeable action. This Rail Alignment EIS cumulative impacts analysis incorporates updated cumulative impacts information from the Repository SEIS, as appropriate.

5.1.4 RESPONSIBILITY FOR MITIGATION OF CUMULATIVE IMPACTS

DOE is responsible for impacts associated with activities for which it is the project proponent. The Department would plan and design the Caliente and Mina rail alignments to avoid sensitive and regionally important resources like Wilderness Areas and Wilderness Study Areas and to avoid or minimize impacts to sensitive environmental areas (such as wetlands) and to private property. In addition, the Department would construct and operate the proposed railroad in compliance with all applicable requirements. Actions undertaken by other proponents are subject to a variety of environmental requirements to avoid, minimize, or otherwise reduce adverse impacts on the environment.

To help comply with requirements and to eliminate or reduce potential environmental impacts, the Department would implement a variety of engineering, site planning actions, and ***best management practices,*** all of which are parts of the Proposed Action (see Chapters 2 and 7). The DOE best management practices include the practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the environmental impacts of an action. Such practices would avoid, minimize, or otherwise reduce the direct and indirect environmental impacts of the DOE Proposed Action, thereby avoiding or minimizing contributions to direct, indirect, and cumulative environmental impacts along either the Caliente or Mina rail alignment cumulative impacts region of influence.

To the extent the Proposed Action would contribute cumulatively to impacts to regional resources, or to other activities such as BLM land management activities, DOE could take additional actions to reduce any identified impacts associated with its Proposed Action, as practicable (see Chapter 7). DOE continues to coordinate with public- and private-sector project proponents to foster adequate consideration of cumulative environmental issues. As part of its NEPA responsibilities, the Department would perform additional NEPA analysis related to the proposed railroad, if required.

5.1.5 ORGANIZATION OF THE ANALYSIS

Section 5.2 summarizes potential cumulative impacts associated with implementing the Proposed Action along the Caliente rail alignment. Section 5.3 summarizes potential cumulative impacts associated with implementing the Proposed Action along the Mina rail alignment. Section 5.4 summarizes combined repository and Nevada rail transportation impacts.

5.2 Caliente Rail Alignment

Sections 5.2.1 and 5.2.2 summarize the projects and activities considered in the Caliente rail alignment cumulative impacts analysis. Figure 5-1 shows the locations of these major projects and activities, including:

1. Southwest Intertie Project
2. Southern Nevada Water Authority Groundwater Development Project
3. Nevada Test and Training Range
4. Timbisha Shoshone Trust Land
5. Yucca Mountain Geologic Repository
6. Nevada Test Site
7. Coyote Springs Development Project
8. Union Pacific Railroad Operations
9. Toquop Energy Project
10. BLM Disposal of Public Land – Lincoln County Land Sales

This section also considers other relevant projects and actions that are not depicted on the map, such as:

- BLM planning and management actions – There are a variety of BLM past, present, and reasonably foreseeable actions within the three BLM management areas (Ely, Battle Mountain, and Las Vegas) relevant to the Caliente rail alignment.
- Various rights-of-way – Many future utility or other right-of-way corridors are not depicted in Figure 5-1 because specific routes are not known. For example, DOE and the BLM are preparing a programmatic environmental impact statement for potential designation of energy corridors on federal land in western states (70 *Federal Register* [*FR*] 56647, September 28, 2005).
- Energy and mineral development activities.
- Other regional economic development plans and activities within Lincoln, Nye, and Esmeralda Counties.

The Caliente rail alignment ranges in length from about 528 to 541 kilometers (328 to 336 miles), depending on the alternative segments considered. As a linear project, land disturbance and other direct impacts would be most likely to occur within the relatively narrow ***construction right-of-way*** and the narrower ***operations rights-of-way***. However, other direct and indirect impacts for some resources could occur outside of these rights-of-way.

To evaluate the potential for cumulative impacts, DOE identified and reviewed public and private actions in the Caliente rail alignment region of influence to determine if the impacts associated with these actions could coincide in time or space with potential impacts from construction and operation of the proposed Caliente rail alignment. Only those projects and activities DOE believes would have the potential for cumulative impacts are identified herein. In some cases, similar actions have been grouped together and listed by category of action.

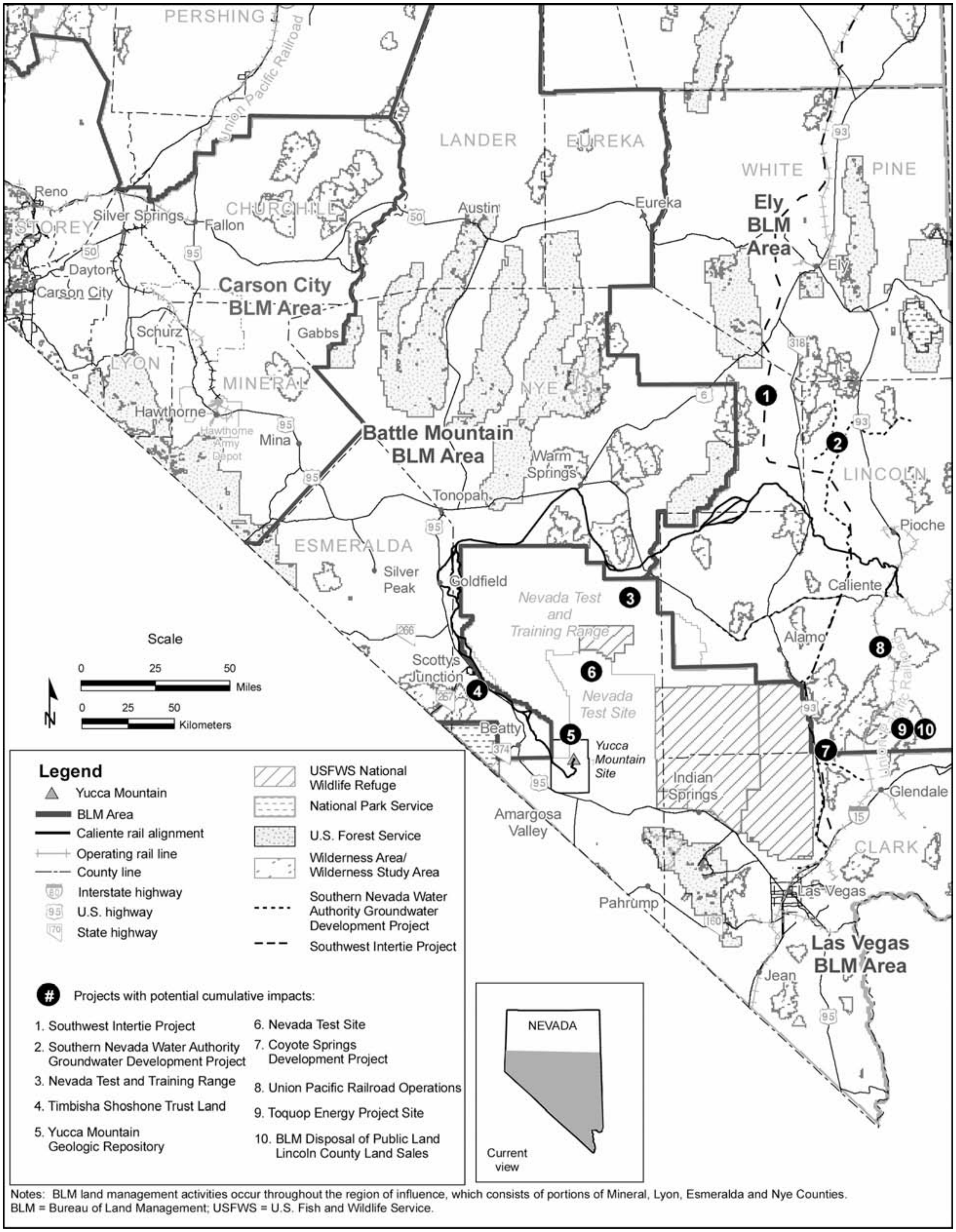


Figure 5-1. Major reasonably foreseeable future actions and continuing activities in the Caliente rail alignment cumulative impacts region of influence.

5.2.1 PROJECTS AND ACTIVITIES INCLUDED IN THE CUMULATIVE IMPACTS ANALYSIS – CALIENTE RAIL ALIGNMENT

5.2.1.1 Past and Present Actions

The descriptions of existing (baseline) environmental conditions (Chapter 3) and impacts (Chapter 4) associated with the various environmental resource regions of influence for the Caliente rail alignment considered in this Rail Alignment EIS include the relationships between proposed railroad construction, operation, abandonment, and past and present actions such as:

- Operations at major federal facilities such as the Yucca Mountain Geologic Repository, Nevada Test and Training Range, and Nevada Test Site
- BLM resource management planning and land management uses
- Traditional land uses such as regional ranching, mining, and recreation
- Military operations
- Residential, commercial, and industrial development activities associated with growth in the Caliente rail alignment cumulative impacts region of influence

Reasonably foreseeable future actions and the continuation of existing actions in the Caliente rail alignment cumulative impacts region of influence were also considered. Figure 5-1 shows the locations of individual projects and activities.

5.2.1.2 Reasonably Foreseeable Future and Continuing Federal Actions

Sections 5.2.1.2.1 through 5.2.1.2.6 describe reasonably foreseeable future and continuing federal agency actions that could result in cumulative impacts when combined with the potential impacts of constructing and operating the proposed railroad along the Caliente rail alignment.

5.2.1.2.1 Yucca Mountain Geologic Repository

The Proposed Action in this Rail Alignment EIS is directly related to the proposed geologic repository at Yucca Mountain, which is a reasonably foreseeable project that would have potential cumulative impacts in the Caliente rail alignment region of influence (see Figure 5-1, Project #5). In the Yucca Mountain FEIS (DIRS 155970-DOE 2002, all) and the *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (the Repository SEIS; DOE/EIS-0250F-S1 DOE proposes to construct, operate and monitor, and eventually close a ***geologic repository*** for the ***disposal*** of 70,000 metric tons (77,000 tons) of heavy metal of ***spent nuclear fuel*** and ***high-level radioactive waste*** at Yucca Mountain in Nye County, Nevada. DOE proposed to dispose of spent nuclear fuel and high-level radioactive waste in the repository using the natural geologic features of the mountain and engineered barriers as a total system to help ensure long-term ***isolation*** of the materials from the accessible environment. As analyzed in the Repository SEIS, the repository design and associated construction and operation plans require the following:

- DOE spent nuclear fuel and high-level radioactive waste would be placed in disposable canisters at the DOE sites, and as much as 90 percent of the commercial spent nuclear fuel would be placed in ***transportation, aging, and disposal*** (TAD) canisters at the commercial sites prior to shipment. This is the preferred method of receipt. The remaining commercial spent nuclear fuel (about 10 percent) would be transported to the repository in ***dual-purpose canisters*** (canisters suitable for storage and transportation), or would be uncanistered.

- Most spent nuclear fuel and high-level radioactive waste would be transported from 72 commercial and four DOE sites to the repository in Nuclear Regulatory Commission-certified transportation casks placed on trains dedicated only to these shipments. Some shipments, however, would be transported to the repository by truck over the Nation's highways.
- At the repository, DOE would conduct waste handling activities to manage thermal output of the commercial spent nuclear fuel and to package the spent nuclear fuel into TAD canisters. The disposable canisters and TAD canisters would be placed into ***waste packages*** for disposal in the repository. A waste package is a container that consists of the barrier materials and internal components in which DOE would place the canisters that contained spent nuclear fuel and high-level radioactive waste.
- DOE would place approximately 11,000 waste packages, containing no more than a total of 70,000 metric tons (77,000 tons) of heavy metal, spent nuclear fuel, and high-level radioactive waste in the repository at Yucca Mountain.
- When authorized by the Nuclear Regulatory Commission, the repository would be closed permanently. The design for construction would allow for phased construction of the surface and subsurface facilities that would be compatible with constrained funding.
- The surface and subsurface facilities and associated infrastructure, such as the onsite road and water distribution networks and emergency response facilities, would be constructed in phases to accommodate the expected receipt rates of spent nuclear fuel and high-level radioactive waste.
- DOE also would construct a four-lane access road that would extend from U.S. Highway 95 to the existing access road at Gate 510. This access road might be constructed using a phased approach, with initial construction of two lanes, and the road being widened later. The Department would also build a suitable intersection at U.S. Highway 95.
- DOE assumes that the following facilities would be constructed outside the repository land withdrawal area: a training facility near Yucca Mountain to support the Project Prototype Testing and the Operator Training and Qualification programs; temporary accommodations for construction workers; a proposed Sample Management Facility to consolidate, upgrade, and improve storage and warehousing for scientific samples and materials, perhaps near the Town of Amargosa Valley; and a marshalling yard and warehouse, a proposed leased facility that would consolidate material shipment and receipt into a 0.2-square-kilometer (50-acre) facility to allow for off-site receipt, transfer, and staging of materials required to perform construction activities at the Yucca Mountain site.

The Nuclear Regulatory Commission, through its licensing process, would regulate repository construction, operation and monitoring, and closure. Repository operations would only begin after the Commission granted DOE a license to receive and possess spent nuclear fuel and high-level radioactive waste. DOE is currently preparing an application for construction authorization.

The Yucca Mountain FEIS and the Repository SEIS evaluate the cumulative impacts of two additional inventories (Modules 1 and 2), which include spent nuclear fuel and high-level radioactive waste in addition to that of the Proposed Action inventory, and other radioactive wastes generally considered unsuitable for near-surface disposal. Inventory Module 1 or 2 could have cumulative impacts on the operation of the proposed railroad. Regarding potential cumulative impacts from Inventory Module 1 or 2, there would be no cumulative construction impacts because the need for a new railroad would not change; that is, whichever rail alignment DOE selected in which to build the proposed railroad to serve the Yucca Mountain FEIS Proposed Action would also serve Module 1 or 2. In addition, because the planned annual shipment rate of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository would be about the same for Module 1 or 2 and the FEIS Proposed Action, the only cumulative operations impacts would result because of the annual increase of shipments for Module 1 or 2. Because Modules 1 and 2 exceed the NWPA disposal limit of 70,000 metric tons (77,000 tons) of heavy metal considered in the Repository SEIS, the emplacement of any such waste at Yucca Mountain would require legislative action by Congress unless a second licensed repository was in operation. The 70,000 metric tons of heavy metal limit is comprised of 63,000 metric tons (69,000 tons) of heavy metal from commercial utilities and 7,000 metric tons (7,000 tons) of heavy metal from DOE.

DOE is preparing the *Disposal of Greater-Than-Class-C Low-Level Radioactive Waste Environmental Impact Statement* (DOE/EIS-0375) (72 *FR* 40135, July 23, 2007). That EIS will address the disposal of wastes with concentrations greater than Class C, as defined in U.S. Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE Low-Level Radioactive Waste and ***transuranic*** waste having characteristics similar to Greater-Than-Class-C waste and that otherwise do not have a path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low-level waste disposal in a geologic repository; in intermediate depth boreholes; and in enhanced near surface facilities. Candidate locations for these disposal facilities are the Idaho National Laboratory; the Los Alamos National Laboratory and Waste Isolation Pilot Plant in New Mexico; the Nevada Test Site and the proposed Yucca Mountain Repository; the Savannah River Site in South Carolina; the Oak Ridge Reservation in Tennessee; and the Hanford Site in Washington. DOE will also evaluate disposal at generic commercial facilities in arid and humid locations. The Draft Yucca Mountain SEIS evaluates the potential cumulative impacts of disposal of these wastes at Yucca Mountain as a reasonably foreseeable action, which are included in Inventory Module 2. Current repository design plans do not accommodate disposal of Greater-Than-Class-C low-level radioactive waste.

DOE is preparing the *Programmatic Environmental Impact Statement for the Global Nuclear Energy Partnership* (DOE/EIS-0396). Global Nuclear Energy Partnership (GNEP) would encourage expansion of domestic and international nuclear energy production while reducing nuclear proliferation risks, and reduce the volume, thermal output, and ***radiotoxicity*** of spent nuclear fuel before disposal in a geologic repository. DOE anticipates that its Programmatic EIS will evaluate a range of alternatives, including a proposal to recycle spent nuclear fuel and separate many of the high-heat ***fission products*** and the uranium and transuranic components. The full implementation of GNEP would involve the construction and operation of advanced reactors, which would be designed to generate energy while destroying the transuranic elements. DOE also anticipates evaluating project-specific proposals to construct and operate an advanced fuel-cycle research facility at one or more DOE sites.

The United States uses a "once through" fuel cycle in which a nuclear power reactor uses nuclear fuel only once, and then the utility places the spent nuclear fuel in storage while awaiting disposal. GNEP would establish a fuel cycle where the uranium and transuranic materials would be separated from the spent nuclear fuel and reused in thermal and/or advanced nuclear reactors. GNEP would not diminish in any way the need for the nuclear waste disposal program at Yucca Mountain, because under any fuel recycle scenario, high-level radioactive waste will continue to be produced and require disposal.

DOE anticipates that by about 2020 the commercial utilities will have produced about 86,000 metric tons (95,000 tons) of heavy metal of spent nuclear fuel, which exceeds the DOE disposal limit of 63,000 metric tons (69,000 tons) of heavy metal of commercial spent nuclear fuel at the Yucca Mountain Repository. If DOE were to decide, in a GNEP Record of Decision, to proceed with its proposal to recycle spent nuclear fuel, the Department anticipates that the necessary facilities would not commence operations until 2020 or later. Although the spent nuclear fuel-recycling concept has not yet been implemented and the capacity of a separations facility has not been determined, one or more separations facilities could be designed with a total capacity sufficient to recycle the spent nuclear fuel discharged by commercial utilities. Consequently, the Department believes there would be no change in the spent nuclear fuel and high-level radioactive waste inventory, and therefore the number of casks of spent nuclear fuel and high-level radioactive waste shipped to the Yucca Mountain repository analyzed under the Proposed Action in this Rail Alignment EIS would remain unchanged (that is, the shipment of approximately 9,500 casks containing spent nuclear fuel and high-level radioactive waste).

Overall, development of a GNEP fuel cycle has the potential to decrease the amount (number of assemblies) of spent nuclear fuel that would require geologic disposal, but would increase the number of casks of high-level radioactive waste requiring disposal in a geologic repository in the long term. Consequently, recycling of commercial spent nuclear fuel could affect the nature of the inventory that represents the balance of Inventory Module 1 (that is, commercial spent nuclear fuel in amounts greater than 63,000 metric tons [69,000 tons] of heavy metal). Nevertheless, given the uncertainties inherent at this time in estimating the amount of spent nuclear fuel and high-level radioactive waste that would result from full or partial implementation of the GNEP closed fuel cycle, this Rail Alignment EIS analyzes rail transportation within Nevada of approximately 9,500 casks of spent nuclear fuel and high-level radioactive waste.

5.2.1.2.2 Nevada Test Site (Continuation of Activities)

The Nevada Test Site, adjacent to the Nevada Test and Training Range, engages in a number of defense-related material and management activities, waste management, environmental restoration, and non-defense research and development (see Figure 5-1, Project #6). The Nevada Test Site was established in 1951 as the Nation's proving ground for developing and testing nuclear weapons. The site is on land administratively held by the BLM, but the Nevada Test Site land was withdrawn for use by the Atomic Energy Commission and its successors (including DOE). At present, the DOE National Nuclear Security Administration manages the site. It consists of about 3,200 square kilometers (800,000 acres) of land.

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all) described existing and projected future actions at the Nevada Test Site. That EIS was followed by a *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 162638-DOE 2002, all). DOE activities at the Nevada Test Site include stockpile stewardship and management (helping ensure the U.S. nuclear weapon stockpile is safe, secure, and reliable), materials disposition (removal of nuclear materials in a safe and timely manner), and nuclear emergency response. Activities at the Nevada Test Site since the 1996 EIS and 2002 supplement analysis have continued to support these missions in accordance with federal law, DOE policies and missions, and NEPA requirements. There are a number of other programmatic DOE waste management initiatives that can affect current and potential future operations at the Nevada Test Site, many of which require NEPA analyses. The Nevada Test Site also produces annual environmental reports that describe program activities and related environmental issues and activities.

DOE is currently preparing the *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement–Complex 2030* (Complex Transformation Supplemental PEIS [formerly known as the Complex 2030 SEIS]; DOE/EIS-0236-S4). That SEIS will analyze the environmental impacts of the continued transformation of the United States nuclear weapons complex by implementing the National Nuclear Security Administration's vision of the complex as it would exist in 2030, and alternatives to that action. Part of the proposed action in that SEIS is to identify one or more sites for conducting National Nuclear Security Administration flight test operations. Existing Department of Defense and DOE test ranges (for example, the White Sands Missile Range in New Mexico and the Nevada Test Site in Nevada) would be considered as alternatives to the continued operation of the Tonopah Test Range in Nevada.

Another part of the proposed action in the Complex Transformation Supplemental PEIS is to accelerate dismantlement activities. The DOE sites that will be considered as potential locations for the consolidated plutonium centers and consolidation of Category I (high strategic significance) and II (moderate strategic significance) special nuclear materials include Los Alamos National Laboratory, the Nevada Test Site, the Pantex Plant, the Y-12 National Security Complex, and the Savannah River Site.

DOE manages several types of radioactive and hazardous waste (***low-level radioactive waste***, ***mixed low-level waste*** [referred to as mixed waste], transuranic waste, high-level radioactive waste, and ***hazardous waste***) generated by past and present nuclear defense research activities at many DOE sites across the United States, including the Nevada Test Site. The Department manages each of those waste types separately because they have different components, levels of radioactivity, and regulatory requirements. DOE needs facilities like the Nevada Test Site to manage its radioactive and hazardous wastes to maintain safe, efficient, and cost-effective control of these wastes; comply with applicable federal and state laws; and protect public health and safety and the environment. In *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DIRS 101816-DOE 1997, all) DOE evaluated the environmental impacts of managing the five waste types. The Nevada Test Site will continue to be a major facility involved in DOE waste management programs, including serving as a disposal site for certain waste types generated off the site, and for on-site wastes primarily from environmental restoration and remediation activities.

The Nevada Test Site is a candidate disposal location for Greater-Than-Class-C Low-Level Radioactive Waste which is currently being examined in the *Disposal of Greater-Than-Class-C Low-Level Radioactive* Waste *Environmental Impact Statement* (DOE/EIS-0375). That DOE EIS will address the disposal of wastes with concentrations greater than Class C, as defined in Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE low-level radioactive waste and transuranic waste having characteristics similar to Greater-Than-Class-C low-level waste and that might not have an identified path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low level waste disposal in a geologic repository; in intermediate-depth boreholes; and in enhanced near-surface facilities.

Table 5-1 lists and briefly describes recent environmental assessments that describe Nevada Test Site operations.

Table 5-1. Recent environmental assessments describing Nevada Test Site operations.

Title	Description
Environmental Assessment for Relocation of Technical Area 18 capabilities and materials from the Los Alamos National Laboratory to the Nevada Test Site (DIRS 162639-DOE 2002, all)	DOE completed relocation of Technical Area 18 operational capabilities and materials from the Los Alamos National Laboratory to the Nevada Test Site in November 2005. Relocation included the transport of about 2.4 metric tons (2.6 tons) of special nuclear material and approximately 10 metric tons (11 tons) of natural and depleted uranium and thorium, as well as support equipment, some of which would have radioactive contamination, associated with the operations. A Finding of No Significant Impact was issued.
Environmental Assessment for Defense Logistics Agency Transfer of Waste to DOE and Finding of No Significant Impact (DIRS 172280-DLA 2003, all; DIRS 172281-DOD 2003, all)	The Defense Logistics Agency of the Department of Defense issued an environmental assessment of its proposal to transfer thorium nitrate from the Defense National Stockpile Center to DOE for disposal as a low-level radioactive waste at the Nevada Test Site. The Agency issued a Finding of No Significant Impact in November 2003 (DIRS 172281-DOD 2003, all). The Defense Logistics Agency made eight shipments of low-level thorium waste (about 310 cubic yards [10,800 cubic feet]) in 2004 (DIRS 182346-DOE 2005, all).

5.2.1.2.3 BLM Resource Planning and Management

The presence of BLM-administered public land is a very important factor affecting how and where activities occur within Caliente rail alignment regions of influence. Many private and federal projects, including the proposed ***railroad***, would involve use of BLM-administered public land. Therefore, these projects would require BLM-issued ***right-of-way grants*** before they could proceed. Right-of-way grants have two general forms: linear (applicable to such projects as transmission lines, railroads, and pipelines), and nonlinear (applicable to projects at one specific location). Rights-of-way on BLM-administered land are extensive in the region. These rights-of-way vary tremendously in size and scope of activity.

The BLM administers most of the land through which the Caliente rail alignment would pass. The BLM manages these lands through a multiple-use concept (which means managing public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people) in accordance with the Federal Lands Policy and Management Act of 1976 (43 U.S.C. 1732, *et seq*.) and other federal legislation. The management framework for each BLM planning area is documented in a resource management plan. The Caliente rail alignment would cross three BLM planning areas (Ely, Battle Mountain, and Las Vegas). The Battle Mountain and Las Vegas planning areas are operating under resource management plans adopted in 1998 and 1997, respectively (DIRS 176043-BLM 1998, all; DIRS 173224-BLM 1997, all). The Ely planning area is currently operating under terms of the Schell and Caliente Management Framework Plans approved in 1983 and 1981, respectively, and the Egan Resource Management Plan approved in 1987. The Caliente rail alignment would pass through areas outlined in the Schell and Caliente Management Framework Plan. The Ely Field Office issued a Draft Resource Management Plan in 2005 (DIRS 174518-BLM, 2005, all), which when finalized, will replace the existing plans within the Ely planning area. Because the Ely Resource Management Plan is still in draft form and has not yet been adopted by the BLM, the Schell, Caliente, and Egan land-use plans provide the basis for planning activities in the Ely planning area.

The BLM manages public lands in accordance with the existing management goals and objectives in applicable plans, and takes various specific actions on the affected public lands. There are many land uses on BLM-administered land in the region of influence; livestock grazing is a major use. The BLM activities to plan for and manage the public lands it administers have a major role in balancing competing needs and resources, and in determining the scope and locations of public and private activities on public lands.

5.2.1.2.4 BLM Disposal of Public Land – Lincoln County Land Sales

Based on the terms of federal legislation, the BLM is implementing the following laws that authorize disposing of (selling) public lands in southern Nevada (See Figure 5-1, Project #10). These land disposals are driven by two primary legislative initiatives, as follows:

- Lincoln County Land Act of 2000 – This Act (Public Law 106-298) identified approximately 53square kilometers (13,000 acres) in the southeastern corner of Lincoln County near Mesquite, Nevada, for sale. In February 2005, the BLM sold this acreage to private interests for $47.5 million. Ten percent of the proceeds of this sale go to Lincoln County, and the remainder is earmarked for archaeological preservation and development of a multi-species habitat conservation plan in Lincoln County.
- Lincoln County Conservation, Recreation and Development Act of 2004 – This Act (Public Law 108-424) provides for the sale of up to 360 square kilometers (90,000 acres) in Lincoln County.

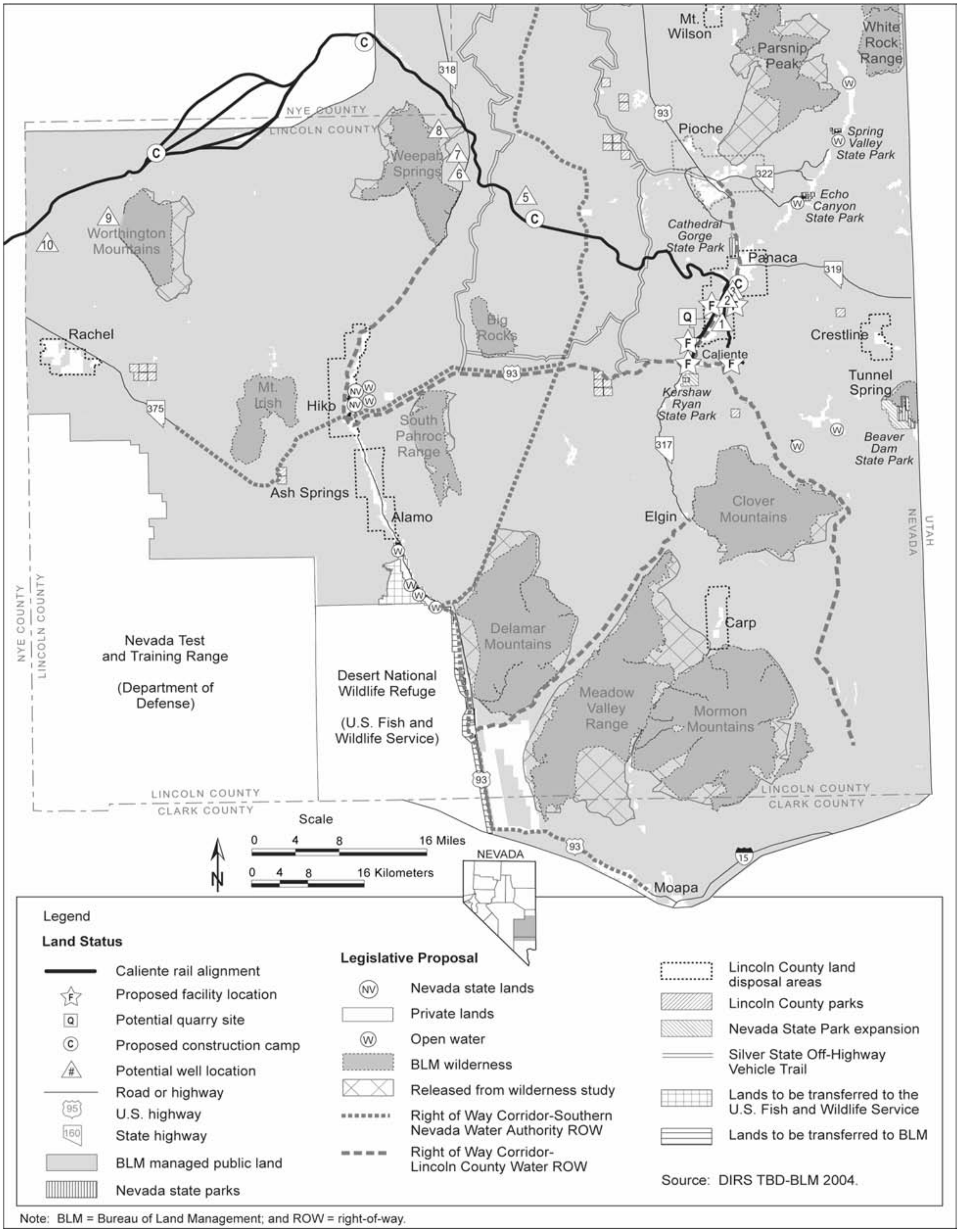


Figure 5-2. Lincoln County Conservation, Recreation, and Development Act activities.

The lands that would be eligible for sale will be identified in the Final Ely Resource Management Plan, which is currently being prepared by the BLM and is scheduled for completion in 2007. The Act will affect the growth and development in the Caliente rail alignment region of influence. See Figure 5-2 for the locations of activities and projects related to this Act. In addition to the planned BLM land disposals, the Act provides for:

- Designation of 14 new wilderness areas (consisting of 3,100 square kilometers [770,000 acres]) of BLM-administered land in Lincoln County, and release of 1,000 square kilometers (250,000 acres) of land from the BLM wilderness study area status.
- Establishment of nonexclusive utility corridors for the Southern Nevada Water Authority and the Lincoln County Water District/Vidler Water Company totaling 740 kilometers (460 miles) as rights-of-way for water pipelines and associated facilities to convey water in Clark and Lincoln Counties.
- Movement of an undeveloped right-of-way from the east side of U.S. Highway 93 to an existing utility corridor on the west side of the highway. Coyote Springs Investment will pay the Federal Government for the appreciated value of the property due to adding the right-of-way to their property.
- Establishment of a 420-kilometer (260-mile) Silver State Off-Highway Vehicle Trail along a series of existing backcountry roads that are currently open and used by off-highway vehicle enthusiasts, subject to the BLM preparation of a management plan for this trail.
- Transfer of about 35 square kilometers (8,500 acres) of BLM-administered land to the Desert National Wildlife Range, and transfer of about 34 square kilometers (8,400 acres) of Desert National Wildlife Range land to the BLM to facilitate the utility corridor for the Coyote Spring Investment development.
- Conveyance of up to 61 square kilometers (15,000 acres) of BLM-administered land to Lincoln County for conservation of natural resources or for public parks, with specific lands to be identified based on consultation between the county and the BLM.

In addition to the disposals required by the federal legislation described above, about 92 square kilometers (22,622 acres) have been identified for potential disposal in the vicinity of Goldfield, about 23 square kilometers (5,765 acres) have been identified for potential disposal near Scottys Junction, and 160 square kilometers (39,432 acres) have been identified for potential disposal near Beatty.

5.2.1.2.5 Nevada Test and Training Range (Continuation of Activities)

The U.S. Air Force operates the Nevada Test and Training Range in south-central Nevada (see Figure 5-1, Project #3), a national test and training facility for military equipment and personnel consisting of approximately 12 million square kilometers (3 million acres). Military training maneuvers and jet aircraft are commonly visible in the Caliente rail alignment cumulative impacts region of influence. In 2005, the U.S. Air Force designated the Indian Springs Air Force Auxiliary Airfield to Creech Air Force Base and expanded its mission and infrastructure to play a major role in the war on terrorism. The base is home to two key military operations: the MQ-1 unmanned aerial vehicle and the Unmanned Aerial Vehicle Battle laboratory.

The 1,600-square-kilometer (390,000-acre) BLM-administered National Wild Horse Management Area is within the boundary of the Nevada Test and Training Range. More than 3,200 square kilometers (800,000 acres) of the Nevada Test and Training Range comprise the Desert National Wildlife Range. The U.S. Air Force and the U.S. Fish and Wildlife Service jointly manage this area.

In *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999, all) the U.S. Air Force addressed potential environmental consequences of extending the land withdrawal in order to continue using the Nevada Test and Training Range lands for military use. Activities at the Nevada Test and Training Range change, as necessary, to meet military test and training needs.

In 2004, the BLM prepared a resource management plan for about 8,900 square kilometers (2.2 million acres) of withdrawn public lands within the Nevada Test and Training Range (DIRS 178102-BLM 2004, all). The plan guides the management of the affected Nevada Test and Training Range natural resources 20 years into the future (2024). The decisions, directions, allocations, and guidelines in the plan are based on the primary use of the withdrawn area for military training and testing purposes.

Table 5-2 lists and briefly describes recent environmental assessments that describe Nevada Test and Training Range operations.

Table 5-2. Recent environmental assessments describing Nevada Test and Training Range operations.

Title	Description
Final Environmental Assessment for Increased Depleted Uranium Use on Target 63-10, Nevada Test and Training Range (DIRS 181607-USAF 2006, all)	The proposed action was to increase the use of depleted uranium ammunition at the Nevada Test and Training Range to meet ongoing test and training requirements for A-10 aircraft. The Air Force was to increase the number of depleted uranium rounds authorized to be fired on Target 63-10 from 7,900 to 19,000 annually. The environmental assessment evaluated five resource areas—air quality, soils and water resources, health and safety, hazardous and radioactive materials and waste, and biological resources—in detail to identify potential environmental consequences. The Air Force issued a Finding of No Significant Impact.
Final Environmental Assessment for Predator Force Structure Changes at Indian Springs Air Force Auxiliary Field, Nevada (DIRS 172314-USAF 2003, all)	The proposed action included changes to personnel assignments, upgrades to existing facilities, construction of new facilities, and extension of a runway by 120 meters (400 feet). The Air Force completed facilities for the Predator unmanned aerial vehicles in 2006. The Air Force issued a Finding of No Significant Impact.
Expeditionary Readiness Training Course Expansion, Final Environmental Assessment, Creech AFB (DIRS 182838-USAF 2006, all)	Environmental assessment to increase the number of Security Forces personnel trained at the Regional Training Center at Silver Flag Alpha and Creech AFB, Nevada, from an existing 2,520 to 6,000 students per year. The Air Force issued a Finding of No Significant Impact.
Wing Infrastructure Development Outlook, Final Environmental Assessment, Nellis AFB (DIRS 182839-USAF 2006, all)	The proposed action consists of 630 Wing Infrastructure and Development Outlook projects in 11 categories as classified under 32 CFR Part 989, *Air Force EIAP*. A total of 18 new construction and demolition projects are proposed for Creech Air Force Base. On the Nevada Test and Training Range, the proposed action would implement four new construction projects at four locations. At Tonopah Test Range, three new construction projects are planned along with the demolition of 10 buildings. The Air Force issued a Finding of No Significant Impact.
Draft Range 74 Target Complexes Environmental Assessment Nevada Test and Training Range, Nevada (DIRS 182840-USAF 2007, all)	The proposed action is to construct and operate three target complexes in mountainous terrain in Range 74 of the Nevada Test and Training Range at Saucer Mesa, Limestone Ridge, and Cliff Springs. The Saucer Mesa target array would employ both large-scale live and inert munitions; the Limestone Ridge sites would employ large-scale inert munitions; both target sites would employ small-scale live munitions. The Cliff Springs target complex would be laser and simulated attack targets and no munitions would be used. The Air Force issued a Finding of No Significant Impact.
A Final Base Realignment and Closure Environmental Assessment for Realignment of Nellis Air Force Base (DIRS 181492-USAF 2007, all)	The proposed action would affect the Nevada Test and Training Range by adding 1,400 F-16 sorties flown from Nellis Air Force Base, although they would not cause total annual sortie operations to exceed the current maximum of 300,000 at the Nevada Test and Training Range. The environmental assessment evaluated noise, air quality, socioeconomics and infrastructure, water and soil resources, biological resources, cultural resources, and hazardous materials and waste. The Air Force issued a Finding of No Significant Impact.

5.2.1.2.6 Timbisha Shoshone Trust Land (Federal Action)

The Secretary of the Interior issued a draft report to Congress (DIRS 103470-Timbisha Shoshone Tribe [n.d.], all) describing a plan to establish trust lands for people of the Timbisha Shoshone Tribe in portions of the Mojave Desert in eastern California and southwestern Nevada (see Figure 5-1, Project #4). On November 1, 2000, the President signed the Timbisha Shoshone Homeland Act (Public Law 106-423) to provide a permanent land base for the Timbisha Shoshone Tribe within its ancestral homeland in five separate parcels. Lands in the designated area for tribal purposes were then identified, including land parcels containing water rights. The parcel near Scottys Junction (about 11 square kilometers [2,800 acres]) is approximately 3.2 kilometers (2 miles) from the proposed Caliente rail alignment. The Timbisha Shoshone Tribe is actively evaluating economic development opportunities on this Scottys Junction parcel. The locations and nature of these future development opportunities are not known and are not considered to be reasonably foreseeable for the purpose of this analysis.

5.2.1.3 Reasonably Foreseeable Future Non-Federal Actions

Non-federal and private actions in the Caliente rail alignment region of influence primarily consist of energy development, infrastructure development, groundwater development projects, continued Union Pacific railroad operations, residential development, and general economic development initiatives and efforts. As noted above, many of these privately sponsored projects would interact with the BLM land management policies and procedures because of a need to acquire right-of-way grants to initiate proposed activities on BLM-administered land.

5.2.1.3.1 Power Plants, Transmission Lines, Pipelines, and Other Infrastructure

Various power companies and public utilities have proposed locations for new power plants in southern Nevada due to substantial population and economic growth in southern California, Arizona, and southern Nevada. Much of this recent and proposed development is in Clark County. In addition to the power plants, regional infrastructure developments include natural gas pipelines and transmission lines that provide fuel and transmit electricity. Recently completed projects or reasonably foreseeable projects that could result in cumulative impacts near the proposed Caliente rail alignment and associated facilities are listed below. It is likely that other power plants, transmission lines, pipelines, and other infrastructure would be built in the proposed Caliente rail alignment region of influence in the future, but the locations and timing of other future projects are not known at this time. Additionally, the region holds the potential for wind, solar, and geothermal energy development, although the magnitude and specific locations of these energy development projects are not known.

- <u>Southwest Intertie Project</u> (see Figure 5-1, Project #1) – LS Power Associates acquired the right-of-way, which is approximately 870 kilometers (540 miles) long, originally granted by the BLM in 1994 for a transmission line that would run from near Twin Falls, Idaho, to the Dry Lake Valley northeast of Las Vegas. The power line would connect the Nevada Power Company and Sierra Pacific Power Company electrical generation and transmissions systems.
- <u>Toquop Energy Power Project</u> (see Figure 5-1, Project #9) – This proposed power plant would be near Mesquite in Lincoln County, about 160 kilometers (100 miles) northeast of Las Vegas, on BLM-administered lands. In September 2003, the BLM issued to the proponent, Toquop Energy, Inc., a right-of-way to build the proposed 1,100-megawatt natural-gas fired power plant and associated facilities. However, since then, the project plan has changed to a 750-megawatt coal-fired power plant, in the same location as originally proposed. The BLM has determined that the proposed changes warrant the preparation of a new NEPA analysis and has initiated an environmental impact statement on the revised project concept (71 *FR* 8869, February 21, 2006).

In addition to the power plant itself, the project would require an approximate 50-kilometer (30-mile) rail spur, transmission lines, water, and a new access road.

- Various utilities in the Caliente rail alignment cumulative impacts region of influence have recently been constructed and are being planned, including new cable lines (for example, fiber optic lines) and other facilities (such as wireless towers) that would require BLM right-of-way grants or use of private land in the area. The BLM has designated certain corridors in the area that should be used for most utility purposes; however, use of other BLM-administered land requiring new right-of-way grants has traditionally been considered on a case-by-case basis. To identify appropriate right-of-way corridors throughout the western United States, including Nevada, DOE and the BLM are preparing a programmatic EIS (*Designation of Energy Corridors on Federal Land in the 11 Western States*; 70 *FR* 56647, September 28, 2005). This effort could include changes to the rights-of-way in the Caliente rail alignment cumulative impacts region of influence in future years but any such changes are unknown at this time.

5.2.1.3.2 Groundwater Development Projects

As part of its effort to augment future water supplies, the Southern Nevada Water Authority has initiated plans to develop groundwater for which it holds rights and applications in Clark, Lincoln, and White Pine Counties (see Figure 5-1, Project #2). The groundwater proposed for development involves seven hydrographic areas. These hydrographic areas generally lie along the east side of the state from an area north of the Las Vegas Valley, north into Lincoln County, and then extending into White Pine County. One of the hydrographic areas involved in the plan is hydrographic area 181 (Dry Lake Valley), which is west of the City of Caliente. The proposed Caliente rail alignment would pass through hydrographic area 181. The proposed project would develop and convey about 250 million cubic meters (204,000 acre-feet) per year of groundwater through a series of water wells, pipelines, and other infrastructure. The groundwater planned for development includes both existing and future permitted water rights, as permitted by the Nevada State Engineer. Of the total annual water planned for development, the Southern Nevada Water Authority would produce about 210 million cubic meters (170,000 acre-feet) per year for use by its purveyor members in the Las Vegas Valley, and about 44 million cubic meters (36,000 acre-feet) per year for conveyance to the Lincoln County Water District under terms of a February 2006 cooperative agreement between the two entities (DIRS 178053-Southern Nevada Water Authority 2006, all). The project would also involve electricity substations, transmission lines, pumping stations, a water storage facility, and a water treatment facility.

Final locations for individual well fields, and the number of wells in each valley, have not yet been determined, but preliminary exploratory areas have been identified, and water rights applications have been submitted for some proposed new wells at some specific locations (described below) that could lie within the region of influence used for groundwater resources as determined through the impacts analysis. In August 2004, the Southern Nevada Water Authority filed an application with the BLM to obtain necessary rights-of-way for the proposed system of regional water supply facilities associated with the project. The BLM has begun development of an EIS (70 *FR* 18043, April 8, 2005) to identify and disclose the environmental effects associated with this project. Scoping for the project was originally conducted in 2005; however, because of refinements in project plans, scoping for the project was reopened in July 2006.

As described in Section 3.2.6.2, applications have been filed for a proposed irrigation well that would be within approximately 1.7 kilometers (1.1 miles) of a DOE-proposed well location in Dry Lake Valley (hydrographic area 181), and an application has been filed for a proposed municipal well that would be located within approximately 1.7 kilometers of a DOE-proposed new well location in Pahroc Valley (hydrographic area 208). Each application gives 5 years as the minimum time period required for the construction of works and an estimated time required to complete the application of water to beneficial use of 10 years, as of the date the application was submitted (either December 1998 or October 2005). Applications have also been submitted for proposed municipal wells that would be approximately 1.5 kilometers (0.9 mile) northeast of another DOE-proposed new well location in area hydrographic 208, and approximately 1 kilometer (0.6 mile) northeast of another DOE-proposed well location in hydrographic area 208, respectively (Section 3.2.6.2). Both applications are under request-for-proposal status and according to the applications, the minimum time for construction of works (pumping station, pipelines, reservoirs, and distribution system) is 20 years for each proposed well. Section 5.2.2.6 evaluates the potential for cumulative impacts if these proposed well applications were to be approved and the wells installed and pumped contemporaneously with the DOE-proposed groundwater withdrawals.

The Lincoln County Land Act Groundwater Development and Utility Right of Way Project would include a projected 8 production water wells in the Tule Desert hydrographic basin and up to 10 production water wells in the Clover Valley hydrographic basin, cumulatively producing over 28 million cubic meters (23,000 acre-feet) of groundwater per year. A system of pipelines would collect the pumped water for conveyance through a main transmission pipeline southeast to the Lincoln County Land Act development area near Mesquite. Associated facilities would include power distribution and transmission and communications lines to be placed in the utility right-of-way to provide power and communication for the project facilities. A natural gas pipeline would parallel the water pipeline from the existing Kern River Natural Gas pipeline. The BLM initiated an EIS on this project (71 *FR* 16340, March 31, 2006) to evaluate potential impacts associated with this project.

As described in Section 3.2.6.3.3 of this Rail Alignment EIS, an application has been filed for a proposed municipal well that would be approximately 1.2 kilometers (0.8 mile) southwest of a DOE-proposed new well location in Garden Valley (hydrographic area 172). The municipal well would have a proposed production rate of up to 10,200 liters (2,690 gallons) per minute and would operate year round. The application lists an estimated time to construct this new well of 5 years and lists the estimated time required to complete the application of water to beneficial use as 10 years, as of the date the application was submitted (October 2005). The current status of this well is listed by the Nevada Division of Water Resources as “Ready for Action.” Section 5.2.2.6 evaluates the potential for cumulative impacts if these proposed well applications were to be approved and the wells installed and pumped contemporaneously with the DOE-proposed groundwater withdrawals.

The Kane Springs Valley Groundwater Development Project would consist of up to seven water production wells along Kane Springs Road north of the Coyote Springs development site. The project is being proposed by the Lincoln County Water District, and would result in the groundwater withdrawal of about 6.17 million cubic meters (5,000 acre-feet) of groundwater per year. Ancillary facilities would include lateral pipelines, power distribution and communications lines, and access roads. The BLM initiated an EIS on this project to evaluate potential impacts associated with this project (71 *FR* 16340, March 31, 2006).

As with the other BLM EIS processes under way, BLM could not issue the necessary right-of-way grants for any of the water development projects, and the projects could not be initiated, until the EIS process was complete and the BLM decision was to allow the developments. In addition, the Nevada State Engineer must approve any proposed water production and grant approval for the use of groundwater for any project in Nevada (Nevada Revised Statutes, Chapters 532 through 538). The proposed rights-of-way for the proposed groundwater development projects are all based on terms of the Lincoln County Conservation, Recreation and Development Act of 2004 (see Section 5.2.2.6).

5.2.1.3.3 Union Pacific Railroad Operations

Under the Caliente Implementing Alternative evaluated in this Rail Alignment EIS, rail transportation of spent nuclear fuel and high-level radioactive waste would originate in or near the City of Caliente from the Union Pacific Railroad mainline track (see Figure 5-1, Project #8). The existing relevant portion of the Union Pacific Railroad track enters Nevada from Utah, with the track generally trending southwest into the Caliente area. From Caliente, the track continues southwest into Las Vegas. Union Pacific Railroad operations are well established in the area, and as of 2005, approximately 25 trains pass through Caliente each day on the Union Pacific Railroad track.

5.2.1.3.4 Coyote Springs Development Project

As outlined in Section 5.2.1.2.4, the BLM sold approximately 53 square kilometers (13,000 acres) of land in Lincoln County to a private entity, Coyote Springs Investment, LLC, which is in the process of turning the land into a housing development. The Coyote Springs Development Project would be a planned community about 80 kilometers (50 miles) north of Las Vegas (see Figure 5-1, Project #7). The planned development area consists of about 170 square kilometers (43,000 acres) in the Coyote Spring Valley. About one-third of the land held by Coyote Springs Investment, LLC, is in Clark County and two-thirds is in Lincoln County. As envisioned, the community would consist of a series of neighborhoods and villages located among open space corridors. Initially, the community focus would be on second-home development and development of a destination resort concept centering on golf courses. Over time, there would be more traditional community development, with ultimate development occurring over 40 years. Development would begin in the Clark County portion of the land, with plans for about 47,500 residential units, together with commercial and recreational facilities. The BLM stated that public services such as water, roads, law enforcement, emergency services, sewer, and power, must be established before home construction could begin on the land. Water for the potential new housing developments on the land might come from the Tule Springs area of Lincoln County. In addition, a new road from Caliente to Mesquite might be built to provide additional land access to these areas. The road would be about 130 kilometers (80 miles) long with a 30-meter (100-foot)-wide construction right-of-way. Coyote Springs Development, LLC, has not yet obtained water rights to provide for full build-out, and this could be a limiting factor for the development.

5.2.1.3.5 Other Regional Economic Development

Cumulative impacts issues associated with regional economic development actions include socioeconomic effects and overall growth in the region of influence. All of the counties and cities in the Caliente rail alignment region of influence have expressed a desire for economic development. The Lincoln County government is preparing for extensive growth (for example, Coyote Springs and population growth through BLM land disposals) with expansion of the county planning department, development of a Strategic Tourism Plan, and refinement of economic development strategies. Examples of Lincoln County economic development include the Meadow Valley Industrial Park and the Alamo Industrial Park (that would use land obtained through a BLM land disposal).

Nye and Esmeralda Counties also are pursuing growth and development opportunities. Economic development plans and tourism enhancement concepts have also been developed in those areas. Pahrump will continue to grow and urbanize with its proximity to Las Vegas. A perceived need for support to the Nevada Test Site has led to designation of the Nevada Science and Technology Corridor by the Economic Development Authority for Nye County. The Science and Technology Corridor extends from Indian Springs in Clark County in the south to Tonopah in the north, passing through the Pahrump Valley, Mercury (entrance to the Nevada Test Site), Amargosa Valley, Beatty and Goldfield, with industrial park and technology initiatives associated with the Tonopah Aeronautics and Technology Park, the Nevada Science and Technology Park in Amargosa Valley, and the Pahrump Center for Technology Training and

Development. The continuing BLM land sales and other development in the area indicate an increasing trend toward and desire for economic development, especially in Lincoln County. The locations and nature of specific future development opportunities are not known and are not considered to be reasonably foreseeable for the purpose of this analysis.

Nye County has completed a Yucca Mountain Project Gateway Area Concept Plan with proposed activities for the area around the entrance to the proposed repository site (DIRS 182345-Giampaoli 2007, all). This plan presents Nye County's conceptual, multi-phased land-use guidance for communities adjacent to and near the site entrance area. Nye County proposed this plan with the objective that land development occurs in an orderly and consistent manner and to increase opportunities for industrial and commercial development beneficial to the repository program. Nye County views this plan as a starting point for development of the infrastructure, institutional capacity, and facilities to support the proposed repository. The county developed the plan to use and manage existing initiatives while expanding and improving the area.

5.2.2 POTENTIAL CUMULATIVE IMPACTS – CALIENTE RAIL ALIGNMENT

Located in portions of Lincoln, Esmeralda, and Nye Counties, the Caliente rail alignment cumulative impacts region of influence covers millions of acres of land, most of which is BLM-administered public land. Most of the land in the Caliente rail alignment region of influence is undeveloped, although much of it has been affected by human activity such as ranching, mining, and recreation.

Potential cumulative impacts are often discussed herein within the context of the existing regulatory framework (primarily federal and state laws and regulations) and the BLM resource management planning goals and objectives. For example, the existing regulatory frameworks for water and air consider a regional and cumulative impacts perspective, in that regulatory decisions consider the potential effects from other projects and a proposed action. As the primary regional land manager, BLM planning and management actions consider the cumulative effects for many resources through stated planning goals and objectives, which often are based on quantitative criteria.

The following analysis of the cumulative impacts associated with the Caliente rail alignment is organized by resource area, with Sections 5.2.2.1 through 5.2.2.15 summarizing potential cumulative impacts in the same order of resource discussions in Chapter 4.

5.2.2.1 Physical Setting

5.2.2.1.1 Disturbance of Physical Resources

Physical resources consist of resources, conditions, and characteristics such as physiography, soils, and geology. As construction of any project in the area occurs, there would be a potential for changes to the physical setting because land would be disturbed through activities such as cuts and fills, and constructing new structures such as buildings and bridges. The proposed railroad would be one of many new sources of change to physical resources that would continue the trend of increasing land disturbance and modifications of the natural physical environment. In large-scale projects that involve substantial ground disturbance, natural features are considered in project design, construction, operations, and potential abandonment plans, which would tend to limit direct, indirect, and cumulative impacts. The proposed railroad would disturb only a small percentage of land in the Caliente rail alignment cumulative impacts region of influence.

Given the large amount of land potentially available for development of existing and reasonably foreseeable projects, and the small percentage of potentially available land required for the proposed railroad, overall cumulative impacts to physical setting in the Caliente rail alignment region of influence would be small.

5.2.2.1.2 Known or Potentially Contaminated Soils

The major sources of existing soil contamination in the Caliente rail alignment region of influence include mining and the Nevada Test Site. Mining activities in the region have occurred for many years, with mining wastes still remaining from older operations before the regulatory framework required waste management and clean-up. Nevada Test Site contamination has been described in recent NEPA documentation (DIRS 101811-DOE 1996, all; DIRS 162638-DOE 2002, all). Historic contamination of soils resources at the Nevada Test Site resulted primarily from radioactive-waste management sites and nuclear testing activities. Environmental restoration and remediation is occurring at contaminated Nevada Test Site locations in accordance with the facility's Environmental Restoration Program. For most of the contaminated soils within the Nevada Test Site boundary, DOE is planning a characterization and long-term monitoring program. Contaminated areas on the Nevada Test Site are generally defined and access is restricted for safety and security reasons. Spills of hazardous materials are possible from the projects described in this section; however, the current regulatory framework to manage and control hazardous materials and wastes ensures that actions are in place to minimize any impacts.

While any potential impacts associated with hazardous materials and wastes from current and future mining operations in the region are controlled through the existing regulatory framework, mining wastes from past mining extraction and processing activities, especially in the Goldfield area, remain a concern related to soil contamination.

The proposed railroad could result in very localized contamination of soils through occasional spills (such as fuel, oil, and solvents). However, such incidents would be minor in scope and quickly mitigated in accordance with plans and regulations. All existing and foreseeable projects would be subject to the same regulations. Cumulative impacts related to contamination of soils would likely be small.

5.2.2.2 Land Use and Ownership

5.2.2.2.1 Land Use Changes

Many of the past, present, and reasonably foreseeable future actions in the Caliente rail alignment region of influence result in land use changes. Changes in land uses can also alter land ownership, land management responsibilities, and preclude future activities from these areas. More than 97 percent of the land the proposed Caliente rail alignment and associated facilities would disturb is on BLM-administered land in Lincoln, Nye, and Esmeralda Counties. The BLM manages more than 55,700 square kilometers (13.7 million acres) in those three counties. One of the primary land uses in and around the proposed Caliente rail alignment on those BLM-administered lands is grazing. Regional grazing activities are often affected by BLM land management plans and activities.

Other existing and reasonably foreseeable major land uses in the Caliente rail alignment region of influence include:

- Yucca Mountain Repository – About 6.3 square kilometers (1,600 acres) of land disturbance, most of which would be on the Nevada Test Site (already withdrawn for Nevada Test Site activities).
- Nevada Test and Training Range – About 12,000 square kilometers (3 million acres) of land the U.S. Air Force has withdrawn for special-purpose use, with about 530 square kilometers (130,000 acres) of that land disturbed by Air Force tactical target complexes and associated infrastructure.

- Nevada Test Site – About 3,200 square kilometers (800,000 acres) of land DOE has withdrawn for special-purpose use (about 4.12 square kilometers [1,020 acres]) of this land would be used by the proposed Yucca Mountain railroad).
- Coyote Springs Development Project – About 170 square kilometers (43,000 acres) of land.
- Lincoln County Land Act of 2000 – Completed disposal of about 53 square kilometers (13,000 acres) of BLM-administered land.
- Lincoln County Conservation, Recreation, and Development Act of 2004 – Approved disposal of up to 360 square kilometers (90,000 acres) of BLM-administered land in Lincoln County (specific locations to be determined as part of the BLM Ely Resource Management Plan process; the Draft Ely Resource Management Plan (DIRS 174518-BLM 2005, all), includes alternatives and assessment for disposal of about 140 square kilometers (34,000 acres), with various linear rights-of-way of about 61 square kilometers (15,000 acres).
- Rights-of-way corridors that may be established when DOE and the BLM complete the Energy Corridor programmatic EIS (70 *FR* 56647, September 28, 2005).

The proposed Caliente rail alignment would disturb up to 165 square kilometers (40,000 acres) of BLM land, most of which would be within the construction right-of-way. Therefore, the proposed Caliente rail alignment would directly affect about 0.3 percent of the BLM-administered land in the three counties. This disturbance would include construction and operation of the proposed rail line, facilities, quarries, water wells, construction camps, and access roads. While the amount of disturbed land would be relatively small compared to the total amount of BLM-administered land, this disturbance could also result in indirect effects beyond the direct disturbance area.

Considering both the proposed railroad and existing and reasonably foreseeable land uses and land ownership, cumulative impacts from land-use changes would be small.

5.2.2.2.2 Existing or Potential Land-Use Conflicts

The Federal Government administers most of this land in the Caliente rail alignment cumulative impacts region of influence, with the BLM, DOE, and the U.S. Air Force acting as the major federal land managers. Private land holdings are small, and generally associated with the towns in the Caliente rail alignment region of influence. Traditional land uses in most of the Caliente rail alignment region of influence that would be directly and indirectly affected include grazing and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing.

Over time, human activity in the area, while relatively minor, has begun to change the natural and traditional conditions, and land-use conflicts occasionally result from this human activity. The Nevada Test Site and Nevada Test and Training Range lands have been withdrawn for special purpose and use. Both of these areas are inaccessible to the general public and land use is that of "dominant use," in which the specific DOE and U.S. Air Force missions, respectively, for these lands have ultimate priority over all other potential land uses. However, around these primary regional land uses are other uses, including mineral development, recreation, urban development, and rights-of-way for various infrastructure. All of these activities and land uses result from a much more intensive land usage involving human activity.

BLM land management goals allow for management of the land for special purposes (protection of cultural resources, wilderness designations or study areas, protection of wildlife habitat, or visual resource management), but with increasing development in the Caliente rail alignment region of influence there are more occurrences of land-use conflicts. As noted in Chapter 4 of this Rail Alignment EIS, construction and operation of a railroad along the Caliente rail alignment would have potential direct and indirect conflicts with grazing uses, access to grazing infrastructure, access to mineral resources, recreational resources, other linear rights-of-way (for example, utility corridors), and wildlife movement patterns in some locations. Potential land-use conflicts resulting from a railroad along the Caliente rail alignment would be similar in scope to some of the other linear rights-of-way proposed in the region of influence (such as water pipelines and transmission lines) but more extensive in scope compared to many of the other projects, which are generally smaller on a linear scale or at a specific location. Even with the existing and reasonably foreseeable land-use changes, the region as a whole would continue its traditional ways, with grazing and wildlife habitat as major land uses, and cumulative impacts related to land-use conflicts would be small.

5.2.2.2.3 Energy and Mineral Development

Existing and potential future energy and mineral development occurs in various locations throughout the Caliente rail alignment cumulative impacts region of influence. In addition to the traditional energy and mineral development (primarily hard-rock mining, industrial mineral development, and limited oil and gas development), more recently, this development includes geothermal resources and wind energy. The BLM administers energy and mineral development on public lands. Today's energy development environment includes a mix of old and new, involving both non-renewable and renewable resource development. Wind-energy development on the BLM-administered lands could be one of the biggest changes in the future landscape, because wind-energy opportunities are growing and the BLM-administered land is valued for possible wind-energy locations. Depending on the number and size of each new proposed wind-energy site, land requirements for development of this resource could be substantial.

Because of the scope and extent of typical mining operations, mineral resources that become actual operating mines could result in environmental and land-use issues. Within the Caliente rail alignment region of influence, most mining and energy-development activities would occur on federal lands, and the BLM will have a major role in mitigating and monitoring potential effects through its mining and reclamation requirements, NEPA, and other elements of the regulatory framework. Mineral exploration will continue to occur in many parts of the Caliente rail alignment region of influence, and some level of conflict from mining exploration and development with other land uses could be unavoidable.

Any potential conflict of the proposed railroad with energy and mineral development would be small in scope and occur in localized areas, and the effects of any such conflicts would be mitigated through the existing regulatory framework and BLM policies and plans. All existing and foreseeable projects would be subject to regulatory requirements and BLM policies and plans related to energy and mineral development. Therefore, cumulative impacts resulting in land-use conflicts related to energy and mineral development along the Caliente rail alignment would be small.

5.2.2.2.4 BLM Land Sales and Other Disposals

The BLM has identified a number of land parcels in the Caliente rail alignment region of influence that have been or will be removed from government ownership and disposed of through auctions or agreements with local governments. These BLM land disposals will continue, and will either directly or indirectly, enhance the potential for growth and urbanization in the Caliente rail alignment region of influence, as the land is changed from generally undeveloped to private lands available for residential or other development, or to government lands available for utility corridors, airports, or parks.

In many cases, these BLM land disposals would result in permanent land-use changes. With private land at a premium in the area, private-sector developer interest in the BLM land disposals will likely continue. These changes in land use could cause increasing urbanization and economic development in the Caliente rail alignment cumulative impacts region of influence.

While the proposed railroad would operate within the regional context of BLM land disposal efforts and any related implications and effects, it would have no affect on, nor would it be affected by, BLM land disposal efforts.

5.2.2.2.5 Recreational Land Use

Public lands in the Caliente rail alignment region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as recreation management areas. Demand for recreation is increasing as more people move to and recreate in the Caliente rail alignment cumulative impacts region of influence. Dispersed recreation, the principal opportunities available within the Caliente rail alignment region of influence, requires a variety of sites but needs no special facilities. These opportunities include caving, photography, automobile touring, backpacking, bird watching, hunting, primitive camping, hiking, rock climbing, and competitive and non-competitive off-highway vehicle events. Water-based recreation in the Caliente rail alignment region of influence is extremely limited. Increased demand for off-highway vehicle use from the increasing regional population, including the Las Vegas area, has been noted and is expected to continue. Many areas of BLM-administered land in Clark County previously used for off-highway vehicle recreation have been closed, causing a shift in use into the BLM Ely District. As growth and development occur in the Caliente rail alignment cumulative impacts region of influence, recreational resources will continue to be in demand, but the potential for conflict with recreational resources also will increase. Recreational resource locations, quality, and availability will evolve as the Caliente rail alignment region of influence changes.

The Lincoln County Conservation, Recreation, and Development Act of 2004 (Public Law 108-424) included such recreation initiatives as the designation of wilderness areas and the Silver State Off-Highway Vehicle Trail. Table 5-3 lists the wilderness designations, and the amount of land designated as wilderness area in Lincoln County. The wilderness-area designations provide wilderness characteristics such as solitude, primitive conditions, and unconfined recreation in these areas. DOE has sited the proposed Caliente rail alignment to avoid wilderness areas.

Table 5-3. Lincoln County wilderness designations from Public Law 108-424.

Wilderness Area	Designated as wilderness (square kilometers)[a]
Weepah Springs	210
Worthington Mountains	130
Big Rock	57
Mt. Irish	130
South Pahroc Range	100

a. To convert square kilometers to square miles, multiply by 0.38610.

The BLM has a major role in recreation opportunities in the Caliente rail alignment region of influence. BLM field offices are evaluating opportunities for new Areas of Critical Environmental Concern and Special Recreation Management Areas that would provide both passively and actively managed recreation opportunities. There are substantial management efforts to focus off-highway recreation opportunities to appropriate designated areas. For example, the Silver State Off-Highway-Vehicle Trail is a 420-kilometer (260-mile) combination of existing backcountry roads that are currently open and being used by off-highway vehicle enthusiasts. The Lincoln County Conservation, Recreation, and Development Act of 2004 provided for the creation of a Silver State Trail Management Plan to minimize impacts on natural resources and to protect cultural and archaeological resources. The Act also provides for the temporary closure of the Trail in the event that there are unintended adverse impacts on resources associated with the Trail. The proposed Caliente rail alignment would intersect the Silver State Off-Highway-Vehicle Trail in three places; however, the BLM and DOE could effectively manage those intersections.

Cumulative impacts to access to and use of recreational resources along the Caliente rail alignment would be small.

5.2.2.2.6 BLM Rights-of-Way

As urbanization and other development occurs in the Caliente rail alignment region of influence, the need for utility and other rights-of-way will increase. This has already begun to occur and will likely continue in the future in various parts of the Caliente rail alignment cumulative impacts region of influence. The BLM has developed certain preferred corridors over federal lands that it uses to the maximum extent possible for linear rights-of-way, such as for utilities. This keeps many right-of-way purposes together in one location instead of spreading them out over more dispersed areas. However, the BLM also acknowledges the need for exceptions to these standard rights-of-way locations. *Approved Caliente Management Framework Plan Amendment and Record of Decision for the Management of the Desert Tortoise* (DIRS 174200-BLM 2000, p. 27) states that the BLM would "[g]rant power distribution lines 69 kilovolt or less, local telephone, water distribution pipelines and facilities, local fiber optic loops and cable lines outside of designated corridors on a case-by-case basis." Proposed other future projects involving pipelines, railroads, transmission lines, etc., would all change land uses along a linear route if approved through the BLM right-of-way approval process. The BLM also has seen increasing demand for nonlinear rights-of-way, and will continue to grant rights-of-way for these nonlinear projects such as power plants, construction camps, and communication-tower sites.

The land use changes authorized by a BLM right-of-way grant would also have the potential to impact other resource areas as those land-use changes occur. Before approval of right-of-way applications, the BLM will evaluate the impacts of the projects through appropriate NEPA evaluation. Use of land for right-of-way purposes is consistent with BLM regulations and planning processes, and any land-use changes or disturbances associated with those rights-of-way are mitigated to the extent possible and according to BLM policies. As required for the issuance of rights-of-way, the project proponent would prepare and submit to the BLM a Plan of Development for each proposed right-of-way. The Plan of Development would describe the methods and procedures to be used to construct the proposed action on the right-of-way, including site-specific stipulations, terms, and conditions to satisfy all BLM requirements. Certain rights-of-way are long-term in nature and result in unavoidable impacts through land disturbance and the exclusion of other land uses now or in the future.

Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. Land areas for the Caliente rail alignment, construction camps, quarries, and access roads would cross or overlap up to 34 existing or proposed utility rights-of-way. Land areas for the proposed railroad facilities could also overlap existing or proposed utility rights-of-way. This situation would be typical for other linear rights-of-way. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Cumulative impacts to BLM rights-of-way and right-of-way holders would be small.

5.2.2.2.7 Other BLM Land-Management Actions

The Federal Land Policy Management Act of 1976 (Public Law 94-579) mandates the BLM to manage its public lands from a multiple-use perspective. The Federal Land Policy Management Act specifically mentions balancing renewable and non-renewable resources, including but not limited to recreation, range, timber, minerals, watershed, wildlife, fish, natural, scenic, scientific, and historic values. Therefore, the BLM mission to manage the lands to meet multiple-use objectives is challenging, because many of the resources and associated values often conflict.

Within the context of the Caliente rail alignment cumulative impacts region of influence, the BLM planning process and management goals and objectives within their plans are key determinants of the compatibility of the proposed Caliente rail alignment with other projects in the Caliente rail alignment region of influence. Because the BLM is and will remain the major land manager in and around the Caliente rail alignment region of influence, BLM land-management goals, objectives, and subsequent land-management actions will largely determine if and how new projects and activities occur.

BLM objectives and goals within the resource management plans can serve to encourage or restrict activities in certain locations. Areas needing special management attention (such as Areas of Critical Environmental Concern) are also identified in the planning process to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. Multiple-use management goals and objectives become more challenging as cumulative development and land-use changes encroach on open land in the Caliente rail alignment region of influence.

The proposed Caliente rail alignment would cross several BLM planning areas. The Las Vegas and Tonopah Resource Management Plans and the Schell and Caliente Management Framework Plans (within the Ely planning district) would be applicable to the proposed location of the Caliente rail alignment. The Ely BLM Field Office is currently preparing an updated Resource Management Plan, which would replace the Schell and Caliente Management Framework Plans when formally adopted. When finalized, the Ely District Resource Management Plan will serve as the initial effort to implement the Eastern Nevada Landscape Restoration Project, which is eastern Nevada's regional program to put into practice the national BLM priority to revitalize the ecological condition of the Great Basin through the Great Basin Restoration Initiative.

These programs and resource management plans require a number of public and private partnerships and a collaborative approach to land management and planning. Grazing operations are a major BLM land-management program in the Caliente rail alignment region of influence. Grazing results in both direct and indirect cumulative impacts to vegetation, habitats, and wildlife in the Caliente rail alignment region of influence. The environmental impacts associated with grazing operations are a function of the location, timing, intensity, duration, and frequency of grazing. Grazing animals directly affect plant communities through trampling and nutrient redistribution. The most noticeable impacts occur around waters, salt blocks, fence lines, and other areas where animals concentrate. With proper grazing management, these concentration areas are limited in extent and mitigated regularly through management procedures such as movement of salt blocks and water hauls. While grazing can stimulate growth of some plants and provide other benefits, it can also reduce plant abundance, density, and vigor, especially in sandy soils.

Ultimately, BLM land management efforts and content of the resource management plans will play a major role in the magnitude, location, and extent of direct, indirect, and cumulative impacts in the Caliente rail alignment region of influence, and in the relative balance among multiple uses and resource values chosen for the public lands. DOE recognizes the importance of these land management actions and encourages readers to review specific resource management plans for more detailed information.

5.2.2.2.8 Urbanization and Economic Development Initiatives

Even without the increased urbanization and economic development caused by the BLM land disposals or expansion of the Las Vegas metropolitan complex northward into the Caliente rail alignment cumulative impacts region of influence, the urbanized areas in the Caliente rail alignment region of influence have generally planned for and solicited ways to grow and increase urbanization. Concepts such as industrial-park development, airport expansion, increased retail opportunities, and housing are prominent goals of the public and private sectors in the Caliente rail alignment region of influence.

The Coyote Springs development and the Toquop Township (24 kilometers [15 miles] northwest of Mesquite in southern Lincoln County) are examples of major potential community development sites. The Coyote Springs development has entered its initial development phase and is planned to include a full suite of homes, zoning regulations, services, and infrastructure in direct association with the BLM land sales of the 53 square kilometers (13,000 acres) of public land resulting from the Lincoln County Land Act of 2000. This trend is likely to continue, with land-use and ownership changes and potential land-use conflicts becoming an increasing issue and challenge for the future.

With or without the proposed railroad, urbanization and economic development activities, while increasing, would not generally change the overall undeveloped character of the Caliente rail alignment region of influence.

5.2.2.3 Aesthetic Resources

Cumulative impacts to aesthetic resources from the proposed railroad and other regional activities would primarily result from modifications to natural ***viewsheds***. The natural setting of the Caliente rail alignment region of influence includes vast and expansive viewsheds typical of much of the western United States. The open spaces and wide vistas offer interesting cloud, weather, and landscape interactions. Human activity disturbs the natural viewsheds with land disturbances such as buildings, roads, removal of vegetation, power lines, equipment, and vehicles. Any activity that disturbs substantial areas of land can result in visual impacts from fugitive dust and ground scars. Additionally, most man-made structures are designed and built for their functionality and safety, not for their visual appeal. For example, projects with construction-related equipment, facilities, and activities can include the presence of workers, camps, vehicles, machinery, lay-down yards, and dust.

The presence of the railroad would be an identifiable change to the regional viewsheds from some observation points and provide a noticeable contrast with natural visual attributes. The passage of a train would attract the attention of an observer, both because of the noise associated with the train and the change in the landscape, especially if the train were to fall in the foreground or middle ground of the viewshed. Visual impacts of passing trains would be temporary, but visual impacts of the track would be long-term.

Visual resources within the region of influence have been considered through application of the BLM Visual Resource Management System (see Sections 3.2.3 and 4.2.3 and Appendix D of this Rail Alignment EIS). This system identifies and classifies the BLM-administered lands within established visual resource objectives, and proposed activities are evaluated within the visual resource management framework to consider consistency with the visual resource objectives. Without restoration and reclamation efforts, ground disturbances in the regional environment would last for long periods. The magnitude and extent of potential visual impacts vary based on the number of viewers affected, distance and atmospheric conditions of viewing, degree of visual contrast compared to existing visual attributes, viewer sensitivity to the visual changes, and compatibility with existing land uses. BLM generally requires ground disturbances to be restored and reclaimed as part of project approval.

For the Caliente rail alignment, analysis using the BLM Visual Resource Management System indicated that the proposed railroad could be inconsistent with visual resource management objectives in the areas of the Caliente-Indian Cove Staging Yard during construction, in Garden Valley during railroad construction and operations, and in some other sites of rock cuts and fills during construction and operations. As shown in Appendix D, lands that have potential restrictive visual resource objectives (Classes I and II) are not prevalent in the region of influence.

There would be no known interactions of the proposed railroad with other reasonably foreseeable activities that would affect a Class I or Class II area in the Caliente region of influence.

5.2.2.4 Air Quality and Climate

Emissions of concern in the Caliente rail alignment region of influence include ***fugitive dust*** and emissions resulting from the operation of machinery and equipment. Construction activities such as surface disturbance and use of haul trucks in the Caliente rail alignment region of influence would generate fugitive dust. Fugitive dust is a type of nonpoint source air pollution (small airborne particles that do not originate from a specific point). These ***particulate matter*** emissions are regulated according to their size (aerodynamic diameter equal to or less than 2.5 micrometers [$PM_{2.5}$] and 10 micrometers or less [PM_{10}]). Fugitive dust is generally controlled through the application of water, or in some cases, application of a chemical compound designed to minimize dust emissions. Most of the projects and activities identified in this analysis would generate some level of fugitive dust. The plumes associated with fugitive dust generation are often localized to the area being disturbed and are temporary. In arid areas such as the Caliente rail alignment cumulative impacts region of influence, generation and control of fugitive dust will always be a concern. Exhaust emissions from the operation of machinery and equipment include sulfur dioxide, oxides of nitrogen, volatile organic compounds, and carbon monoxide.

There is a comprehensive air quality permitting system in Nevada to evaluate and approve only those projects that are allowable within quantitative air quality thresholds. The Nevada Division of Environmental Control, Bureau of Air Pollution Control, has established and implemented air pollution control requirements in Nevada Revised Statutes 445B.100 through 445B.825, inclusive, and Nevada Revised Statutes 486A.010 through 486A.180, inclusive. The Bureau of Air Pollution Control has jurisdiction over air quality programs in all counties in the state except Washoe and Clark. The Bureau of Air Pollution Control also has jurisdiction over all fossil fuel-fired units in the state that generate steam for electrical production. The Caliente rail alignment would be subject to the permitting requirements noted above, and would occur in air basins that are either in attainment or unclassifiable. The State of Nevada will not grant permits for activities that cannot show compliance with the applicable federal and state regulations will not be permitted.

The air quality impact analysis for the Caliente rail alignment assessed potential impacts through several means including air quality modeling of maximum concentrations relevant to National Ambient Air Quality Standards. The analysis concluded that emissions during construction or operation of the rail line or any associated facilities would be in conformance with applicable standards with the possible exception of the 24-hour National Ambient Air Quality Standards for PM_{10}, which could be exceeded from quarry operations at South Reveille Valley during the construction phase. DOE would be required to prepare an application for a Dust Control Permit and a Surface Area Disturbance Permit Dust Control Plan and submit them to the Nevada Division of Environmental Protection Bureau of Air Pollution Control prior to quarry development. It is likely that the requirements of the plan would greatly reduce fugitive dust particulate matter emissions, thus reducing the possibility of exceeding National Ambient Air Quality Standards.

Potential cumulative impacts to air quality from construction and operation of the proposed railroad along the Caliente rail alignment would be small, but could approach moderate if the potential violation of the National Ambient Air Quality Standards noted above occurred.

5.2.2.5 Surface-Water Resources

5.2.2.5.1 Changes in Drainage, Infiltration Rates, and Flood Control

Construction of major projects in previously undeveloped areas often results in changes to natural drainage. Construction could include regrading that would allow runoff from a number of minor drainage channels to collect in a single culvert or pass under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. This would cause some localized changes in drainage patterns, but this probably would occur only in areas where natural drainage channels are small. Compaction of soil during construction could reduce water infiltration rates and change natural runoff and drainage patterns. However, some activities would disturb and loosen the ground for some time, which could cause higher infiltration rates.

Construction in washes or other flood-prone areas probably would reduce the area through which floodwaters naturally flow. This could result in water building up, or ponding, on the upstream side of crossings during flood events, and then slowly draining through the culverts or bridges. These alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the impact of floods on human health and safety, or cause significant harm to the natural and beneficial values of the floodplains.

One special area of drainage/flooding concern, however, involves the Meadow Valley Wash area near the City of Caliente. The Caliente alternative segment would start next to Meadow Valley Wash in an area where the wash is joined by Clover Creek, and travel up Meadow Valley alternatively running adjacent to, or crossing the wash. The Federal Emergency Management Agency has studied Meadow Valley Wash, Antelope Canyon Wash, and Clover Creek Wash for flooding potential within the corporate limits of the City of Caliente and for some portions of Lincoln County. One-hundred-year water surface elevations and regulatory floodways have been established for these watercourses within the area studied. Encroachment into the floodway is prohibited unless it can be determined that such an encroachment into the floodway portion of the floodplain does not cause any increase in the water surface elevations for these watercourses. The area has a history of flooding events that can affect the roads, trails, and Union Pacific rail lines. In January 2005, a substantial flooding event occurred in the Meadow Valley Wash area. The BLM is currently involved in a multi-agency evaluation of remedial actions to avoid drainage/flooding issues in the area. The presence of the proposed railroad in this area has raised concerns about the potential interaction of railroad operations with future flooding events; these concerns and issues are currently being evaluated through the multi-agency evaluation and appropriate measures to reduce direct, indirect, or cumulative impacts would be identified through that process.

Overall effects would generally be localized to each specific project, and these concerns and potential impacts are factored into project design considerations as standard engineering and construction operating procedures. While cumulative impacts would be small, the risks and localized impacts from a flood event such as that experienced in the Meadow Valley Wash area in 2005 cannot be totally eliminated.

As a long linear project of up to 541 kilometers (336 miles) long (DIRS 180916-Nevada Rail Partners 2007, Table E-2), a rail line along the Caliente rail alignment would pose new surface drainage challenges because of the existing characteristics of terrain, topography, soils, and physical features. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the rail roadbed (subgrade) and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and to allow movement of equipment to the construction initiation points.

Project planning and best management practices would help avoid or reduce potential impacts from the proposed railroad or other ongoing or reasonably foreseeable future actions. Potential cumulative impacts due to changes in drainage, infiltration rates, and flood control would be very small and localized.

5.2.2.5.2 Spill and Contamination Potential

Major construction activities and other projects in the region of influence would use materials including petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to operate construction equipment, and could include solvents used in cleaning or degreasing actions. A release or spill of contaminants to a stream or river would have the greatest potential for adverse environmental impacts; a release of contaminants to dry impermeable soil would have the least potential for adverse impacts. Spill-control and management plans (and standard operating procedures for the construction industry) would reduce the likelihood of spills. Railroad construction and operation along the Caliente rail alignment would be typical of major activities that use materials that could cause contamination through spills.

While the risk of a spill and associated water contamination cannot be totally eliminated, risks can be managed through regulatory controls so that the resulting cumulative impacts would be small.

5.2.2.6 Groundwater Resources

Increasing urbanization and other development in the Caliente region of influence presents the challenge of matching water supply with water demand. Because water availability is a potential resource constraint in the Caliente rail alignment region of influence over time, water demand can be both competitive among potential users and controversial among users and the general public. To allocate water uses, the State of Nevada uses a water permit application process coordinated by the State Engineer. Once granted, water rights in Nevada have the standing of both real and personal property. It is possible to buy or sell water rights and change the water's point of diversion, manner of use, and place of use by filing the appropriate application with the State Engineer. Overall, because the water permitting and allocation process considers the broad range of factors noted above, the process serves as a way to manage potential cumulative impacts of water demand and use within each basin.

Representative existing and reasonably foreseeable water users in the Caliente rail alignment region of influence include:

- Agriculture, which consumes the most water in the Caliente rail alignment region of influence. Based on groundwater usage data compiled by the U.S. Geological Survey, during calendar year 2000, approximately 46 percent of groundwater withdrawals in the State of Nevada were for irrigation, about 26 percent were for mining purposes, and the remainder were for drinking-water systems, geothermal production, and other uses.
- The Toquop power plant, the FEIS for which (DIRS 174208-BLM 2003, all) estimates future water needs associated with a portion of recent BLM land dispositions and the Coyote Springs residential development (at build out) to be roughly 140 million cubic meters (115,000 acre-feet) per year.
- The Clark, Lincoln, and White Pine Groundwater Development Project (Southern Nevada Water Authority) (DIRS 175909-Hafen et al. 2003, all), which would result in water withdrawal and transfer of up to 250 million cubic meters (200,000 acre-feet) per year.
- The combined effects of the Lincoln County Land Act Groundwater Development Project and the Kane Springs Valley Groundwater Development Project (DIRS 175909-Hafen et al. 2003, all), which would produce more than 35 million cubic meters (28,000 acre-feet) of water per year for conveyance to other locations.

- Groundwater withdrawals, which if approved, would be associated with the specific water-rights applications that have been submitted for proposed new municipal or irrigation wells in hydrographic areas 181, 208, and 172 (see Section 5.2.1.3.2).
- Recently constructed or planned power plants (water-cooled) in the Apex and Moapa areas, which require about 8 million to 9 million cubic meters (6,500 to 7,000 acre-feet) of water per year. The air-cooled power plants in those areas require less than 123,000 cubic meters (100 acre-feet) of water per year.
- The Nevada Test Site, which uses about 830,000 cubic meters (673 acre-feet) of water per year.
- Grazing activity in the 38 allotments around the proposed Caliente rail alignment, which demands about 600,000 cubic meters (500 acre-feet) of water per year.
- The Yucca Mountain Repository, which would have demands ranging from about 218,000 to 527,000 cubic meters (176 to 427 acre-feet) of water per year between calendar years 2010 and 2013 (this represents the period of the highest water demand for the proposed railroad project). The Repository would use approximately 76,700 to 397,000 cubic meters (62 to 322 acre-feet) of water per year in calendar year 2014 through completion of operation.

Excluding the large agricultural water use in the Caliente rail alignment region of influence, cumulative water use for the projects described above could total more than 430 million cubic meters (350,000 acre-feet) per year. Overall, the share of water that would be committed to construction and operation of the proposed railroad would represent a small portion of water use in the Caliente rail alignment region of influence, which would still be dominated by agriculture. Committed groundwater resources already exceed annual perennial yield values (a measure of available groundwater supply replenished each year through recharge) within some of the groundwater basins (hydrographic areas) that would be affected by the proposed railroad. Based on the proposed locations of new wells in specific hydrographic areas along the Caliente rail alignment, additional groundwater appropriations would be needed in 19 hydrographic areas. However, committed (cumulative) groundwater resources currently exceed estimated perennial yields in eight of these hydrographic areas (146, 149, 170, 173A, 203, 204, 228, and 229). One of these eight hydrographic areas (229) and two other hydrographic areas (144 and 145) the rail would cross have low perennial yields. Five of these areas are State of Nevada-designated groundwater basins. While designated groundwater basins are not considered closed to additional appropriations, the State Engineer could impose additional restrictions and preferred uses of the water in these designated basins.

A number of scenarios have been developed to assess the potential effects of the proposed Caliente rail alignment's contribution to cumulative water demand in the Caliente rail alignment cumulative impacts region of influence. The assumption used for developing these scenarios is that proposed railroad construction and operation and associated quarry and rail facility construction and operation water demands would be met through installing and withdrawing groundwater from new wells. Pumping in individual wells would occur primarily over 9 months to support construction, over 2 to 3 years at quarry sites, and over the rail system operational period for the rail facilities. Total water withdrawals associated with the proposed railroad could substantially exceed annual perennial yield values for hydrographic areas 145 and 229, and could represent approximately 99 percent of the annual perennial yield in hydrographic area 227A. In other areas, water withdrawals associated with the railroad could range from less than 1 percent to as high as 57 percent of the annual perennial yield value.

A proposed new irrigation well in Dry Lake Valley would have an average pumping rate of approximately 17,000 liters (4,488 gallons) per minute and the would operate year round This application is currently under protest. If this well application were to be approved and the well installed and used contemporaneously with a nearby proposed well location (location DLV3), analysis results indicate that the proposed new DLV3 well location would lie within the radius of influence of this irrigation well and the DLV3 well location would therefore not be viable. In that event, DOE could obtain the water required from one or more alternative proposed well locations from which the simultaneous pumping from that well location or locations and the proposed municipal well would not impact each other's operation, water could be obtained from an existing water rights holder, or one or more other best management practices could be implemented to preclude cumulative impacts from occurring.

The proposed new municipal well that would be northeast of a DOE-proposed new well location (PahV9) in Pahroc Valley would have an average pumping rate of up to 10,200 liters (2,690 gallons) per minute, and would operate year round. If this municipal well application were to be approved and the well installed and used contemporaneously with the DOE-proposed well(s) at location PahV9, analysis results indicate that, depending on the transmissivity (hydraulic conductivity) of the host consolidated rock unit aquifers involved, withdrawal of groundwater at a rate of up to approximately 920 liters (244 gallons) per minute from an equivalent single well at the PahV9 could either not, or might, impact pumping operations at the proposed new municipal well location, and vice versa. The 920-liter-per-minute pumping rate used in the analysis comprises the total withdrawal rate required for well locations PahV7, PahV8, and PahV9 combined and, therefore, represents a very conservative assumption. If hydraulic conductivities of the host aquifers are similar to values estimated in some published reports (such as DIRS 176852-Drici et al. 1993, p. 56), the proposed municipal well and the DOE-proposed well(s) at location PahV9 would not be expected to impact each other's operations if the two well locations were to be pumped simultaneously and the average pumping rate at location PahV9 were as high as 924 liters (244 gallons) per minute. Alternatively, if host aquifer hydraulic conductivity values were lower, if necessary, the average pumping rate imposed at location PahV9 could be restricted to a sufficiently low value (with the remainder of the required water acquired from locations PahV7 and/or PahV8), some of the required amount of water could be obtained from an existing water rights holder, if needed, or one or more other best management practices could be implemented to preclude potential impacts resulting from simultaneous groundwater withdrawals from the PahV9 location and the proposed new municipal well location.

Water rights applications have been submitted for two proposed municipal wells that would be approximately 1.5 kilometers (0.9 mile) northeast of, and approximately 1 kilometer (0.6 mile) northeast of, two DOE-proposed new well locations in hydrographic area 208, respectively. These water rights have not yet been granted and given the relatively long timeframes (20 years) estimated for completing the infrastructure components required for these wells, even if the applications were approved, these wells would likely be placed into use at a time beyond the proposed railroad projected 4- to 10-year construction phase. Therefore, DOE did not evaluate potential cumulative impacts from these proposed future municipal supply wells.

A water rights application has been submitted for a proposed municipal well that would be approximately 1.2 kilometers (0.8 mile) southwest of a DOE-proposed new well location (GV10) in Garden Valley (hydrographic area 172). At present, the Nevada Department of Water Resources lists the status of this well as "Ready for Action." The well has an estimated time to construct of 10 years. If this well application were to be approved and the well installed and used contemporaneously with the DOE-proposed GV10 well(s), the GV10 well location would lie within the radius of influence of this municipal well; therefore, the GV10 well location would not be viable. In that event, the Department could (1) obtain the required water from one or more alternative DOE-proposed wells from which the simultaneous pumping from that well(s) and the proposed municipal well would not impact each other's operation; (2) obtain water from an existing water rights holder; or (3) or implement one or more other best management practices to preclude cumulative impacts.

By utilizing one or more specific approaches or a combination of approaches for obtaining groundwater for construction of the proposed railroad (including approaches that are tailored to a hydrographic area's unique groundwater conditions), potential cumulative impacts to groundwater resources would be minimized. New groundwater withdrawals could, depending on the withdrawal rate; the hydrogeologic conditions present at the proposed pumping location and in the surrounding area; and the location and characteristics of nearby groundwater resource features, cause some decrease in the amount of water that might be available to an existing well having an associated water right, to an existing spring discharge, or to a downgradient groundwater basin.

Overall, the needs of the proposed railroad would represent a small portion of the current cumulative water usage within the Caliente rail alignment region of influence, which in some locations would continue to exceed perennial yield values.

5.2.2.7 Biological Resources

5.2.2.7.1 Habitat Loss and Fragmentation

The past, present, and reasonably foreseeable future actions in the Caliente rail alignment cumulative impacts region of influence would result in noticeable cumulative land disturbance. Existing activities such as the Nevada Test and Training Range and the Nevada Test Site have already resulted in land disturbance, and projects such as the various proposed rights-of-way and the Coyote Springs development would continue this trend. Such land disturbances result in altered natural biological and ecological conditions, and directly serve to reduce the amount of natural land available as habitat and open space.

The primary adverse construction-related impacts to vegetation communities from ground disturbance are the physical destruction or removal of the vegetation, and the permanent or temporary removal or compaction of the topsoil or other growing medium for the plants. These effects would occur with any major activity resulting in ground disturbance, including the proposed railroad. As more activity occurs, the cumulative loss of vegetative communities and associated habitats would increase. Management of these effects would typically be considered in project planning and mitigation, including projects on BLM-administered land. Much of the emphasis in land management in the Caliente rail alignment region of influence concerns the maintenance or reconstruction of healthy habitats.

Habitat destruction leads to direct impacts such as wildlife injury and mortality, alteration of behavior and movement patterns, and the indirect impacts of reduced vegetative health, reduced biological diversity, and locally degraded ecological function. When extensive habitat fragmentation occurs, the individuals or populations of particular species may have difficulty surviving. Habitat destruction arises from a number of sources, including projects that involve land disturbance, land management actions including wild horse and burro management. Though any project that causes disturbance of vegetation contributes to habitat fragmentation, linear projects that impose any degree of impediment to movements, like the proposed railroad, amplify the potential effects. A number of utility and water rights-of-way are anticipated in the eastern portion of the proposed Caliente rail alignment, with many of these crossing the Caliente rail alignment.

Measures to avoid, minimize or otherwise reduce impacts are typically implemented by project proponents and encouraged by government agencies and generally include actions to reduce or avoid habitat fragmentation and loss. Such actions would include minimizing land disturbance, using existing roads, interim reclamation, combined roads/utility rights-of-way for pipelines and cables, noise reduction, centralization of facilities, and employee training and education.

In areas proposed for railroad operational purposes, the impacts to vegetation would typically be moderate in scope, and cumulatively add to habitat loss and fragmentation. However, in areas slated for short-term use during construction, such as construction camps, revegetation and reclamation efforts would result in replacement of topsoil, reseeding of native species, monitoring for success, and eventual return of a native vegetation community somewhat comparable to predisturbance conditions.

Cumulative impacts due to habitat loss and fragmentation would be small to moderate through the construction and operations phases throughout the Caliente rail alignment region of influence.

5.2.2.7.2 Invasive Species and Noxious Weeds

Invasive species and noxious weeds naturally move into new areas over time, but this occurrence has been accelerated in many areas through human activity, either intentionally or by accident. In many cases these plants have been moved into North America from another continent. They have been accidentally introduced through contaminated grain or hay, or sometimes intentionally introduced for erosion control or as ornamentals. In addition, livestock and vehicles can cause invasive species and noxious weeds to spread, birds could carry seed, or the species can be brought in with contaminated fill dirt. Regardless of how they were introduced, invasive species and noxious weeds possess characteristics that allow them to compete aggressively with native vegetation. Invasive species and noxious weeds impact native plants, animals, and natural ecosystems by:

- Reducing biodiversity
- Altering hydrologic conditions
- Altering soil characteristics
- Altering fire intensity and frequency
- Interfering with natural succession
- Competing for pollinators
- Displacing rare plant species
- Replacing complex communities with single-species monocultures

From a cumulative impacts perspective, any time land is disturbed and native vegetation is lost there is an opportunity for noxious weeds to replace the native vegetation. While the BLM and other land owners/managers in the area have implemented programs to minimize this potential, invasion of noxious weeds cannot always be prevented. Therefore, coordinated multi-agency management actions and efforts are needed to mitigate the effects from cumulative land disturbance. Management of noxious and invasive weeds is essential for restoration of native plant community health and resiliency. If noxious and invasive weeds were not managed, they would continue to gradually replace more desirable native species throughout the Caliente rail alignment region of influence.

Linear disturbances such as pipelines, roads, utility corridors, or rail alignments that cross relatively undisturbed land have the potential to exacerbate the spread of these species into areas not previously affected. As the invasive or noxious weeds become established along the linear features they spread to adjacent areas, affecting the plant and animal communities beyond the actual disturbance, and are able to out-compete native species by responding more rapidly to the infrequent availability of water.

These impacts could occur as a result of railroad construction and operation and from existing or foreseeable projects, but strict adherence to best management practices would reduce the potential for impacts. Cumulative impacts due to the introduction and spread of invasive species and noxious weeds would be small.

5.2.2.7.3 Special-Status Species

Habitat for several special-status species would be disturbed and individuals of several of the species could be killed or injured during construction and operation of the proposed Caliente rail alignment. Implementation of best management practices, making minor adjustments to site locations during final design, and conducting pre-construction clearance surveys would substantially reduce these potential impacts. Through the NEPA and permitting processes, each proposed project and land management planning effort in the Caliente rail alignment region of influence will face challenges for the protection of various special-status species. There are a number of special-status species that could be affected by cumulative impacts in the Caliente rail alignment region of influence. Recent attention has focused on several specific species, including the desert tortoise and greater sage grouse, as discussed below.

The Mojave population of the desert tortoise (*Gopherus agassizii*) is listed as threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531 to 1544). It is found within the proposed Caliente rail alignment only in the southwestern-most 48 kilometers (30 miles), from the Beatty Wash area to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 55 to 72). The desert tortoise is found in southern California, parts of southern Utah, and in the southern portions of Nevada, with the tortoises potentially affected by railroad construction and operation at the extreme northern extent of their range. While relative abundance of the tortoise is low in much of the Caliente rail alignment region of influence, every action that could disturb soil or vegetation within the tortoise's range has potential cumulative impacts of loss or fragmentation of the species' habitat or the direct mortality of individual desert tortoises,

The BLM resource management plans sometimes place restrictions on other activities (such as grazing, wild horse and burro abundance, off-road vehicle use, mineral activities) so that desert tortoise or other special status species habitat can be protected. However, off-road vehicle use, shooting, and collecting of individuals continue to affect tortoise populations. Habitat protection efforts for the desert tortoise are coordinated among a number of federal, state, and local governmental agencies, with the cumulative impact perspective a major factor in determining allowable impacts to the tortoise. Restoration plans and habitat conservation plans also affect the required mitigation measures, best management practices, and standard operating procedures for the protection of the desert tortoise or other special-status species.

In early 2005, the U.S. Fish and Wildlife Service completed its status review of the greater sage-grouse (*Centrocercus urophasianus*) throughout its range and determined that the species does not warrant protection under the Endangered Species Act at this time. The BLM would maintain habitats used by the greater sage-grouse in consideration of the priorities identified in the BLM National Sage-Grouse Conservation Strategy. This strategy considers that the greater sage-grouse has been substantially affected throughout the Great Basin by habitat loss due to residential development and the associated infrastructure; habitat degradation from heavy grazing, drought, and invasive and noxious weeds; habitat fragmentation from development of roads and other rights-of-way; and other activities throughout the Caliente rail alignment region of influence. A number of projects within the Caliente rail alignment region of influence, including the potential for wind-energy projects and associated infrastructure, have the potential to directly affect this species in a number of areas. The proposed Caliente rail alignment could pass near a small portion of previously used sage-grouse habitat, but it is not expected that the project would have direct, indirect, or cumulative impacts on this species.

Private landowners, corporations, state or local governments, or other non-federal landowners who wish to conduct activities on their land that might incidentally harm (or "take") wildlife listed as endangered or threatened must first obtain an incidental take permit from the U.S. Fish and Wildlife Service. To obtain a permit, the applicant must develop a Habitat Conservation Plan designed to offset any harmful effects the proposed activity might have on the species. Multi-species Habitat Conservation Plans are underway in two places in the Caliente rail alignment region of influence: (1) the Coyote Springs area and (2) in southern Lincoln County in the area of the recent BLM land disposal. Additionally, there is a single species (desert tortoise) Habitat Conservation Plan being developed in the Pahrump area of Nye County. These plans would support development of private lands while accounting for the potentially affected species.

No major effects on special status species are projected to result from construction and operation of the proposed railroad along the Caliente rail alignment. DOE would conduct any required consultation with the U.S. Fish and Wildlife Service in accordance with the Endangered Species Act. There is a substantial regulatory framework, to which all projects are subject, that serves to evaluate and protect special status species. Therefore, cumulative impacts to special status species would be small.

5.2.2.7.4 Wildfires

Wildfires are a major environmental concern throughout the Caliente rail alignment region of influence due to the generally dry climate and the increasing presence of invasive plant species. When they occur, wildfires have a significant and long-term impact on vegetation, wildlife, other natural resources, and human safety. The most important biological effects of fires include:

- Loss of native plant communities
- Decreased stability of watershed and soils
- Decreased or degraded wildlife habitat
- Increase in potential for invasive species spread
- Overall disruptions to ecological function

Sources of regional wildfires are both natural (for example, lightning) and human caused. With increased activity in the Caliente rail alignment region of influence, the potential for future human-caused fires increases. Because the BLM administers most of the land in the Caliente rail alignment region of influence, the BLM has primary fire-avoidance and fire-fighting responsibilities in the Caliente rail alignment region of influence.

Both the proposed railroad project and other reasonably foreseeable future actions would likely implement appropriate fire-avoidance strategies in consultation with the BLM. Potential cumulative impacts from wildfires would be small.

5.2.2.8 Noise and Vibration

5.2.2.8.1 Railroad Noise

The Union Pacific Railroad is the predominant ***Class I commercial railroad*** in Nevada and has operated in the state for many years. Noise associated with Union Pacific Railroad operations is part of the existing environment, specifically in the area of Caliente where the presence of the railroad is very evident. The sounds associated with the Union Pacific Railroad in and near the City of Caliente include wayside noise (noise generated by the cars and locomotives) and horn sounding. The individual operating rules of each railroad require train engineers to sound horns when approaching most grade crossings. Horn sounding is generally not required at private crossings. Wayside noise and horn sounding are common in Caliente and other portions of the existing Union Pacific Railroad routes.

The Toquop Energy Project could involve a new short rail spur of about 50 kilometers (30 miles) in an isolated part of Lincoln County south of Caliente. This spur would connect with the Union Pacific Railroad system but would be in an area that would not have any identifiable noise receptors.

Transportation of spent nuclear fuel and high-level radioactive waste casks along the Caliente rail alignment would result in as many as eight one-way trips per week. Train activity associated with supply and maintenance of the Yucca Mountain Repository is also proposed (as many as seven one-way trips per week), as is Caliente rail alignment maintenance activity (about two one-way trips per week), for a total of about 17 one-way trips per week. During construction, the completed portions of the rail line could also be used to deliver ballast to construction areas.

Potential noise impacts (as evaluated through noise modeling near Caliente, in Garden Valley, and in Goldfield) would be expected to be small. Construction and operation of a railroad along the Caliente rail alignment would introduce railroad noise into areas of the Caliente rail alignment region of influence that previously had none. This could result in annoyance for some people.

5.2.2.8.2 Urban Noise

As the population increases in Lincoln, Nye, and Esmeralda Counties, existing towns will grow and new residential areas will develop characteristics of more urban areas. Urban noise includes automobiles, construction activities, barking dogs, and other human activities generally within an identifiable community. At present, urban noise in the Caliente rail alignment region of influence is limited because there are only a few cities and communities. However, with economic development and growth goals throughout the Caliente rail alignment region of influence, the number and scope of urbanized areas is expected to increase. Urban noise is generally localized and is differentiated from aircraft and railroad noise sources, which move with the source from one location to another, while urban noise is within identifiable geographic borders associated with the locations of populations.

The proposed railroad would have a very small effect on urbanization in the area, and its effect on urban noise in the Caliente rail alignment region of influence would be small. Cumulative impacts related to urban noise would be small.

5.2.2.8.3 Aircraft Noise

Noise from aircraft engines and sonic booms is common throughout most of the Caliente rail alignment cumulative impacts region of influence, and can cause "startle" and annoyance effects. The noise associated with military aircraft is consistent with the "dominant use" of the area for military and defense-related activities at the Nevada Test and Training Range. Any noise effects associated with Nevada Test and Training Range missions would be considered necessary and unavoidable. Commercial air traffic also contributes to noise impacts in the region of influence.

The proposed railroad project would not contribute to cumulative aircraft noise.

5.2.2.8.4 Vibration

Vibration can be perceived on land surfaces and within buildings with certain types of activities. Construction activity is one of the more common sources of vibration, but railroad construction vibration would be very localized and typically minor in scope and duration. In the Caliente rail alignment cumulative impacts region of influence, other possible sources of vibration include occasional testing activities at the Nevada Test and Training Range and sonic booms from aircraft-related military activities in the airspace above the region of influence. These events would also tend to be short term and localized.

Cumulative impacts from vibration would be small.

5.2.2.9 Socioeconomics

The economy in the Caliente rail alignment cumulative impacts region of influence has traditionally been based on mineral development and livestock grazing. However, the economy in the region of influence is changing, just as land uses are changing. New economic drivers include services, retirement communities, and tourism, including recreation opportunities.

While the proposed railroad would be a major development in the Caliente rail alignment region of influence, its long-term economic development potential would be limited and would primarily be related to construction activities. This pattern of larger magnitude, short-term construction impacts followed by relatively small, long-term operations impacts for linear projects (for example, pipelines and transmission lines) is not uncommon in the Caliente rail alignment region of influence. If the Shared-Use Option were chosen and implemented, there would be greater potential for positive economic development benefits compared to the Proposed Action.

Population growth in the Caliente rail alignment cumulative impacts region of influence is projected to occur in existing residential areas such as Caliente and Tonopah, but also in new areas such as Coyote Springs and the BLM land-disposal areas in Lincoln County. It is uncertain if there is sufficient economic development growth potential in these areas to support all of the desired growth. It is possible that some areas would grow at the expense of other areas, or that recently developed plans for growth turn out to be unrealistic. Provision of housing to meet market demand is a private-sector activity, with the private-housing sector assumed to build to the needed level to meet housing demand at the appropriate locations. One of the factors that will affect how and where growth occurs is the availability of infrastructure to support the growth. Beyond the traditional infrastructure needs like roads, sewer, water, and public buildings, modern infrastructure such as the availability of fiber optic lines might also affect growth patterns. For example, the availability of fiber-optic lines or other high-technology infrastructure is likely to be a substantial growth discriminator for both businesses and individuals. The locations of and extent to which factors such as fiber-optic lines would ultimately affect growth cannot be projected at this time.

The recent and potential future BLM land disposals have the potential to provide land for private sector projects such as housing, industrial or commercial facilities, or other developments. In addition to the growth opportunities presented by the BLM land disposals, the proposed Coyote Springs community would be comprised of about 170 square kilometers (43,000 acres), about two-thirds of which would be in Lincoln County and one-third of which would be in Clark County). As envisioned, the development would be a series of neighborhoods with villages nestled between open-space corridors. It is planned to consist of both second-home residents and commuters to Las Vegas (about 80 kilometers [50 miles] away), with initial plans to focus on a role as a destination vacation location. At final build-out, the development could provide about 47,500 residential housing units. However, the development has not procured sufficient water rights for build-out, and the ability to reach its build-out objectives is primarily dependent on water availability.

As part of the Shared-Use Option analysis for this Rail Alignment EIS, the existing decisionmakers for Lincoln, Nye, and Esmeralda Counties, and the City of Caliente clearly stated their objective to grow and develop with additional business enterprises. Esmeralda County is working on a plan to relocate the Goldfield airport to a point west of the community, and develop a light industrial/manufacturing complex adjacent to the airport. The City of Caliente is working on the redevelopment of a 0.24 square kilometer (60-acre) industrial park south of the city, and Lincoln County is working aggressively to attract new business from Southern California and Las Vegas to the area.

The State of Nevada has developed population projections for the Caliente rail alignment cumulative impacts region of influence (DIRS 178807-Hardcastel 2006, all) as follows:

- Esmeralda County is projected to have a small decrease in population from 2005 to 2026
- Lincoln County is projected to add only about 2,000 persons from 2005 to 2026
- Nye County is projected to add more than 32,000 persons from 2005 to 2026

The Nevada State Demographer develops population projections for Nevada counties, which are always subject to change with new information. For example, the full potential growth from Coyote Springs and the BLM land disposals in Lincoln County over the next 20 years would increase population growth beyond the State Demographer's projections for Lincoln County.

Nye County's projected growth continues a recent trend, with growth in Pahrump very evident over the past several years. Growth in Pahrump is being driven by low-cost land, proximity to the Las Vegas metropolitan area, and relocation of retirees to the area. Growth in Nye County is also linked directly to existing and future Yucca Mountain Site operations.

As discussed in Section 4.2.9 of this Rail Alignment EIS, DOE used an economic model to estimate potential socioeconomic impacts of the proposed rail line (DIRS 182251-REMI 2007, all). The model includes consideration of construction and operation employment and wages, project-related spending, and other parameters that could affect the socioeconomic environment. The model included a future baseline of socioeconomic parameters that would represent a cumulative impacts baseline without the proposed railroad (see Table 3-61 of this Rail Alignment EIS).

Consistent with the methodology established in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 4-43), most of the construction workers for the proposed railroad are assumed to be residents of Clark County. This assumption is made because the construction sectors in Nye, Lincoln, and Esmeralda Counties are not large enough to provide enough workers for construction activities. Therefore, it is not surprising that Clark County is projected to attain the largest levels of construction-related employment, income, and spending effects from the proposed project, followed by Nye, Lincoln, and Esmeralda Counties. Lincoln County would experience the largest employment percentage increase during construction with an estimated increase of about 6 percent above baseline conditions.

Employee locations for the operations phase would follow the same general pattern and relative magnitude of the construction phase, but there would be fewer operations jobs than construction jobs. Gains in employment during the operations phase would be felt most strongly in Lincoln County, where the peak percentage change in average annual employment is projected to be 4 percent above baseline conditions during full operations. Esmeralda County is the only other county in the region of influence projected to experience more than a 1-percent change in average annual employment at any point during the operations phase (3-percent change).

Population changes that would result from railroad construction and operations are also projected to generally follow this pattern. During the construction phase, the upper bound of increase to population would be about 2 percent or less of the future cumulative population baseline in all four counties. The operations phase population change would have the largest percentage increase compared to the cumulative baseline in Lincoln County (about a 3-percent average annual increase over the baseline).

Strains on housing infrastructure during the construction phase would not be anticipated, because most construction workers could be housed in construction camps at strategic locations along the proposed Caliente rail alignment, rather than in nearby communities. Contractors might elect to use commercially available facilities for housing construction personnel at locations such as Caliente, Tonopah, Goldfield, Beatty, and Pahrump. There would be enough vacant housing in these locations to absorb both construction and operations personnel.

Some infrastructure impacts would be expected where construction activities or operating facilities were near communities. For example, construction workers, including those from the proposed railroad, could strain the existing health care service capacity in the Caliente rail alignment region of influence, particularly in Caliente, Goldfield, and Tonopah. The operations-related population gains could also result in identifiable effects on health and education-related services.

The road network in the Caliente rail alignment region of influence consists generally of two-lane highways and unpaved roads. In rural, less populated parts of the Caliente rail alignment cumulative impacts region of influence, roads are adequate to handle existing and projected future traffic flow. However, the array of new and proposed activities throughout the Caliente rail alignment cumulative impacts region of influence would have the potential to strain parts of the existing roadway infrastructure.

Railroad project-related road traffic would result in small increases in some areas but construction of the proposed railroad itself would not materially affect traffic volumes on local roads because most construction materials would be transported using rail, and most construction employees and contractors would be housed in construction camps linked to the work site by access roads. Cumulative traffic levels in the region would likely continue to increase as overall regional growth and development occurs.

Any road improvement and maintenance responsibilities in the region of influence are handled by the Nevada Department of Transportation through a Statewide Transportation Plan and a Statewide Transportation Improvement Program. The Statewide Transportation Improvement Program includes a 3-year list of federally funded and regionally important non-federally funded transportation projects and programs consistent with the goals and strategies of the Statewide Transportation Plan. Routine highway improvements and maintenance projects for the period 2006 through 2015 have been identified for Lincoln, Nye, and Esmeralda Counties as part of the Nevada Department of Transportation planning processes. The level of cumulative traffic changes would generally not be sufficient for major upgrades of regional roads.

Overall, the proposed railroad project would have a small impact on economic development and growth, housing and community infrastructure, and traffic in the Caliente rail alignment region of influence. While there is some limited potential for induced growth impacts, the specific locations and scope of these actions is unknown at this time, and any such actions are projected to be small. Cumulative impacts to socioeconomics in the Caliente rail alignment region of influence would be small.

5.2.2.10 Occupational and Public Health and Safety

5.2.2.10.1 Nonradiological Health and Safety

Throughout the Caliente rail alignment region of influence, continuing and reasonably foreseeable activities have the potential to result in occupational injuries or fatalities including, but not necessarily limited to sources such as tripping, being cut on equipment or material, dropping heavy objects, and catching clothing in moving machine parts, and other types of accidents. Other occupational risks include biological hazards, dust and soils hazards, air quality hazards, transportation accidents, and noise hazards. Biological hazards include potential human health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human health effects from exposure to inhalable soils and dusts containing hazardous constituents, and potential occupational encounters with unexploded ordnance.

While occupational injuries or fatalities are unavoidable with human activity, the public and private facilities within the Caliente rail alignment region of influence cumulative activity area are highly regulated. There is a substantial regulatory framework for occupational health and safety, with the Occupational Safety and Health Administration programs and regulations forming the basis for protection of workers. Through DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, the Department has prescribed the Occupational Safety and Health Act Standards that contractors are to meet in their work at government-owned, contractor-operated facilities. The Department of Labor, Bureau of Labor Statistics, measures occupational incident rates, including total recordable cases, lost workday cases, and fatalities, associated with the work environment.

There are no data on injury/illness incident rates for the Caliente rail alignment cumulative impacts region of influence, but injury/illness incidence rates in Nevada are generally higher than those in the United States as a whole. The economic segments with the highest injury/illness incidence rates in Nevada are construction and goods-producing industries.

Additional traffic is a concern with the construction phases of reasonably foreseeable projects. The construction phase of a project not only brings construction workers to the work sites, but also means an increase in slow-moving and bulky traffic involving the transportation of construction equipment. Use of trucks for hauling hazardous or other dangerous materials is also an increasing concern as traffic increases on the road network. To minimize traffic impacts at the entrance to the Yucca Mountain Site, a new interchange with U.S. Highway 95 at the site entrance has been proposed for both traffic flow and safety reasons. Increased traffic would not necessarily mean an increase in the rate of traffic accidents, but the number of accidents would increase if the rate of traffic accidents stayed the same and traffic increased. Therefore, transportation safety concerns would increase and there could be an increased workload for traffic-accident responders in the Caliente rail alignment region of influence with the cumulative growth in traffic.

An estimated 9,500 casks would be transported to the repository by rail along the Caliente rail alignment. Nonradiological occupational health and safety impacts are projected as follows:

- Construction and operations activities for the Caliente rail alignment are projected to result in approximately 880 recordable incidents, approximately 520 lost-workday accidents, and approximately three fatalities.
- Vehicular-related fatalities related to worker commuting are projected to result in an estimated 14 vehicular-related fatalities for the Caliente rail alignment.
- Rail-related accidents and rail-related fatalities related to the movement of cask trains, maintenance trains, and supply trains are projected to result in 16 rail-related accidents and two rail-related fatalities for the Caliente alignment.

Under Module 1, approximately 22,000 casks would be transported to the repository by rail and under Module 2, approximately 24,000 casks would be transported to the repository by rail. To estimate the cumulative health and safety impacts of Module 1 and Module 2, the impacts of the Proposed Action were increased by the ratio of the number of casks transported in Module 1 or Module 2 versus the Proposed Action. For Module 1, the nonradiological health and safety impacts noted above would increase by a factor of approximately 2.3 over the impacts under the Proposed Action. For Module 2, nonradiological safety impacts would increase by a factor of approximately 2.4 over the impacts under the Proposed Action.

Other regional activities would also cumulatively add to the totals beyond the railroad-related impacts, but cumulative nonradiological health and safety impacts in the Caliente rail alignment region of influence would be small within the context of the overall region of influence.

5.2.2.10.2 Radiological Health and Safety

Existing and reasonably foreseeable future activity (such as the Nevada Test Site and Yucca Mountain Repository activity managed by DOE) in the Caliente rail alignment region of influence involves the storage, handling, transportation, use, and disposal of radioactive materials and wastes. There is an extensive regulatory framework associated with transportation safety, and the proposed railroad would operate in compliance with these laws and regulations. For example, DOE complies with U.S. Department of Transportation regulations regarding the transportation of radioactive materials. DOE also uses U.S. Environmental Protection Agency protective action guides (identifying projected dose levels at which specified actions should be taken) and actions designed to limit doses and impacts in the event of a transportation accident resulting in releases of radioactive material. The regulatory framework and implementation of appropriate standard operating procedures would reduce the potential for accidents. Coordination of plans for proposed railroad construction and operation with local emergency response providers would be important to limit the potential for accidents, and for an effective response to an accident should one occur.

There is a small risk of radiological impacts to workers and the general public from external radiation exposure during normal operations and incident-free transportation. Staff at the Nevada Test Site and the Yucca Mountain Repository would be separate, and it is not anticipated that there would be cumulative exposures to workers from both operations. The modes of transportation of radioactive wastes for the Nevada Test Site (shipment by truck) and the Yucca Mountain Repository (shipment by rail) would differ. Radiological impacts associated with rail operations would be higher under Repository SEIS Module 1 or 2 operations compared to the Repository SEIS Proposed Action level of transportation. The radiological risk relationships among the repository, the proposed Caliente rail alignment, and Nevada Test Site operations is summarized below.

As part of the Repository SEIS process, DOE estimated that 9 to 28 latent cancer fatalities for members of the public would result from Yucca Mountain Repository construction, operations, monitoring, and closure for the population within the 80-kilometer (50-mile) repository region of influence. The estimated latent cancer fatalities correspond to a total collective dose of 15,000 to 46,000 person-rem, and the projected population within the repository region of influence is 120,000 persons. The region of influence for the Yucca Mountain Repository extends 80 kilometers (50 miles) to the northwest from the repository site boundary along the rail corridor, approximately to Scottys Junction; the remainder of the Caliente rail alignment is outside of the Yucca Mountain Repository region of influence. Population within the area where the rail alignment region of influence and the Yucca Mountain Repository region of influence coincide (between the repository boundary and the Scottys Junction area) would receive radiation dose from both the repository and from the railroad operations. Members of the public along the rail line but outside of the region of influence of the Yucca Mountain Repository would receive a negligible radiation dose from the repository.

For members of the public along the rail line, DOE estimated that there could be up to 1.3×10^{-4} latent cancer fatalities, corresponding to a collective population dose of 0.2 person-rem for the Caliente alignment. Therefore, for members of the public situated along the rail alignment, the radiological impacts of operation of the Caliente rail line would be a very small contribution to the overall radiological impacts of the Yucca Mountain Repository.

The estimated radiological dose to members of the public from Nevada Test Site operations in 2005 was 0.2 mrem per year; the maximum radiation dose was 2.3 mrem per year at the northwest corner of the Nevada Test Site boundary. Dose at off-site populated locations between 20 kilometers and 80 kilometers (12 to 50 miles) from this location would experience much lower radiation doses due to wind dispersion (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-4, p. 8-2.) The collective population dose from Nevada Test Site operations was below 0.6 person-rem in 2004 (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-3, p. 8-8.) Radiation dose from Nevada Test Site operations would be a very small contribution to the overall radiological impacts of the Yucca Mountain repository.

Operation of the proposed railroad along the Caliente rail alignment under the Proposed Action would result in a small contribution to cumulative radiological health and safety impacts. Cumulative radiological impacts in the Caliente rail alignment region of influence would be small.

5.2.2.11 Utilities, Energy, and Materials

5.2.2.11.1 Utilities

From a cumulative impacts perspective within the Caliente alignment region of influence, utility crossings are and will continue to be commonplace, with little impact other than minor ground disturbance. The proposed railroad project would contribute to regional utility and other right-of-way crossings, which are common to linear projects such as roads, railroads, and pipelines. Land areas for the rail line, construction camps, quarries, and access roads would cross or encroach upon existing or proposed utility rights-of-way in a variety of locations. Land areas for railroad operations support facilities could also encroach upon existing or proposed utility rights-of-way. This situation would be typical for other rights-of-way in the region, meaning that the cumulative region of influence would have hundreds of utility and other right-of-way crossings for the various existing and reasonably foreseeable projects in the region. The crossings would be accomplished with small impacts using standard engineering procedures and appropriate design details.

Many regional activities, including the proposed railroad, would increase demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and other utilities. However, regional service providers are projected to be able to adjust to any increasing demand, and overall cumulative impacts to utilities would be small.

5.2.2.11.2 Energy and Materials Usage

Large projects such as pipelines, transmission lines, and power plants that could occur within the Caliente rail alignment cumulative impacts region of influence require materials and energy to construct and operate. Energy and material resources necessary for construction or operation of these projects are often obtained within regional or, in some cases, national markets.

For this Rail Alignment EIS, DOE analyzed cumulative energy and materials supply and demand from a regional perspective. Energy and materials (for example, steel and concrete) that would be needed for construction and operation of the proposed railroad are not constrained in regional markets, and proposed railroad needs would represent a small percentage of the cumulative annual materials use within the Caliente rail alignment cumulative impacts region of influence.

While the regional markets for various construction-related materials and energy sources will continue to grow as the region develops, there is no evidence of potential limits to growth from constrained material or energy supplies. Cumulative impacts from energy and materials usage in the Caliente rail alignment region of influence would be small.

5.2.2.12 Hazardous Materials and Waste

5.2.2.12.1 DOE Waste-Management Activities

DOE has had existing waste-management programs at the Nevada Test Site for several decades. While Site missions have changed over time (with an emerging focus on national security, energy, and environmental issues), waste management and disposal at the Site has been one of the primary long-term land uses. There are two active waste-management and disposal sites on the Nevada Test Site:

- Area 5 occupies 2.9 square kilometers (720 acres) and is in Frenchman Flat north of Mercury, Nevada.
- Area 3 occupies 0.53 square kilometer (130 acres) north of Mercury in Yucca Flat.

Environmental restoration efforts are under way at various locations throughout the Nevada Test Site. The Nevada Test Site waste-management program currently includes management and disposal operations for hazardous waste, mixed waste, and low-level radioactive waste. Transportation of the waste is accomplished by truck from both on-site and off-site sources. There are no plans for Nevada Test Site activities to include use of the proposed Caliente rail alignment for shipment of wastes.

The proposed railroad would not contribute to cumulative impacts associated with DOE waste-management activities on the Nevada Test Site.

At present, Yucca Mountain Repository-development efforts are focused on preparing an application to the U.S. Nuclear Regulatory Commission for authorization to construct the repository for spent nuclear fuel and high-level radioactive waste. Proposed operations at the Yucca Mountain Site are discussed in detail in the Yucca Mountain FEIS and the Repository SEIS.

5.2.2.12.2 Sanitary and Construction Wastes

As the populated areas in the Caliente rail alignment cumulative impacts region of influence expand, the volume of sanitary waste generated will also expand. Project proponents are legally required to dispose of nonhazardous and nonradiological construction and other solid waste in appropriately permitted solid waste landfills. Nevada has 24 operating municipal landfills with a combined capacity to accept more than 11,000 metric tons (12,000 tons) of waste per day. However, the number of operating landfills has decreased substantially over the past 15 years, and while there is sufficient capacity to accept waste for the state of Nevada as a whole, there are some areas, such as Pahrump, that have limited capacity for future years.

Construction- and operations-related waste that would be associated with the proposed railroad would add only a fraction of a percent to the total waste stream in the state. If there were a constraint to landfill capacity at some future time, additional land would be needed to expand or open a new landfill. Because of the scarcity of private land in the Caliente rail alignment region of influence, any land used for this purpose might need to come from BLM-administered federal land. As an alternative to local government landfill provision, private companies can also be expected to seek business opportunities to provide solid- and hazardous-waste management, transportation, and disposal.

DOE would store and use hazardous materials (such as oil, gasoline and solvents) during the construction phase, and would control and manage these materials in accordance with the extensive federal and state regulatory framework. Other major projects would have similar waste streams, and project plans and requirements would call for disposal of such wastes in permitted facilities and materials management according to accepted industry practices.

The proposed railroad's contribution to impacts from the generation and management of sanitary and construction wastes would be small. Cumulative impacts to waste disposal facilities in the Caliente rail alignment region of influence would be small.

5.2.2.13 Cultural Resources

Cultural resources include historic and archeological sites, buildings, structures, landscapes, and objects. Most reasonably foreseeable projects in the Caliente rail alignment cultural resources region of influence will involve at least some ground disturbance. With that ground disturbance, cultural resources could be destroyed, damaged, or discovered for recovery or mitigation. As part of the evaluation of proposed projects on federal land, the existing regulatory framework requires that cultural resources be identified and protected. With information on the location of a proposed project, and the estimated extent of ground disturbance, cultural resource specialists can be called on to perform appropriate surveys and inventories of cultural resources in the potentially disturbed area. Once discovered, the sites of cultural resources are kept confidential to reduce the potential for vandalism or theft of the resources.

Because cultural resources are typically on or below the ground, they can be damaged by other activities such as off-highway vehicle use. As the major land manager in the Caliente rail alignment region of influence, the BLM has an extensive cultural resource management program and manages federal land with protection of cultural resources as a key management objective. Once ground is disturbed and facilities are constructed on the land, the opportunity for identification of cultural resources is usually lost. Therefore, the BLM and other land managers in the area (like DOE on the Nevada Test Site and the U.S. Air Force on the Nevada Test and Training Range) employ cultural resource specialists and involve tribal representatives, as appropriate. Commonly, mitigation for any ground disturbance in the Caliente rail alignment region of influence includes the involvement of these cultural resource specialists as potential cultural resources are discovered. Other activities occurring on federal land, such as off-road vehicle use and rock collecting, can cause unintended adverse impacts to cultural resources. Mission activities occurring at the Nevada Test Site, the Nevada Test and Training Range, and the Yucca Mountain Repository also can cause unintended adverse impacts to cultural resources.

The problem of vandalism to and theft of cultural resources is prevalent throughout the western United States. The Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.9-5) notes that the trend of degradation to cultural resource sites is increasing at a rapid rate as the population increases in the Caliente rail alignment region of influence. Land-management agencies such as the BLM make extensive attempts to protect cultural resource locations, but the areas to be managed are often so vast that patrols by law enforcement are not effective in protecting these sites. DOE, the BLM, and other federal agencies in the Caliente rail alignment region of influence are committed to public education and employee training regarding the protection of cultural resources.

Visitors could also be drawn to the area for purposes of curiosity and sight-seeing. Based on the extent of cultural resource site finds within BLM-administered land and the Nevada Test Site, and data collected to date on the Caliente rail alignment, there could be a large number of cultural resources in the Caliente rail alignment region of influence. For example, the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.9-1) notes that approximately 12,000 cultural resource sites covering a time span of more than 10,000 years have been identified within the Ely District. It is likely that only a portion of any currently undiscovered sites would ultimately be found eligible for the *National Register of Historic Places*.

The railroad would be a major new construction project introduced into a remote area. Beyond the implications of ground disturbance and permanent and temporary use areas, railroad construction and operations would bring employees, visitors, and equipment into an area where prior access was limited. If right-of-way roads remain open to the public, there could be an increase in off-road vehicles traveling along newly constructed roads and illegal use of lands. As the number of visitors increases, so does the potential for vandalism and damage to cultural resources. There is an extensive regulatory framework to manage and protect cultural resources.

Impacts to cultural resources in the Caliente rail alignment region of influence would be small because the Department would conduct intensive field surveys and implement mitigation measures, including avoidance. Other project proponents would be subject to the same regulatory framework and BLM policies and procedures. Cumulative impacts to cultural resources in the Caliente rail alignment region of influence would be small.

5.2.2.14 Paleontological Resources

Regional protection, management, and impact issues in relation to paleontological resources are similar to those for cultural resources. Any type of ground disturbance could disturb or destroy known or yet identified paleontological resources. Impacts to paleontological resources would generally be measured by physical damage to fossil-bearing formations through excavation or surface disturbance. The primary cumulative impact mechanisms that could affect paleontological resources include excavations or surface disturbances associated with approval and implementation of BLM rights-of-way, off-highway vehicle use, minerals development, land disposals, and special designations. Many BLM management activities, however, serve to protect and mitigate impacts to paleontological resources. As noted in the Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 4.10-1), knowledge of the outcrop pattern of geologic units, and the kinds and quality of the fossils produced by such units, is a critical management tool for land-use decisionmaking where fossils might be involved. Potential effects on paleontological resources from ground disturbance would continue to be a major regional concern for the BLM from both resource management planning and rights-of-way evaluation perspectives.

Paleontological resources are considered valuable and are collected in the Caliente rail alignment region of influence for their cultural, scientific, and recreational values. Therefore, these resources are sometimes removed from federal lands. While common invertebrate fossils such as plants, mollusks, and trilobites can be collected for personal use in reasonable quantities, the lack of regular site monitoring and public education about fossil collecting has led to increased illegal commercial taking of paleontological resources. Paleontological resources are also vulnerable to intentional or unintentional vandalism. The specific locations of some identified paleontological resources are kept confidential to avoid vandalism or theft.

The most likely locations of currently unknown paleontological resources can be identified based on geological characteristics, and potential impacts can be avoided or minimized through careful project planning and implementation. Most formations the rail line would cross are volcanic and would not contain paleontological resources. Therefore, the proposed railroad project would not contribute to cumulative impacts to paleontological resources.

5.2.2.15 Environmental Justice

5.2.2.15.1 Potential Effects to Low-Income or Minority Populations

Environmental justice impacts result when high and adverse human health or environmental impacts fall disproportionately on low-income and minority populations. If high and adverse impacts are found to have disproportionate impacts on environmental justice populations as compared to the general population in the area, the impacts would be mitigated to the extent practicable by the federal agencies involved in the proposed action.

Based on individual and group values, beliefs, and goals among stakeholders and other interested parties, there are different perspectives on the potential effects of activities in the Caliente rail alignment region of influence on low-income or minority populations. The American Indian Resource Document (DIRS 174205-Kane et al. 2005) discusses cultural resources, American Indian values and their relationship to environmental justice, and broader American Indian values. DOE considers the American Indian Writers Subgroup conclusions to be responsible opposing viewpoints for purposes of its environmental justice responsibilities.

DOE has concluded that there are no identifiable human health or environmental impacts associated with the proposed railroad that would disproportionately affect low-income or minority populations, nor has the Department identified any special pathways for impacts (such as subsistence hunting and gathering) in the Caliente region of influence.

Cumulative impacts to low-income or minority populations along the Caliente rail alignment would be would be small, if any.

5.2.2.15.2 Economic Opportunity

Existing and reasonably foreseeable projects and activities in the Caliente rail alignment region of influence would present economic opportunities for some people in the area. Economic opportunities include employment, wages, revenue from business operation, and other economic stimuli associated with growth and development. DOE and other project proponents in the Caliente rail alignment region of influence have a legally mandated equal opportunity approach to these economic opportunities. Any potential for economic gain would be distributed equally to people or businesses in the area that seek employment or business opportunity.

While not all people would gain economically from the cumulative group of projects and activities, the opportunity for gain does not favor one population group or another based on minority or income status.

5.3 Mina Rail Alignment

Sections 5.3.1 to 5.3.2 summarize the projects and activities considered in the cumulative impacts analysis for the Mina rail alignment. Figure 5-3 shows the locations of these major projects and activities, including the:

1. Naval Air Station Fallon
2. Federal actions on the Walker River Paiute Reservation
3. Hawthorne Army Depot
4. Walker River Basin Restoration
5. Monte Cristo's Castle (proposed state park)
6. Timbisha Shoshone Trust Land (federal land transfer)
7. Yucca Mountain Geologic Repository
8. Nevada Test Site
9. Nevada Test and Training Range

This section also considers other relevant projects and actions that are not depicted on the map, such as:

- BLM planning and management actions – A variety of BLM past, present, and reasonably foreseeable actions are located within the three BLM management areas (Carson City, Battle Mountain, and Las Vegas) relevant to the Mina rail alignment.
- Various rights-of-way – Many future utility or other rights-of-way corridors are not depicted in Figure 5-3 because specific routes are not known. For example, DOE and the BLM are preparing a programmatic environmental impact statement for potential designation of energy corridors on federal land in western states (70 *FR* 56647, September 28, 2005).
- Energy and mineral development activities.
- Other regional economic development plans and activities within Nye, Esmeralda, Lyon, and Mineral Counties.

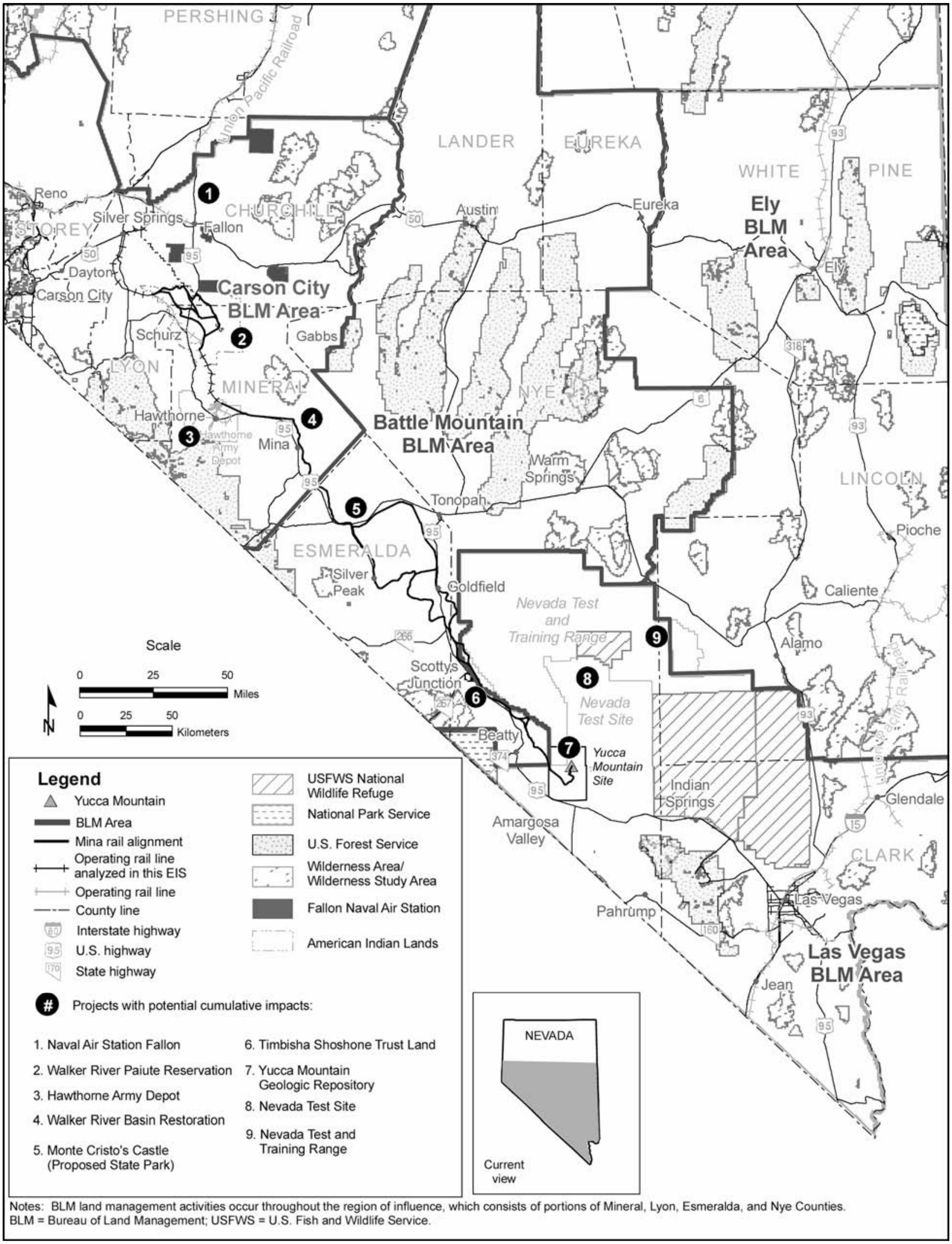


Figure 5-3. Major reasonably foreseeable future actions and continuing activities in the Mina rail alignment cumulative impacts region of influence.

The Mina rail alignment ranges in length from about 469 to 502 kilometers (281 to 312 miles), depending on the alternative segments considered. As a linear project, land disturbance and other direct impacts would be most likely to occur within the relatively narrow construction and operations rights-of-way. However, there could be other direct and indirect impacts for some resources outside the rights-of-way.

To evaluate the potential for cumulative impacts, DOE identified and reviewed public and private actions in the Mina rail alignment region of influence to determine if the impacts associated with these actions could coincide in time or space with potential impacts from railroad construction and operations along the Mina rail alignment. Only those projects and activities DOE believes would have the potential for cumulative impacts are identified herein. In some cases, similar actions have been grouped together and listed by category of action.

5.3.1 PROJECTS AND ACTIVITIES INCLUDED IN THE CUMULATIVE IMPACTS ANALYSIS – MINA RAIL ALIGNMENT

5.3.1.1 Past and Present Actions

The descriptions of existing (baseline) environmental conditions (Chapter 3) and impacts (Chapter 4) associated with the various environmental resource regions of influence for the Mina rail alignment considered in this Rail Alignment EIS include the relationships between proposed railroad construction, operation, and abandonment and past and present actions such as:

- Operations at major federal facilities such as the Yucca Mountain Geologic Repository, Nevada Test and Training Range, Nevada Test Site, Hawthorne Army Depot, and Naval Air Station Fallon
- BLM resource management planning and land management uses
- Traditional land uses such as regional ranching, mining, and recreation
- Military operations
- Walker River Basin restoration activities
- Residential, commercial, and industrial development activities associated with growth in the Mina rail alignment cumulative impacts region of influence; including the Pahrump area and the Reno-Carson City area adjacent to the northern portion of the Mina rail alignment region of influence.

Reasonably foreseeable future actions and the continuation of existing actions in the Mina rail alignment cumulative impacts region of influence were also considered. Figure 5-3 shows the locations of individual projects and activities.

5.3.1.2 Reasonably Foreseeable Future and Continuing Federal Actions

Sections 5.3.1.2.1 through 5.3.1.2.8 describe reasonably foreseeable future and continuing federal agency actions that could result in cumulative impacts when combined with the impacts of constructing and operating a railroad along the Mina rail alignment.

5.3.1.2.1 Yucca Mountain Geologic Repository

The Proposed Action in this Rail Alignment EIS is directly related to the proposed geologic repository at Yucca Mountain, which is a reasonably foreseeable project that would have potential cumulative impacts in the Mina rail alignment region of influence (see Figure 5-3, Project #7). In the Yucca Mountain FEIS

(DIRS 155970-DOE 2002, all) and the *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (the Repository SEIS; DOE/EIS-0250F-S1 DOE proposes to construct, operate and monitor, and eventually close a geologic repository for the disposal of 70,000 metric tons (77,000 tons) of heavy metal of spent nuclear fuel and high-level radioactive waste at Yucca Mountain in Nye County, Nevada. DOE proposed to dispose of spent nuclear fuel and high-level radioactive waste in the repository using the natural geologic features of the mountain and engineered barriers as a total system to help ensure long-term isolation of the materials from the accessible environment. As analyzed in the Repository SEIS, the repository design and associated construction and operation plans require the following:

- DOE spent nuclear fuel and high-level radioactive waste would be placed in disposable canisters at the DOE sites, and as much as 90 percent of the commercial spent nuclear fuel would be placed in transportation, aging, and disposal (TAD) canisters at the commercial sites prior to shipment. The remaining commercial spent nuclear fuel (about 10 percent) would be transported to the repository in dual-purpose canisters (canisters suitable for storage and transportation), or would be uncanistered.
- Most spent nuclear fuel and high-level radioactive waste would be transported from 72 commercial and four DOE sites to the repository in Nuclear Regulatory Commission-certified transportation casks placed on trains dedicated only to these shipments. Some shipments, however, would be transported to the repository by truck over the Nation's highways.
- At the repository, DOE would conduct waste handling activities to manage thermal output of the commercial spent nuclear fuel and to package the spent nuclear fuel into TAD canisters. The disposable canisters and TAD canisters would be placed into waste packages for disposal in the repository. A waste package is a container that consists of the barrier materials and internal components in which DOE would place the canisters that contained spent nuclear fuel and high-level radioactive waste.
- DOE would place approximately 11,000 waste packages, containing no more than a total of 70,000 metric tons (77,000 tons) of heavy metal, of spent nuclear fuel and high-level radioactive waste in the repository at Yucca Mountain.
- When authorized by the Nuclear Regulatory Commission, the repository would be closed permanently. The design for construction would allow for phased construction of the surface and subsurface facilities that would be compatible with constrained funding.
- The surface and subsurface facilities and associated infrastructure, such as the onsite road and water distribution networks and emergency response facilities, would be constructed in phases to accommodate the expected receipt rates of spent nuclear fuel and high-level radioactive waste.
- DOE also would construct a four-lane access road that would extend from U.S. Highway 95 to the existing access road at Gate 510. This access road might be constructed using a phased approach, with initial construction of two lanes, and the road being widened later. The Department would also build a suitable intersection at U.S. Highway 95.
- DOE assumes that the following facilities would be constructed outside the repository land withdrawal area: a training facility near Yucca Mountain to support the Project Prototype Testing and the Operator Training and Qualification programs; temporary accommodations for construction workers; a proposed Sample Management Facility to consolidate, upgrade, and improve storage and warehousing for scientific samples and materials, perhaps near the Town of Amargosa Valley; and a marshalling yard and warehouse, a proposed leased facility that would consolidate material shipment and receipt into a 0.2-square-kilometer (50-acre) facility to allow

for offsite receipt, transfer, and staging of materials required to perform construction activities at the Yucca Mountain site.

The Nuclear Regulatory Commission, through its licensing process, would regulate repository construction, operation and monitoring, and closure. Repository operations would only begin after the Commission granted DOE a license to receive and possess spent nuclear fuel and high-level radioactive waste. DOE is currently preparing an application for construction authorization.

The Yucca Mountain FEIS and the Repository SEIS evaluate the cumulative impacts of two additional inventories (Modules 1 and 2), which include spent nuclear fuel and high-level radioactive waste in addition to that of the Proposed Action inventory, and other radioactive wastes generally considered unsuitable for near-surface disposal. Inventory Module 1 or 2 could have cumulative impacts on the operation of the proposed railroad. Regarding potential cumulative impacts from Inventory Module 1 or 2, there would be no cumulative construction impacts because the need for a new railroad would not change; that is, whichever rail alignment DOE selected in which to build the proposed railroad to serve the Yucca Mountain FEIS Proposed Action would also serve Module 1 or 2. In addition, because the planned annual shipment rate of spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository would be about the same for Module 1 or 2 and the FEIS Proposed Action, the only cumulative operations impacts would result because of the annual increase of shipments for Module 1 or 2. Because Modules 1 and 2 exceed the NWPA disposal limit of 70,000 metric tons (77,000 tons) of heavy metal considered in the Repository SEIS, the emplacement of any such waste at Yucca Mountain would require legislative action by Congress unless a second licensed repository was in operation. The 70,000 metric tons of heavy metal limit is comprised of 63,000 metric tons (69,000 tons) of heavy metal from commercial utilities and 7,000 metric tons (7,000 tons) of heavy metal from DOE.

DOE is preparing the *Disposal of Greater-Than-Class-C Low-Level Radioactive Waste Environmental Impact Statement* (DOE/EIS-0375) (72 *FR* 40135, July 23, 2007). That EIS will address the disposal of wastes with concentrations greater than Class C, as defined in U.S. Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE Low-Level Radioactive Waste and transuranic waste having characteristics similar to Greater-Than-Class-C waste and that otherwise do not have a path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low-level waste disposal in a geologic repository; in intermediate depth boreholes; and in enhanced near surface facilities. Candidate locations for these disposal facilities are the Idaho National Laboratory; the Los Alamos National Laboratory and Waste Isolation Pilot Plant in New Mexico; the Nevada Test Site and the proposed Yucca Mountain Repository; the Savannah River Site in South Carolina; the Oak Ridge Reservation in Tennessee; and the Hanford Site in Washington. DOE will also evaluate disposal at generic commercial facilities in arid and humid locations. The Draft Yucca Mountain SEIS evaluates the potential cumulative impacts of disposal of these wastes at Yucca Mountain as a reasonably foreseeable action, which are included in Inventory Module 2. Current repository design plans do not accommodate disposal of Greater-Than-Class-C low-level radioactive waste.

DOE is preparing the *Programmatic Environmental Impact Statement for the Global Nuclear Energy Partnership* (DOE/EIS-0396). Global Nuclear Energy Partnership (GNEP) would encourage expansion of domestic and international nuclear energy production while reducing nuclear proliferation risks, and reduce the volume, thermal output, and radiotoxicity of spent nuclear fuel before disposal in a geologic repository. DOE anticipates that its Programmatic EIS will evaluate a range of alternatives, including a proposal to recycle spent nuclear fuel and separate many of the high-heat fission products and the uranium and transuranic components. The full implementation of GNEP would involve the construction and operation of advanced reactors, which would be designed to generate energy while destroying the transuranic elements. DOE also anticipates evaluating project-specific proposals to construct and operate an advanced fuel-cycle research facility at one or more DOE sites.

The United States uses a "once through" fuel cycle in which a nuclear power reactor uses nuclear fuel only once, and then the utility places the spent nuclear fuel in storage while awaiting disposal. GNEP would establish a fuel cycle where the uranium and transuranic materials would be separated from the spent nuclear fuel and reused in thermal and/or advanced nuclear reactors. GNEP would not diminish in any way the need for the nuclear waste disposal program at Yucca Mountain, because under any fuel recycle scenario, high-level radioactive waste will continue to be produced and require disposal.

DOE anticipates that by about 2020 the commercial utilities will have produced about 86,000 metric tons 995,000 tons) of heavy metal of spent nuclear fuel, which exceeds the DOE disposal limit of 63,000 metric tons (69,000 tons) of heavy metal of commercial spent nuclear fuel at the Yucca Mountain Repository. If DOE were to decide, in a GNEP Record of Decision, to proceed with its proposal to recycle spent nuclear fuel, the Department anticipates that the necessary facilities would not commence operations until 2020 or later. Although the spent nuclear fuel-recycling concept has not yet been implemented and the capacity of a separations facility has not been determined, one or more separations facilities could be designed with a total capacity sufficient to recycle the spent nuclear fuel discharged by commercial utilities. Consequently, the Department believes there would be no change in the spent nuclear fuel and high-level radioactive waste inventory, and therefore the number of casks of spent nuclear fuel and high-level radioactive waste shipped to the Yucca Mountain repository analyzed under the Proposed Action in this Rail Alignment EIS would remain unchanged (that is, the shipment of approximately 9,500 casks containing spent nuclear fuel and high-level radioactive waste).

Overall, development of a GNEP fuel cycle has the potential to decrease the amount (number of assemblies) of spent nuclear fuel that would require geologic disposal, but would increase the number of casks of high-level radioactive waste requiring disposal in a geologic repository in the long term. Consequently, recycling of commercial spent nuclear fuel could affect the nature of the inventory that represents the balance of Inventory Module 1 (that is, commercial spent nuclear fuel in amounts greater than 63,000 metric tons [69,000 tons] of heavy metal). Nevertheless, given the uncertainties inherent at this time in estimating the amount of spent nuclear fuel and high-level radioactive waste that would result from a full or partial implementation of the GNEP closed fuel cycle, this Rail Alignment EIS analyzes rail transportation within Nevada of approximately 9,500 casks of spent nuclear fuel and high-level radioactive waste.

5.3.1.2.2 Nevada Test Site (Continuation of Activities)

The Nevada Test Site, adjacent to the Nevada Test and Training Range, engages in a number of defense-related material and management activities, waste management, environmental restoration, and non-defense research and development (see Figure 5-3, Project #8). The Nevada Test Site was established in 1951 as the Nation's proving ground for developing and testing nuclear weapons. The site is on land administratively held by the BLM, but the Nevada Test Site land was withdrawn for use by the Atomic Energy Commission and its successors (including DOE). At present, the DOE National Nuclear Security Administration manages the site. It consists of about 3,200 square kilometers (800,000 acres) of land.

The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 101811-DOE 1996, all) described existing and projected future actions at the Nevada Test Site. That EIS was followed by a *Supplement Analysis for the Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DIRS 162638-DOE 2002, all). DOE activities at the Nevada Test Site include stockpile stewardship and management (helping ensure the U.S. nuclear weapon stockpile is safe, secure, and reliable), materials disposition (removal of nuclear materials in a safe and timely manner), and nuclear emergency response. Activities at the Nevada Test Site since the 1996 EIS and 2002 supplement analysis have continued to support these missions in accordance with federal law, DOE policies and missions, and NEPA requirements. There are a number of other programmatic DOE waste management initiatives that can affect current and potential future operations at the Nevada Test Site, many of which require NEPA analyses. The Nevada Test Site also produces annual environmental reports that describe program activities and related environmental issues and activities.

DOE is currently preparing the *Supplement to the Stockpile Stewardship and Management Programmatic Environmental Impact Statement–Complex 2030* (Complex Transformation Supplemental PEIS [formerly known as the Complex 2030 SEIS]; DOE/EIS-0236-S4). That SEIS will analyze the environmental impacts of the continued transformation of the United States nuclear weapons complex by implementing the National Nuclear Security Administration's vision of the complex as it would exist in 2030, and alternatives to that action. Part of the proposed action in that SEIS is to identify one or more sites for conducting National Nuclear Security Administration flight test operations. Existing Department of Defense and DOE test ranges (for example, the White Sands Missile Range in New Mexico and the Nevada Test Site in Nevada) would be considered as alternatives to the continued operation of the Tonopah Test Range in Nevada.

Another part of the proposed action in the Complex Transformation Supplemental PEIS is to accelerate dismantlement activities. The DOE sites that will be considered as potential locations for the consolidated plutonium centers and consolidation of Category I (high strategic significance) and II (moderate strategic significance) special nuclear materials include Los Alamos National Laboratory, the Nevada Test Site, the Pantex Plant, the Y-12 National Security Complex, and the Savannah River site.

DOE manages several types of radioactive and hazardous waste (***low-level radioactive waste***, ***mixed low-level waste*** [referred to as mixed waste], transuranic waste, high-level radioactive waste, and ***hazardous waste***) generated by past and present nuclear defense research activities at many DOE sites across the United States, including the Nevada Test Site. The Department manages each of those waste types separately because they have different components, levels of radioactivity, and regulatory requirements. DOE needs facilities like the Nevada Test Site to manage its radioactive and hazardous wastes to maintain safe, efficient, and cost-effective control of these wastes; comply with applicable federal and state laws; and protect public health and safety and the environment. In *Final Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste* (DIRS 101816-DOE 1997, all) DOE evaluated the environmental impacts of managing the five waste types. The Nevada Test Site will continue to be a major facility involved in DOE waste-management programs, including serving as a disposal site for certain waste types generated off the site, and for on-site wastes primarily from environmental restoration and remediation activities.

The Nevada Test Site is a candidate disposal location for Greater-Than-Class-C Low-Level Radioactive Waste which is currently being examined in the *Disposal of Greater-Than-Class-C Low-Level Radioactive* Waste *Environmental Impact Statement* (DOE/EIS-0375). That DOE EIS will address the disposal of wastes with concentrations greater than Class C, as defined in Nuclear Regulatory Commission regulations at 10 CFR Part 61, and DOE low-level radioactive waste and transuranic waste having characteristics similar to Greater-Than-Class-C low-level waste and that might not have an identified path to disposal. DOE proposes to evaluate alternatives for Greater-Than-Class-C low level waste disposal in a geologic repository; in intermediate-depth boreholes; and in enhanced near-surface facilities.

Table 5-1 lists and briefly describes recent environmental assessments that describe Nevada Test Site operations.

5.3.1.2.3 BLM Resource Planning and Management

The presence of public land administered by the BLM is a very important factor affecting how and where activities occur within the region of influence. Many private and federal projects in the regions of influence, including the proposed railroad, would involve use of BLM-administered federal land. Therefore, these projects would require BLM-issued right-of-way grants before they could proceed. Right-of-way grants have two general forms: linear (applicable to such projects as transmission lines, railroads, and pipelines), and non-linear (applicable to projects at one specific location). Rights-of-way on BLM-administered land are extensive in the region. These rights-of-way vary tremendously in size and scope of activity.

Similar to the Caliente rail alignment, the BLM also administers most of the public lands along the proposed Mina rail alignment. The BLM manages these lands through a multiple-use concept (which means managing public lands and their various resource values so that they are utilized in the combination that will best meet the present and future needs of the American people) in accordance with the Federal Lands Policy and Management Act of 1976 (43 U.S.C. 1732, et seq.) and other federal legislation. The proposed Mina rail alignment would cross three BLM planning areas (Carson City, Battle Mountain, and Las Vegas). The Carson City Field Office manages its federal lands through a Consolidated Resource Management Plan developed in 2001. The Carson City Field Office was previously divided into eight planning units, all of which were consolidated into the 2001 Carson City Resource Management Plan. The Battle Mountain and Las Vegas planning areas are operating under resource management plans adopted in 1998 and 1997, respectively (DIRS 176043-BLM 1998, all; DIRS 173224-BLM 1997, all). There are many land uses on BLM-administered federal land in the region of influence, with grazing use being a major source of activity.

As directed by Federal legislation, the BLM Carson City Field Office may issue leases for geothermal resources located in multiple areas within the Mina rail alignment cumulative impacts region of influence. The development of any geothermal resources would be guided by BLM land and resource management policies and procedures established in the applicable resource management plans.

5.3.1.2.4 Walker River Paiute Reservation (Federal Actions)

The Walker River Paiute Reservation consists of more 130 square kilometers (323,000 acres) of land between Yerington, Nevada, and Walker Lake (See Figure 5-3, Project #2). Although the Reservation is recognized as a sovereign entity under the non-federal actions discussion below, federal agencies could also be taking actions on the reservation. The Bureau of Indian Affairs operates the Weber Dam and Weber Reservoir, which impounds water from the Walker River just north of the community of Schurz for use on the Reservation. Constructed in the 1930's, the dam needs several repairs and modifications to address a number of deficiencies identified as a result of inspections and a safety analysis conducted in the 1980s under the Bureau of Indian Affairs Dam Safety Maintenance and Repair Program, created as part of the Indian Dams Safety Act. Additionally, the U.S. Fish and Wildlife Service is involved in recovery efforts for the threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*). Lahontan cutthroat trout are stocked in Walker Lake and occur in the Walker River upstream to Weber Reservoir. Weber Dam currently blocks movement further upstream, and prevents spawning by cutthroat trout; however, in the near future a fish ladder might be developed at that dam to allow fish movement. Re-establishment of a self-sustaining population of Lahontan cutthroat trout in the Walker River system is a prerequisite for recovery of this species (see also Sections 5.3.1.3.1 and 5.3.1.3.4 below).

5.3.1.2.5 Nevada Test and Training Range (Continuation of Activities)

The U.S. Air Force operates the Nevada Test and Training Range in south-central Nevada (see Figure 5-3, Project #9), a national test and training facility for military equipment and personnel consisting of approximately 12 million square kilometers (3 million acres). Military training maneuvers and jet aircraft are commonly visible in the Mina rail alignment cumulative impacts region of influence. In 2005, the U.S. Air Force designated the Indian Springs Air Force Auxiliary Airfield to Creech Air Force Base and expanded its mission and infrastructure to play a major role in the war on terrorism. The base is home to two key military operations: the MQ-1 unmanned aerial vehicle and the Unmanned Aerial Vehicle Battle laboratory.

The 1,600-square-kilometer (390,000-acre) BLM-administered National Wild Horse Management Area is within the boundary of the Nevada Test and Training Range. More than 3,200 square kilometers (800,000 acres) of the Nevada Test and Training Range comprise the Desert National Wildlife Range. The U.S. Air Force and the U.S. Fish and Wildlife Service jointly manage this area.

In *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999, all), the U.S. Air Force addressed potential environmental consequences of extending the land withdrawal in order to continue using the Nevada Test and Training Range lands for military use. Activities at the Nevada Test and Training Range change, as necessary, to meet military test and training needs.

In 2004, the BLM prepared a resource management plan for about 8,900 square kilometers (2.2 million acres) of withdrawn public lands within the Nevada Test and Training Range (DIRS 178102-BLM 2004, all). The plan guides the management of the affected Nevada Test and Training Range natural resources 20 years into the future (2024). The decisions, directions, allocations, and guidelines in the plan are based on the primary use of the withdrawn area for military training and testing purposes.

See Table 5-2 for a list and brief description of recent environmental assessments that describe Nevada Test and Training Range operations.

5.3.1.2.6 Hawthorne Army Depot

The Hawthorne Army Depot occupies approximately 590 square kilometers (147,000 acres) in Mineral County, Nevada (see Figure 5-3, Project #3). Hawthorne Army Depot was commissioned in 1930 as a Naval Ammunition Depot, transferred to the Army in October 1977, and renamed Hawthorne Army Ammunition Plant. It was converted to a government-owned, contactor-operated installation in December 1980. In 1994, the name changed back to the Hawthorne Army Depot. Control of Hawthorne Army Depot is maintained by the U.S. Army, which is responsible for the plans, installation, operation, and equipment of the Depot. The mission of Hawthorne Army Depot is to support the Army, Air Force, and Navy. It also has the capabilities to receive, maintain, store, and issue ammunition and explosive ordnance items. The Hawthorne Army Depot also has the responsibility to renovate, recover, or dispose of unserviceable ammunition and explosives. These latter operations are referred to as demilitarization activities.

The primary ordnance areas at Hawthorne Army Depot extend over 400 square kilometers (100,000 acres) that cross U.S. Highway 95. This area is surrounded on its northeast, east, south, and west sides by fencing and on its north and northwest sides by a boundary line that includes a portion of Walker Lake. The southern one-third of Walker Lake is within the ordnance area. The Mount Grant watershed is in the northwest part of the installation. This watershed consists of about 180 square kilometers (45,000 acres), and is a resource that Hawthorne Army Depot maintains to supply its primary potable water needs. Hawthorne Army Depot has 2,572 buildings and structures, which are comprised of offices, production buildings, ammunition storage magazines, and warehouses. The Depot is bordered by public grazing lands administered by the BLM, and the installation completely surrounds the town of Hawthorne. Hawthorne Army Depot is planning to construct a rail siding, known as the Wabuska Spur, which would increase the Depot’s outloading capacity.

5.3.1.2.7 Naval Air Station Fallon

Naval Air Station Fallon is in the Lahontan Valley of west-central Nevada, approximately 113 kilometers (70 miles) east of Reno and 10 kilometers (6 miles) southeast of the city of Fallon (See Figure 5-3, Project #1). Naval Air Station Fallon administers approximately 32 square kilometers (7,900 acres) of withdrawn and acquired land associated with the air station and approximately 95 square kilometers (234,000 acres) of land associated with the Fallon Range Training Complex. The Fallon Range Training Complex airspace overlies portions of Washoe, Lyon, Churchill, Pershing, Mineral, Nye, Lander, and Eureka Counties, most of which is BLM-administered public land.

In January of 2000, the Navy and BLM issued the *Final Environmental Impact Statement: Proposed Fallon Range Training Complex Requirements Naval Air Station Fallon, Nevada* (DIRS 182891-Department of the Navy, BLM 2000, all). The Naval Strike and Air Warfare Center at Naval Air Station Fallon proposes to implement changes at the Fallon Range Training Complex to meet Chief of Naval Operations mandated training requirements resulting from the real world threat environment. The proposed changes would allow the Navy to update and consolidate Navy training on public and Navy-administered lands and to update existing airspace overlying these lands. The changes evaluated in the EIS include developing new fixed and mobile electronic warfare sites, developing new tracking instrumentation subsystem sites, developing additional targets at two of its training ranges, laying fiber optic cable to two training ranges, utilizing Navy-administered lands in Dixie Valley for close-air-support training, performing Hellfire missile and high altitude weapons delivery training at two of its training ranges, and changes to special-use airspace. The EIS provided a comprehensive evaluation of the environmental impacts, including cumulative impacts, associated with the Navy's proposed changes.

5.3.1.2.8 Timbisha Shoshone Trust Land (Federal Action)

The Secretary of the Interior issued a draft report to Congress (DIRS 103470-Timbisha Shoshone Tribe [n.d.], all) describing a plan to establish trust lands for people of the Timbisha Shoshone Tribe in portions of the Mojave Desert in eastern California and southwestern Nevada (See Figure 5-3, Project #6). On November 1, 2000, the President signed Bill S. 2102 (Public Law 106-423) to provide a permanent land base for the Timbisha Shoshone Tribe within its ancestral homeland in five separate parcels. Lands in the designated area for tribal purposes were then identified, including land parcels containing water rights. The parcel near Scottys Junction (about 11 square kilometers [2,800 acres]) is approximately 3.2 kilometers (2 miles) from the proposed Mina rail alignment. The Timbisha Shoshone Tribe is actively evaluating economic development opportunities on this Scottys Junction parcel. The locations and nature of these future development opportunities are not known and are not considered to be reasonably foreseeable for the purpose of this analysis.

5.3.1.3 REASONABLY FORESEEABLE FUTURE NON-FEDERAL ACTIONS

Non-federal and private actions in the Mina rail alignment cumulative impacts region of influence primarily involve mineral resource development projects, Walker River Paiute Tribal activities, and some residential and general economic development initiatives and efforts. As previously noted, many of these privately sponsored projects would interact with the BLM land management policies and procedures through the need to acquire right-of-way grants to initiate proposed activities on BLM-administered land.

5.3.1.3.1 Walker River Paiute Reservation

The Walker River Paiute Reservation consists of over 130 square kilometers (323,000 acres) of land between Yerington, Nevada and Walker Lake (see Figure 5-3, Project #2). The 2000 census reported a population of 853 people residing on the Reservation. The rural community of Schurz is the only community within the boundaries of the Reservation. Land use on the Reservation consists primarily of open range used for cattle grazing or other agricultural activities. The Department of Defense Branchline from Wabuska extends south through the Reservation to its termination point at the Hawthorne Army Depot.

5.3.1.3.2 Power Plants, Transmission Lines, Pipelines, and Other Infrastructure

There are transmission lines, pipelines, and telecommunications infrastructure within the Mina rail alignment cumulative impacts region of influence, which holds the potential for wind, solar, and geothermal energy development, although the magnitude and specific locations of these energy development projects are not known. As indicated in Section 5.3.1.2.6, the BLM may issue geothermal leases within the Mina rail alignment region of influence. The approval of any leases and subsequent development of geothermal resources would be subject to environmental review and would be guided by BLM resource management plans.

The BLM has designated certain corridors in the area that should be used for most utility purposes; however, use of other BLM-administered land requiring new right-of-way grants has traditionally been considered on a case-by-case basis. As previously noted, the DOE and BLM Energy Corridor programmatic EIS (70 *FR* 56647, September 28, 2005) is an attempt to identify appropriate right-of-way corridors throughout the western United States, including Nevada. This effort could influence the location of rights-of-way in the Mina rail alignment cumulative impacts region of influence in future years.

5.3.1.3.3 Mining

The Mina rail alignment cumulative impacts region of influence contains a variety of mineral resources, with mining claims filed in accordance with BLM requirements and several operating mines. Establishment of mining claims on federal land do not necessarily ever lead to actual development of mining operations on those sites. Major cumulative impact issues involving mining projects include potential land-use conflicts and wastes from operations. Mineral resource locations of note within the region of influence include:

- Nevada Western Silica Corporation holds mining claims for a large, high grade silica deposit near Lida Junction, south of Goldfield in Esmeralda County. There are at least 24 million cubic meters (32 million cubic yards) of silica on site. Both the Caliente and Mina rail alignments pass within 2.4 kilometers (1.5 miles) of the claims.

- Chemetall Foote Corporation runs an operation in Silver Peak, Nevada, that mines lithium carbonate. The company pumps lithium-rich groundwater to the ground surface and then collects the lithium powder as the water evaporates. Chemetall Foote Corporation pumps the groundwater on to dry lake beds in the Clayton Valley to facilitate the evaporation process. Once removed from the water, the raw lithium material is processed in an on-site plant into market-ready, lithium containing products.

- Metallic Ventures Gold holds mining claims near Goldfield in an historic district that produces high-grade gold. The project is currently in the pre-feasibility stage of development.

Mining activities are expected to continue within the Mina rail alignment cumulative impacts region of influence. Mining activities are heavily regulated and must comply with all applicable environmental laws, rules, and regulations. The BLM has an extensive regulatory framework for mineral resource development on federal lands that strives to balance mining activities and mineral extraction with other resource management goals.

5.3.1.3.4 Walker River Basin Restoration

The decline in water quality throughout the Walker River Basin, particularly in Walker Lake, and concerns related to the Lahontan cutthroat trout, have resulted in organized restoration efforts throughout the basin (See Figure 5-3, Project #4). Walker Lake water levels have dropped substantially since the late 1800s. In addition to the declining water level, levels of total suspended solids have also increased in Walker Lake. The increasing total dissolved solid levels along with other physical, biological, and chemical conditions in the watershed and lake have stressed fisheries and other aquatic life in the lake changing the resident fish population. The Walker Lake Working Group is a nonprofit organization building public support for developing a long-term solution to protect the lake without jeopardizing the upstream community. The Group has developed a restoration strategy focused on three objectives: (1) reestablishment of spawning runs of the Lahontan cutthroat trout; (2) providing sufficient water so that levels of total dissolved solids are low enough to support the Walker Lake ecosystem; and (3) acquiring and transferring water rights for environmental and recreational purposes.

5.3.1.3.5 Monte Cristo's Castle (Proposed State Park)

In 2005, a new state park was proposed near Blair Junction (See Figure 5-3, Project #5). If approved, the park would be known as Monte Cristo's Castle and would highlight the unique geology of the area. As proposed, the park would include approximately 23 square kilometers (5,800 acres) of land located just north of the intersection of U.S. 95 and State Route 265 at Blair Junction. As currently envisioned, the proposed park would include hiking areas and interpretive trails with displays about the unique geologic formations in the area. The Nevada State Legislature in June 2007 provided for establishment of the State Park, which would be on land currently administered by the BLM. To transfer the land to the State of Nevada for establishment of the State Park, the BLM would conduct an environmental assessment and other work required as part of the Recreation and Public Purpose Lease process.

5.3.1.3.6 Other Regional Economic Development

Cumulative impacts issues associated with regional economic development actions include socioeconomic effects and overall growth in the region of influence. South and east of the Carson City/Reno area, several regional economic development initiatives are on-going or planned in the northern portion of the Mina rail alignment cumulative impacts region of influence. For example, a county-owned airport near the community of Silver Springs, Nevada, plans to expands its operations, pave its runway, and promote the development of nearby industrial parks totaling approximately 3.8 square kilometers (950 acres). Western Nevada Rail Park is approximately 56 kilometers (35 miles) east of Reno along Alternate U.S. Highway 50. When complete, the rail park would include roughly 1 square kilometer (240 acres) of industrial park serviced by the Union Pacific Railroad mainline. A master-planned community is being developed near the community of Dayton, Nevada. The development contains approximately 12 square kilometers (2,900 acres) consisting of approximately 2,300 single family homes, 0.02 square kilometer (4 acres) of multi-family units, 0.11 square kilometer (27 acres) of commercial land, 1 square kilometer (240 acres) of industrial land, and 0.08 square kilometer (20 acres) for a resort/casino and an improved airstrip that is approximately 1,600 meters (5,400 feet) long. Infrastructure, including new elementary, middle and high schools, fire station, municipal water and wastewater utilities, community center and a health and fitness center, is already in place to support this development. Industrial parks in the Hazen area are also being developed, including a 9.3-square-kilometer (2,300-acre) development along the existing Union Pacific Railroad mainline. As the Reno and Carson City metropolitan areas continue to grow and expand, additional privately sponsored developments can be expected within the northern portion of the Mina rail alignment cumulative impacts region of influence.

Additionally, major transportation corridors such as U.S. Highway 95 through the region of influence into both the Reno and Las Vegas areas will continue to grow and expand, and present additional regional economic development opportunities. A perceived need for support to the Nevada Test Site has led to designation of the Nevada Science and Technology Corridor by the Economic Development Authority for Nye County. The Science and Technology Corridor extends from Indian Springs in Clark County in the south to Tonopah in the north, passing through the Pahrump Valley, Mercury (an entrance to the Nevada Test Site), Amargosa Valley, Beatty and Goldfield, with industrial park and technology initiatives associated with the Tonopah Aeronautics and Technology Park, the Nevada Science and Technology Park in Amargosa Valley, and the Pahrump Center for Technology Training and Development. The locations and nature of specific future development opportunities are not known and are not considered to be reasonably foreseeable for the purposes of this analysis.

Nye County has completed a Yucca Mountain Project Gateway Area Concept Plan with proposed activities for the area around the entrance to the proposed repository site (DIRS 182345-Giampaoli 2007, all). This plan presents Nye County's conceptual, multi-phased land-use guidance for communities adjacent to and near the site entrance area. Nye County proposed this plan with the objective that land development occurs in an orderly and consistent manner and to increase opportunities for industrial and commercial development beneficial to the repository program. Nye County views this plan as a starting point for development of the infrastructure, institutional capacity, and facilities to support the proposed repository. The county developed the plan to use and manage existing initiatives while expanding and improving the area.

5.3.2 POTENTIAL CUMULATIVE IMPACTS – MINA RAIL ALIGNMENT

Located primarily in portions of Esmeralda, Nye, Lyon, and Mineral Counties, the Mina rail alignment cumulative impacts region of influence covers millions of acres of land, most of which is federally managed public land. Most of the land in the Mina rail alignment cumulative impacts region of influence is undeveloped, although much of it has been affected by human activity such as ranching and mining.

Potential cumulative impacts are often discussed herein within the context of the existing regulatory framework (primarily federal and state laws and regulations) and the BLM resource management planning goals and objectives. For example, the existing regulatory frameworks for water and air consider a regional and cumulative impacts perspective, in that regulatory decisions consider the potential effects from other projects as well as a proposed action. As the primary regional land manager, BLM planning and management actions consider the cumulative effects for many resources through stated planning goals and objectives, which often are based on quantitative criteria.

The following analysis of the cumulative impacts associated with the Mina rail alignment is organized by resource area, with Sections 5.3.2.1 through 5.3.2.15 summarizing potential cumulative impacts in the same order of resource discussions in Chapters 3 and 4 of this Rail Alignment EIS.

5.3.2.1 Physical Setting

5.3.2.1.1 Disturbance of Physical Resources

Physical resources consist of resources, conditions, and characteristics such as physiography, soils, and geology. As construction of any project in the area occurs, there would be a potential for changes to the physical setting because land would be disturbed through activities such as cuts and fills and construction of new structures such as buildings and bridges. The proposed railroad would be one of many new sources of change to physical resources that would continue the trend of increasing land disturbance and modifications of the natural physical environment. In large-scale projects that involve substantial ground disturbance, natural features are considered in project design, construction, operations, and potential abandonment plans, which would tend to limit direct, indirect, and cumulative impacts. The proposed railroad would disturb only a small percentage of land in the Mina rail alignment cumulative impacts region of influence.

Given the large amount of land potentially available for development of existing and reasonably foreseeable projects, and the small percentage of potentially available land required for the proposed railroad, overall cumulative impacts to physical setting in the Mina rail alignment region of influence would be small.

5.3.2.1.2 Known or Potentially Contaminated Soils

The major sources of existing soil contamination problems in the Mina rail alignment region of influence are mining, the Nevada Test Site, and the Hawthorne Army Depot. Mining activities in the region have occurred for many years, with mining wastes still remaining from older operations before the regulatory framework required waste management and cleanup. The problems associated with the Nevada Test Site have been described in recent NEPA documentation (DIRS 101811-DOE 1996, all; DIRS 162638-DOE 2002, all). Historic contamination of soils resources on the Nevada Test Site is primarily from radioactive-waste management sites and past nuclear testing activities. Environmental restoration and remediation is occurring at contaminated Nevada Test Site locations in accordance with the facility's Environmental Restoration Program, but much of the contamination is long-term and the land and soil are not restorable to useful condition. For most of the contaminated soils within the Nevada Test Site boundary, DOE is planning only a characterization and long-term monitoring program. Contaminated areas on the Nevada Test Site are generally defined and access is restricted for reasons of safety and security. Spills of any hazardous materials are possible with regional activities, but the current regulatory framework to manage and control hazardous materials and wastes ensures that actions are in place to minimize any impacts.

The Hawthorne Army Depot has an Installation Restoration Program that outlines proposed future investigations and remedial actions at each Solid Waste Management Unit at the installation and other areas of concern. A total of 123 Defense Site Environmental Tracking System sites have been identified on Hawthorne Army Depot property. Soil and groundwater contamination issues exist with the primary contaminants of concern being compounds associated with explosives and heavy metals. Environmental restoration and remediation is ongoing at a number of sites. Other sites have achieved the status of "no further remedial action planned." Contaminated areas on the Hawthorne Army Depot are generally defined and access is restricted for reasons of safety and security.

Contaminated soils or spills can affect other resources such as water resources, biological resources, and land use. Spills of any hazardous materials are possible with regional activities, but the current regulatory framework to manage and control hazardous materials and wastes ensures that actions are in place to minimize any impacts. While any potential impacts associated with hazardous materials and wastes from current and future mining operations in the region are controlled through the existing regulatory framework, mining wastes from old mining extraction and processing activities, especially in the Goldfield area, remain a concern related to soil contamination.

The proposed railroad could result in very localized contamination of soils through occasional spills (such as fuel, oil, and solvents). However, such incidents would be minor in scope and quickly mitigated in accordance with plans and regulations. All existing and foreseeable projects would be subject to the same regulations. Cumulative impacts related to contamination of soils would likely be small.

5.3.2.2 Land Use and Ownership

5.3.2.2.1 Land Use Changes

Many of the past, present, and reasonably foreseeable future actions in the Mina rail alignment region of influence result in land use changes. Land use change can also alter land ownership, land management responsibilities, and preclude future activities from these areas. The vast majority of the land used for the proposed Mina rail alignment and associated facilities would be on BLM-administered land in Lyon, Mineral, Esmeralda, and Nye Counties. The BLM manages more than 45,000 square kilometers (11 million acres) in those four counties. One of the primary land uses in and around the proposed Mina rail alignment on those BLM-administered lands is grazing. Regional grazing activities are often affected by BLM land management plans and activities.

Other existing and reasonably foreseeable major land uses in the Mina rail alignment region of influence include:

- Yucca Mountain Repository – About 6.3 square kilometers (1,600 acres) of land disturbance, most of which would be on the Nevada Test Site (already withdrawn for Nevada Test Site activities).
- Nevada Test and Training Range – About 12,000 square kilometers (3 million acres) of land the U.S. Air Force has withdrawn for special-purpose use, with about 530 square kilometers (130,000 acres) of that land disturbed by Air Force tactical target complexes and associated infrastructure.
- Nevada Test Site – About 3,200 square kilometers (800,000 acres) of land DOE has withdrawn for special-purpose use.
- Naval Air Station Fallon and the Fallon Range Training Complex – Naval Air Station Fallon administers approximately 30 square kilometers (8,000 acres) of withdrawn and acquired land associated with the air station and 950 square kilometers (234,000 acres) of land associated with the Fallon Range Training Complex.
- Walker River Paiute Reservation – Approximately 1,300 square kilometers (323,000 acres) of land managed by the Walker River Paiute Tribal Council.
- Hawthorne Army Depot – Approximately 600 square kilometers (147,000 acres) of land managed by the Army for purposes of receiving, issuing, storing, renovating, inspecting, demilitarizing, and disposing of conventional ammunition. The Army is in the preliminary planning stages regarding an offer from a private firm of 40 square kilometers (10,000 acres) to expand the Army's military training and other missions.
- Reno and Carson City Expansion – A minimum of approximately 25 square kilometers (6,300 acres) of industrial, commercial, and residential developments associated with growth and expansion of the Reno and Carson City Metropolitan areas into the northern portion of the Mina rail alignment cumulative impacts region of influence.
- Hazen industrial parks – Two industrial parks are being developed at Hazen. The Great Basin Industrial Park, a 9.3-square-kilometer (2,300-acre) industrial and residential project is being developed alongside the existing Union Pacific Railroad mainline. Churchill County has already approved this project. The Rail Park, the Union Pacific Railroad mainline from the Great Basin Industrial Park, spans approximately 1.9 square kilometers (480 acres) and is currently in the planning stage.

- Right-of-way corridors that might be established when the DOE West-Wide Energy Corridor programmatic EIS (70 *FR* 56647, September 28, 2005) is completed.

The proposed Mina rail alignment would disturb up to 140 square kilometers (35,000 acres) of land, most of which would be within the construction right-of-way. Therefore, the proposed Mina rail alignment would directly affect about 0.25 percent of the BLM-administered land in the four counties. This disturbance would include construction and operation of the rail line, facilities, quarries, water wells, construction camps, and access roads. The Mina rail alignment would cross up to 15 separate grazing allotments. These 15 grazing allotments constitute about 11,700 square kilometers (2.9 million acres) of BLM-administered land. The approximate disturbance area associated with the proposed Mina rail alignment would constitute less than 1 percent of the land within those 15 grazing allotments. Within this regional perspective of nearby existing and reasonably foreseeable land uses and land ownership, the commitment of land for the proposed Mina rail alignment and associated facilities would constitute a small proportion of overall cumulative land commitment. Use of private land for the proposed rail line would be small, and the rail line would not displace existing or planned land uses on private lands over a substantial area, nor would it substantially conflict with applicable land use plans or goals.

Considering both the proposed railroad and existing and reasonably foreseeable land uses and land ownership, cumulative impacts from land-use changes would be small.

5.3.2.2.2 Existing or Potential Land-Use Conflicts

The Federal Government administers most of the land in the Mina rail alignment region of influence, with the BLM, DOE, and the Department of Defense (Air Force and Army) acting as the major federal land managers. The Mina rail alignment region of influence also includes Walker River Paiute Reservation lands. Private land holdings are small, and generally associated with Chemetall Foote Corporation's Lithium mine near Silver Peak and other towns in the Mina rail alignment region of influence. Traditional land uses in most of the Mina rail alignment region of influence that would be directly and indirectly affected include grazing, mining, and wildlife management. Much of this land is not extensively disturbed, although it has been modified through activity such as grazing and mining.

Over time, human activity in the area, while relatively minor on a regional basis, has begun to change the natural and traditional conditions, and land-use conflicts occasionally result from this human activity. The Nevada Test Site and Nevada Test and Training Range lands have been withdrawn for special purpose and use. Both of these areas are inaccessible to the general public and land use is that of "dominant use," in which the specific DOE and U.S. Air Force missions, respectively, for these lands have ultimate priority over all other potential land uses. Hawthorne Army Depot and Naval Air Station Fallon lands were also withdrawn for special use, are inaccessible to the general public, and land use is that of "dominant use" in which the specific Army and Navy missions, respectively, for these lands have ultimate priority over all other potential land uses. Walker River Paiute Reservation lands are managed by a sovereign tribal government and used by reservation inhabitants accordingly. Around these primary regional land uses are other uses, including mineral development, recreation, urban development, and rights-of-way for various infrastructure. All of these activities and land uses result from a much more intensive land usage involving human activity.

Railroad construction and operation along the Mina rail alignment could have direct and indirect conflicts with grazing uses, access to grazing infrastructure, access to mineral resources, recreational resources, other linear rights-of-way (for example, utility corridors), and wildlife movement patterns in some locations.

Even with the existing and reasonably foreseeable land-use changes, the region as a whole would continue its traditional ways, with grazing and wildlife habitat as major land uses, and cumulative impacts related to land-use conflicts would be small.

5.3.2.2.3 Energy and Mineral Development

Existing and potential future energy and mineral development occurs in various locations throughout the Mina rail alignment cumulative impacts region of influence. In addition to the traditional energy and mineral development (primarily hard-rock mining and industrial mineral development), more recently this development includes geothermal and wind resources. The BLM administers energy and mineral development, evaluates and approves various proposed mineral development operations, and evaluates and approves geothermal energy development projects on federal lands proposed by private companies. Today's energy development environment includes a mix of old and new, involving both nonrenewable and renewable energy resource development.

Because of the scope and extent of typical mining operations, mineral resources that become actual operating mines could result in environmental and land-use issues. Within the Mina rail alignment region of influence, most mining and energy-development activities would occur on federal lands, and the BLM will have a major role in mitigating and monitoring potential effects through its mining and reclamation requirements, NEPA, and other elements of the regulatory framework. Mineral exploration will continue to occur in many parts of the Mina rail alignment region of influence, and some level of conflict from mining exploration and development with other land uses could be unavoidable.

Any potential conflict of the proposed railroad with energy and mineral development would be small in scope and occur in localized areas, and the effects of any such conflicts would be mitigated through the existing regulatory framework and BLM policies and plans. All existing and foreseeable projects would be subject to regulatory requirements and BLM policies and plans related to energy and mineral development. Therefore, cumulative impacts resulting in land-use conflicts related to energy and mineral development along the Mina rail alignment would be small.

5.3.2.2.4 BLM Land Sales and Other Disposals

While specific initiatives for land disposals in the Mina rail alignment region of influence have not yet been developed, BLM has plans to designate for potential future disposal approximately 750 square kilometers (185,000 acres) of public lands in the area including: lands that are difficult and uneconomic to manage (for example, scattered parcels south of Hawthorne and in Smith and Mason Valleys, checkerboard lands near Fernley, Silver Springs and the Carson sink); land that would support community expansion (such as land west of Yerington, land surrounding the towns of Luning, Mina, Sodaville, Fallon, Gabbs, Reno, Verdi, and lands east of Montgomery Pass, near Honey Lake Valley and Dixie Valley); lands with possible agricultural potential (for example, Smith Valley, Mason Valley, Honey Lake Valley, and Edwards Creek); lands along the East Walker River identified for exchange to benefit Bureau programs.

Approximately 92 square kilometers (22,622 acres) have been identified for potential disposal in the vicinity of Goldfield, about 23 square kilometers (5,765 acres) have been identified for potential disposal near Scottys Junction, and 160 square kilometers (39,432 acres) have been identified for potential disposal near Beatty. Land disposal areas have also been identified near Coaldale Junction, Blair Junction, Silver Peak, and Millers.

While the proposed railroad would operate within the regional context of BLM land disposal efforts and any related implications and effects, the railroad would have no affect on, nor would it be affected by, BLM land disposal efforts.

5.3.2.2.5 Recreational Land Use

Public lands in the Mina rail alignment region of influence provide a number of diverse recreation opportunities, and the BLM has designated certain lands as recreation management areas. Demand for recreation is increasing as more people move to and recreate in the Mina rail alignment cumulative impacts region of influence. Dispersed recreation, the principal opportunities available within the Mina rail alignment region of influence, requires a variety of sites but needs no special facilities. These opportunities include caving, photography, automobile touring, backpacking, bird watching, fishing, hunting, primitive camping, hiking, rock climbing, and competitive and noncompetitive off-highway vehicle events. An example of increasing interest in recreation areas is the proposal for the Monte Cristo's Castle as a State Park near Blair Junction; this Park would highlight the unique geology of the area and include hiking areas and interpretive trails with displays about the geologic formations in the area.

The BLM has a major role in recreation opportunities in the Mina rail alignment region of influence. BLM field offices regularly evaluate new opportunities for recreational resources that would provide both passively and actively managed recreation opportunities. There are many such areas that BLM has designated for recreational use, such as a campground and other day-use facilities at Walker Lake, attracting about 35,000 visitors per year. Other forms of dispersed recreation in the region of influence include hunting, camping, and off-highway vehicle use. Increased demand for off-highway vehicle use from the increasing regional population, including the Las Vegas and Reno-Carson City areas, is expected to continue. Many areas of BLM-administered land in Clark County previously used for off-highway vehicle recreation have been closed, causing a shift in use into other BLM areas. As growth and development occur in the Mina rail alignment cumulative impacts region of influence, recreational resources will continue to be in demand, but the potential for conflict with recreational resources also will increase. Recreational resource locations, quality, and availability will evolve as the Mina rail alignment region of influence changes.

The Pahrump area is growing very rapidly for a variety of reasons. Both developed and undeveloped recreational opportunities in the area are abundant, with very easy access to public lands for activities such as hiking, camping, sightseeing, and rockhounding. The town of Pahrump is planning for development of approximately 6 square kilometers (1,500 acres) to be called the Last Chance Park on lands currently managed by the BLM and already used for various types of recreation. The plans include construction of access roads, restrooms, parking areas, and turn-outs, as well as the placing of signs, bike racks, benches, a pole-and-cable fence, trash cans and picnic tables. Much of the park would be dedicated to equestrian, hiking and biking paths, with the remainder allotted to all-terrain vehicle motorized use. Potential environmental impacts and issues will be identified and assessed through the NEPA process.

DOE has sited the proposed Mina rail alignment to avoid wilderness areas and other major recreational resources to the maximum extent practicable. Given the limited effects on regional population, the existence of vast regional recreational opportunities, and limited direct interaction of the railroad with recreational resources, cumulative impacts to access to and use of recreational resources in the Mina rail alignment region of influence would be small.

5.3.2.2.6 BLM Rights-of-Way

As urbanization and other development occur in the Mina rail alignment region of influence, the need for utility and other rights-of-way will increase. The BLM has developed certain preferred corridors over federal lands that it uses to the maximum extent possible for linear rights-of-way, such as for utilities. This keeps many right-of-way purposes together in one location instead of spreading them out over more dispersed areas.

The land-use changes authorized by a BLM right-of-way grant would also have the potential to impact other resource areas as those land-use changes occur. Before approval of right-of-way applications, the BLM will evaluate the impacts of the projects through appropriate NEPA evaluation. Use of land for right-of-way purposes is consistent with BLM regulations and planning processes, and any land-use changes or disturbances associated with those rights-of-way are mitigated to the extent possible and according to BLM policies. As required for the issuance of rights-of-way, the project proponent would prepare and submit to the BLM a Plan of Development for each proposed right-of-way. The Plan of Development would describe the methods and procedures to be used to construct the proposed action on the right-of-way, including site-specific stipulations, terms, and conditions to satisfy all BLM requirements. Certain rights-of-way are long-term in nature and result in unavoidable impacts through land disturbance and the exclusion of other land uses now or in the future.

Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. Land areas for the Mina rail alignment, construction camps, quarries, and access roads would cross or overlap existing or proposed utility rights-of-way in approximately 22 to 29 locations. Land areas for railroad operations support facilities could also overlap existing or proposed utility rights-of-way. This situation would be typical for other linear rights-of-way. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Cumulative impacts to BLM rights-of-way and right-of-way holders would be small.

5.3.2.2.7 Other BLM Land-Management Actions

The Federal Land Policy Management Act of 1976 (Public Law 94-579) mandates the BLM to manage its public lands from a multiple-use perspective. The Federal Land Policy Management Act specifically mentions balancing renewable and nonrenewable resources, including but not limited to recreation, range, timber, minerals, watershed, wildlife, fish, natural, scenic, scientific, and historic values. Therefore, the BLM mission to manage the lands to meet multiple-use objectives is challenging, because many of the resources and associated values often conflict.

Within the context of the Mina rail alignment cumulative impacts region of influence, the BLM planning process and management goals and objectives within their plans are key determinants of the compatibility of the proposed railroad with other projects in the region of influence. As noted in Section 5.3.1, there are many continuing and reasonably foreseeable activities that involve the BLM. Because the BLM is and will remain the major land manager in and around the Mina rail alignment region of influence, BLM land-management goals, objectives, and subsequent land-management actions will largely determine if and how new projects and activities occur.

BLM objectives and goals within the resource management plans can serve to encourage or restrict activities in certain locations. Areas needing special management attention (such as Areas of Critical Environmental Concern) are also identified in the planning process to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards. Multiple-use management goals and objectives become more challenging as cumulative development and land-use changes encroach on open land in the Mina rail alignment region of influence.

The Mina rail alignment would cross three BLM planning areas (Carson City, Battle Mountain, and Las Vegas). Each BLM Field Office manages lands within its administrative boundaries according to one or more Management Framework Plans or Resource Management Plans. The Carson City, Battle Mountain, and Las Vegas plans would be applicable to the Mina rail alignment. These programs and resource management plans require a number of public and private partnerships and a collaborative approach to land management and planning.

Grazing operations are a major BLM land-management program in the Mina rail alignment region of influence. Grazing results in both direct and indirect cumulative impacts to vegetation, habitats, and wildlife. Environmental impacts associated with grazing operations are a function of the location, timing, intensity, duration, and frequency of grazing. Grazing animals directly affect plant communities through trampling and nutrient redistribution. The most noticeable impacts occur around waters, salt blocks, fence lines, and other areas where animals concentrate. With proper grazing management, these concentration areas are limited in extent and mitigated regularly through management procedures such as movement of salt blocks and water hauls. While grazing can stimulate growth of some plants and provide other benefits, it can also reduce plant abundance, density, and vigor, especially in sandy soils.

Ultimately, BLM land-management efforts and the content of resource management plans will play a major role in the magnitude, location, and extent of direct, indirect, and cumulative impacts in the Mina rail alignment region of influence, and in the relative balance among multiple uses and resource values chosen for the public lands. DOE recognizes the importance of these land-management actions and encourages readers to review specific resource management plans for more detailed information. As discussed in Chapter 2 of this Rail Alignment EIS, the proposed railroad would be subject to BLM decisions and approval, and any effects of the railroad on BLM resource management planning, land-management activities, and BLM-managed natural resources would be implemented by BLM as appropriate. The proposed railroad's contribution to cumulative impacts to BLM land-management planning and actions in the Mina rail alignment region of influence would be small.

5.3.2.2.8 Urbanization and Economic Development Initiatives

In response to increased economic development goals in the region of influence, the urbanized areas in the Mina rail alignment region of influence have generally planned for and solicited ways to grow and develop. Concepts such as industrial-park development, airport expansion, increased retail opportunities, and housing are prominent goals of the public and private sectors in the Mina rail alignment region of influence. Several regional economic development initiatives are on-going or planned in the northern portion of the Mina rail alignment cumulative impacts region of influence. This trend is likely to continue, with land-use and ownership changes and potential land-use conflicts becoming an increasing issue and challenge for the future. However, it is likely that the rural nature of the overall Mina rail alignment cumulative impacts region of influence will remain largely in tact.

With or without the proposed railroad, urbanization and economic development activities, while increasing, would not generally change the overall undeveloped character of the Mina rail alignment region of influence.

5.3.2.3 Aesthetic Resources

Cumulative impacts to aesthetic resources from construction and operation of a railroad along the Mina rail alignment and other regional activities would primarily result from modifications to natural viewsheds. The natural setting of the Mina rail alignment region of influence includes vast and expansive viewsheds typical of much of the western United States. The open spaces and wide vistas offer interesting cloud, weather, and landscape interactions. Human activity disturbs the natural viewsheds with views of land disturbances such as buildings, roads, removal of vegetation, power lines, equipment, and vehicles. Any activity that disturbs substantial areas of land can result in visual impacts from fugitive dust and ground scars that create a contrast with the surrounding environment and draw the viewer's attention. Additionally, most man-made structures are designed and built for their functionality and safety, not for their visual appeal or compatibility with the visual character of the landscape. For example, projects with construction-related equipment, facilities, and activities can include the presence of workers, camps, vehicles, and machinery, lay-down yards, and dust. The likely addition of explosives bunkers at the Hawthorne Army Depot and projected wind-energy development are examples of other long-term visual changes that are reasonably foreseeable. Each type of project has its unique visual features, but generally, new projects would not be consolidated into any specific location within the region of influence.

While the area has a history of railroad use, the presence of a railroad and associated train traffic would be an identifiable change to the regional viewsheds from some observation points and provide a noticeable contrast with natural visual attributes. The passage of a train would attract the attention of an observer, both because of the noise associated with the train and the contrast with the landscape, especially if the train were to fall in the foreground or middle ground of the viewshed. Visual impacts of passing trains would be temporary, but visual impacts of the track would be long term.

Visual resources within the region of influence have been considered through application of the BLM Visual Resource Management System (see Sections 3.3.3 and 4.3.3 and Appendix D of this Rail Alignment EIS). This system identifies and classifies the BLM-administered lands within established visual resource objectives, and proposed activities are evaluated within the visual resource management framework to consider consistency with the visual resource objectives. Without restoration and reclamation efforts, ground disturbances in the regional environment would last for long periods. The magnitude and extent of potential visual impacts vary based on the number of viewers affected, distance and atmospheric conditions of viewing, degree of visual contrast compared to existing visual attributes, viewer sensitivity to the visual changes, and compatibility with existing land uses. The BLM generally requires ground disturbances to be restored and reclaimed as part of project approval.

For the Mina alignment, analysis using the Visual Resource Management System indicated that the proposed railroad would potentially be inconsistent with visual resource management objectives in the areas of the Schurz crossing of U.S. Highway 95 (construction), and some cuts and fills (during construction and operations). As shown in Appendix D, lands that have potentially restrictive visual resource objectives (such Classes I and II) are not prevalent in the region of influence.

There would be no known interactions of the proposed railroad with other reasonably foreseeable activities that would affect a Class I or Class II area in the Mina rail alignment region of influence.

5.3.2.4 Air Quality and Climate

Emissions of concern in the Mina rail alignment region of influence include fugitive dust and emissions resulting from the operation of machinery and equipment. Construction activities such as surface disturbance and use of haul trucks in the Caliente rail alignment region of influence would generate fugitive dust. Fugitive dust is a type of nonpoint source air pollution (small airborne particles that do not originate from a specific point). These particulate matter emissions are regulated according to their size (aerodynamic diameter equal to or less than 2.5 micrometers [$PM_{2.5}$] and 10 micrometers or less [PM_{10}]). Fugitive dust is generally controlled through the application of water, or in some cases, application of a chemical compound designed to minimize dust emissions. Most of the projects and activities identified in this analysis would generate some level of fugitive dust. The plumes associated with fugitive dust generation are often localized to the area being disturbed and are temporary. In arid areas such as the Mina rail alignment cumulative impacts region of influence, generation and control of fugitive dust will always be a concern. Exhaust emissions from the operation of machinery and equipment include sulfur dioxide, oxides of nitrogen, volatile organic compounds, and carbon monoxide.

There is a comprehensive air quality permitting system in Nevada to evaluate and approve only those projects that are allowable within quantitative air quality thresholds. The Nevada Division of Environmental Control, Bureau of Air Pollution Control, has established and implemented air pollution control requirements in Nevada Revised Statutes 445B.100 through 445B.825, inclusive, and Nevada Revised Statutes 486A.010 through 486A.180, inclusive. The Bureau of Air Pollution Control has jurisdiction over air quality programs in all counties in the state except Washoe and Clark. The Bureau of Air Pollution Control also has jurisdiction over all fossil fuel-fired units in the state that generate steam for electrical production. The Mina rail alignment would be subject to the permitting requirements noted above, and would occur in air basins that are either in attainment or unclassifiable. The State of Nevada will not grant permits for activities that cannot show compliance with the applicable federal and state regulations.

The air quality impact analysis for the Mina rail alignment assessed potential impacts through several means, including air quality modeling of maximum concentrations relevant to National Ambient Air Quality Standards. The analysis concluded the emissions during construction or operation of the rail line or any associated facilities would be in conformance with applicable standards, with the exception of the 24-hour standard for both PM_{10} and $PM_{2.5}$ near the construction right-of-way at Mina and Schurz during the relatively short construction period, and at the Staging Yard at Hawthorne and the potential Garfield Hills quarry. DOE would be required to prepare an application for a Dust Control Permit and a Surface Area Disturbance Permit Dust Control Plan and submit them to the Nevada Division of Environmental Protection Bureau of Air Pollution Control prior to the quarry and Staging Yard development. It is likely that the requirements of the plan would reduce fugitive dust emissions, thus reducing the possibility of exceeding National Ambient Air Quality Standards.

Potential cumulative impacts to air quality from construction and operation of the proposed railroad along the Mina rail alignment would be small, but could approach moderate if the potential violation of the National Ambient Air Quality Standards noted above occurred.

5.3.2.5 Surface-Water Resources

5.3.2.5.1 Changes in Drainage, Infiltration Rates, and Flood Control

Construction of major projects in previously undeveloped areas often results in changes to natural drainage. Construction could include regrading that would allow runoff from a number of minor drainage channels to collect in a single culvert or pass under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. This would cause some localized changes in drainage patterns, but this probably would occur only in areas where natural drainage channels are small. Compaction of soil during construction could reduce water infiltration rates and change natural runoff and drainage patterns. However, some activities would disturb and loosen the ground for some time, which could cause higher infiltration rates.

Construction in washes or other flood-prone areas probably would reduce the area through which floodwaters naturally flow. This could result in water building up, or ponding, on the upstream side of crossings during flood events, and then slowly draining through the culverts or bridges. These alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the impact of floods on human health and safety, or cause significant harm to the natural and beneficial values of the floodplains.

Insufficient inflow from the Walker River into Walker Lake would continue to jeopardize Walker Lake's future as a viable fishery, with or without the proposed railroad. If developed, the proposed railroad would not result in further inflow reductions into Walker Lake. Mitigation measures that could be implemented by the U.S. Fish and Wildlife Service or other entities could improve the chances for a viable fishery in the lake in future years.

As a long linear project of up to 502 kilometers (312 miles) long, the proposed Mina rail alignment would pose new surface drainage challenges because of the existing characteristics of terrain, topography, soils, and physical features. Construction activities that could temporarily block surface drainage channels include moving large amounts of soil and rock to develop the rail roadbed (subgrade) and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and to allow movement of equipment to the construction initiation points.

Project planning and best management practices would help avoid or reduce potential impacts from the proposed railroad or other ongoing or reasonably foreseeable future actions. Potential cumulative impacts due to changes in drainage, infiltration rates, and flood control would be very small and localized.

5.3.2.5.2 Spill and Contamination Potential

Major construction activities and other projects in the region of influence would use materials including petroleum products (fuels and lubricants) and coolants (antifreeze) necessary to operate construction equipment, and could include solvents used in cleaning or degreasing actions. A release or spill of contaminants to a stream or river would have the greatest potential for adverse environmental impacts; a release of contaminants to dry impermeable soil would have the least potential for adverse impacts. Other projects would face similar situations. Spill-control and -management plans (and standard operating procedures for the construction industry) would reduce the likelihood of spills. Construction and operation of the proposed railroad would be typical of major activities that use materials that could cause contamination through spills.

While the risk of a spill and associated water contamination cannot be totally eliminated, risks can be managed through regulatory controls so that the resulting cumulative impacts would be small.

5.3.2.6 Groundwater Resources

Existing and proposed future development within the Mina alignment region of influence presents the challenge of matching water supply with water demand. Because water availability is a potential resource constraint in the Mina rail alignment region of influence over time, water demand can be both competitive among potential users and controversial among users and the general public. To allocate water uses, the State of Nevada uses a water permit application process coordinated by the State Engineer. Once granted, water rights in Nevada have the standing of both real and personal property. It is possible to buy or sell water rights and change the water's point of diversion, manner of use, and place of use by filing the appropriate application with the State Engineer. Overall, because the water permitting and allocation process considers the broad range of factors noted above, the process serves as a way to manage potential cumulative impacts of water demand and use within each basin.

Representative existing and reasonably foreseeable water uses in the Mina rail alignment region of influence include:

- Public-supply/municipal, agricultural (stock watering), and mining uses collectively comprise approximately 87 percent of groundwater use within the Mina rail alignment region of influence.
- The Nevada Test Site uses about 830,000 cubic meters (673 acre-feet) of water per year.
- The Yucca Mountain Repository demands would range from about 218,000 to 527,000 cubic meters (176 to 427 acre-feet) of water per year between calendar years 2010 and 2013, which represents the period of the highest water demand for the Mina rail alignment project. The Repository would use approximately 76,700 to 397,000 cubic meters (62 to 322 acre-feet) of water per year in calendar year 2014 through completion of operation.

It is estimated that rail construction along the Mina rail alignment would use up to about 7.34 million cubic meters (5,950 acre-feet) of water, with about 80 percent of that water use occurring in the first 2 years of construction. About 23,000 cubic meters (17 acre-feet) of water would be needed annually during the operations phase. DOE would obtain water for construction and operation of the railroad from proposed new wells installed in various water basins along the Mina rail alignment.

Committed groundwater resources in the Mina rail alignment region of influence already exceed annual perennial yield values (a measure of available groundwater supply replenished each year through recharge) within some of the groundwater basins (hydrographic areas) that would be affected by the proposed railroad. Based on the proposed locations of new wells in specific hydrographic areas along the proposed Mina rail alignment, additional groundwater appropriations would be needed in 19 hydrographic areas. However, committed (cumulative) groundwater resources currently exceed estimated perennial yields in eight of these hydrographic areas (146, 149, 170, 173A, 203, 204, 228, and 229). One of these eight hydrographic areas (229) and two other hydrographic areas (144 and 145) that the Mina rail alignment would cross have low perennial yields. Five of these areas are State of Nevada-designated groundwater basins. While designated groundwater basins are not considered closed to additional appropriations, the State Engineer could impose additional restrictions and preferred uses of the water in these designated basins.

A number of scenarios have been developed to assess the potential effects of the Mina rail alignment's contribution to cumulative water demand in the cumulative impacts region of influence. Groundwater would need to be appropriated in 18 hydrographic areas. The assumption used for developing these scenarios is that water demands for railroad construction and operations along the Mina rail alignment would be met through installing and withdrawing groundwater from new wells, with pumping in individual wells at a constant rate occurring primarily over 9 months to support all rail-line construction water needs, over 2 to 3 years at quarry sites, and over the railroad operations period for facilities. Depending on the specific combination of alternative segments, total water withdrawals associated with the proposed railroad could exceed annual perennial yield values for hydrographic areas 123, 144, and 229, and could be as high as 48 percent, 57 percent, 82 percent, 87 percent, and 99 percent of the annual perennial yield in hydrographic areas 145, 228, 110A, 121B, 227A, respectively. In other areas, water withdrawals associated with the railroad would range from less than 1 percent to as high as approximately 28 percent of the annual perennial yield value.

By utilizing a combination of one or more specific approaches or methods to obtain water for construction (including methods that are tailored to a hydrographic area's unique groundwater condition), potential cumulative impacts to groundwater resources would be minimized. New groundwater withdrawals could, depending on the withdrawal rate; hydrogeologic conditions present at the proposed pumping location and in the surrounding area; and the location and characteristics of nearby groundwater resource features, cause some decrease in the amount of water that might be available to an existing well having an associated water right, to an existing spring discharge, or to a downgradient groundwater basin.

Overall, the needs of the proposed railroad would represent a small portion of the current cumulative water usage within the Mina rail alignment region of influence, which in some locations would continue to exceed perennial yield values.

5.3.2.7 Biological Resources

5.3.2.7.1 Habitat Loss and Fragmentation

Past, present, and reasonably foreseeable future actions in the Mina rail alignment cumulative impacts region of influence would result in noticeable cumulative land disturbance. Existing activities such as the

Nevada Test and Training Range, the Nevada Test Site, Naval Air Station Fallon and the Hawthorne Army Depot have already resulted in land disturbance and substantial changes to existing biological resources, and projects such as the various proposed industrial parks and master-planned communities in the northern portion of the Mina rail alignment cumulative impacts region of influence would continue this trend. Such land disturbances result in altered natural biological and ecological conditions, and directly serve to reduce the amount of natural land available as habitat and open space.

The primary adverse construction-related impacts on vegetation communities from ground disturbance would be the physical destruction or removal of vegetation, and the permanent or temporary removal or compaction of topsoil or other growing medium for the plants. These effects would occur with any major activity resulting in ground disturbance, including the proposed railroad. As more activity occurred, the cumulative loss of vegetative communities and associated habitats would increase. Management of these effects would typically be considered in project planning and mitigation, including projects on BLM-administered land. Much of the emphasis in land management in the Mina rail alignment region of influence concerns the maintenance or reconstruction of healthy habitats.

Habitat destruction would lead to direct impacts such as wildlife injury and mortality, alteration of behavior and movement patterns, and the indirect impacts of reduced vegetative health, reduced biological diversity, and locally degraded ecological function. When extensive habitat fragmentation occurs, the individuals or populations of particular species could have difficulty surviving. Habitat destruction arises from a number of sources, including projects that involve land disturbance, and land management actions including wild horse and burro management. Though any project that causes disturbance of vegetation contributes to habitat fragmentation, linear projects that impose any degree of impediment to movements, like the proposed railroad, amplify the potential effects.

Measures to avoid, minimize or otherwise reduce impacts are typically implemented by project proponents and encouraged by government agencies and generally include actions to reduce or avoid habitat fragmentation and loss. Such actions would include minimizing land disturbance, using existing roads, interim reclamation, combined roads/utility rights-of-way for pipelines and cables, noise reduction, centralization of facilities, and employee training and education.

The Hawthorne Army Depot has an Integrated Natural Resources Management Plan (DIRS 181899-USAF 2007, all), which is being used to ensure that natural resource conservation and Army mission activities are integrated and are consistent with federal stewardship requirements on mission lands. The plan describes an ecosystem-management approach that provides guidance to avoid the impacts of habitat loss and fragmentation, conserve biodiversity, and improve and enhance natural resource integrity while supporting sustainable economies and communities.

In areas proposed for railroad operations purposes, the impacts to vegetation would typically be moderate in scope, and cumulatively add to habitat loss and fragmentation. However, in areas slated for short-term use during the construction phase, such as construction camps, revegetation and reclamation efforts would result in replacement of topsoil, reseeding of native species, monitoring for success, and eventual return of a native vegetation community to conditions comparable to predisturbance conditions.

Cumulative impacts due to habitat loss and fragmentation would be small to moderate through the construction and operations phases throughout the Mina rail alignment region of influence.

5.3.2.7.2 Invasive Species and Noxious Weeds

Invasive species and noxious weeds naturally move into new areas over time, but this occurrence has been accelerated in many areas through human activity, either intentionally or unintentionally. In many cases, these plants have been moved into North America from another continent. They have been accidentally introduced through contaminated grain or hay, or sometimes intentionally introduced for erosion control or as ornamentals. In addition, livestock and vehicles can cause invasive species and noxious weeds to spread, birds could carry seed, or the species can be brought in with contaminated fill dirt. Regardless of how they were introduced, invasive species and noxious weeds possess characteristics that allow them to compete aggressively with native vegetation. Invasive species and noxious weeds impact native plants, animals, and natural ecosystems by:

- Reducing biodiversity
- Altering hydrologic conditions
- Altering soil characteristics
- Altering fire intensity and frequency
- Interfering with natural succession
- Competing for pollinators
- Displacing rare plant species
- Replacing complex communities with single-species monocultures

From a cumulative impacts perspective, any time land is disturbed and native vegetation is lost there is an opportunity for noxious weeds to replace the native vegetation. While the BLM and other land owners/ managers in the area have implemented programs to minimize this potential, invasion of noxious weeds cannot always be prevented. Therefore, coordinated multi-agency management actions and efforts are needed to mitigate the effects from cumulative land disturbance. Management of noxious and invasive weeds is essential for restoration of native plant community health and resiliency. If noxious and invasive weeds were not managed, they would continue to gradually replace more desirable native species throughout the Mina rail alignment region of influence.

Linear disturbances such as pipelines, roads, utility corridors, or rail alignments that cross relatively undisturbed land have the potential to exacerbate the spread of these species into areas not previously affected. As the invasive or noxious weeds become established along the linear features they spread to adjacent areas, affecting the plant and animal communities beyond the actual disturbance, and are able to outcompete native species by responding more rapidly to the infrequent availability of water.

These impacts could occur as a result of railroad construction and operation and from existing or foreseeable projects, but strict adherence to best management practices should reduce the potential for impacts. Cumulative impacts due to the introduction and spread of invasive species and noxious weeds would be small.

5.3.2.7.3 Special-Status Species

Habitat for several special-status species would be disturbed, and individual mortality of several of those special status species could occur during railroad construction and operations along the Mina rail alignment. Through the NEPA and permitting processes, each proposed project and land-management planning effort in the Mina rail alignment region of influence will face challenges for the protection of various special-status species. There are a number of special-status species that could be affected by cumulative impacts in the Mina rail alignment region of influence. Recent attention has focused on several specific species, including the desert tortoise and Lahontan cutthroat trout, as discussed below.

The Mojave population of the desert tortoise (*Gopherus agassizii*) is listed as threatened under the Endangered Species Act of 1973 (16 U.S.C. 1531 to 1544). It is found within the proposed Mina rail alignment only in the southwestern-most 48 kilometers (30 miles), from the Beatty Wash area to Yucca Mountain (DIRS 101830-Bury et al. 1994, pp. 55 to 72). The desert tortoise is found in southern California, parts of southern Utah, and in the southern portions of Nevada, with the tortoises potentially affected by railroad construction and operation at the extreme northern extent of their range. While relative abundance of the tortoise is low in much of the Mina rail alignment region of influence, every action that could disturb soil or vegetation within the tortoise's range has potential cumulative impacts of loss or fragmentation of the species' habitat or the direct mortality of individual desert tortoises

The threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*) is stocked in Walker Lake and occurs upstream to Weber Reservoir. Weber Dam currently blocks movement further upstream, and prevents spawning by cutthroat trout. However, in the near future, a fish ladder might be developed at that dam to allow fish movement. Reestablishment of a self-sustaining population of Lahontan cutthroat trout in the Walker River system is a prerequisite for recovery of this species. With mitigation, the construction activities along the Mina rail alignment would have minimal effects on the trout, but the existing problem with Weber Dam blocking movement of the trout further upstream would remain.

The BLM resource management plans sometimes place restrictions on other activities (such as grazing, wild horse and burro abundance, off-road vehicle use, mineral activities) so that desert tortoise or other special status species habitat can be protected. However, off-road vehicle use, shooting, and collecting of individuals continue to affect tortoise populations. Habitat protection efforts for the desert tortoise are coordinated among a number of federal, state, and local governmental agencies, with the cumulative impact perspective a major factor in determining allowable impacts to the tortoise. Restoration plans and habitat conservation plans also affect the required mitigation measures, best management practices, and standard operating procedures for the protection of the desert tortoise or other special-status species.

Private landowners, corporations, state or local governments, or other non-federal landowners who wish to conduct activities on their land that might incidentally harm (or "take") wildlife listed as endangered or threatened must first obtain an incidental take permit from the U.S. Fish and Wildlife Service. To obtain a permit, the applicant must develop a Habitat Conservation Plan, designed to offset any harmful effects the proposed activity might have on the species. Multi-species Habitat Conservation Plans are underway in two places in the Caliente rail alignment region of influence: (1) the Coyote Springs area and (2) in southern Lincoln County in the area of the recent BLM land disposal. Additionally, there is a single species (desert tortoise) Habitat Conservation Plan being developed in the Pahrump area of Nye County. These plans would support development of private lands while accounting for the potentially affected species.

No major effects on special status species are projected to result from construction and operation of the proposed railroad along the Mina rail alignment. DOE would conduct any required consultation with the U.S. Fish and Wildlife Service in accordance with the Endangered Species Act. There is a substantial regulatory framework, to which all projects are subject, that serves to evaluate and protect special status species. Therefore, cumulative impacts to special status species would be small.

5.3.2.7.4 Wildfires

Wildfires are a major environmental concern throughout the Mina rail alignment region of influence due to the generally dry climate and the increasing presence of invasive plant species. When they occur, wildfires have a significant and long-term impact on vegetation, wildlife, other natural resources, and human safety. The most important biological effects of fires include:

- Loss of native plant communities
- Decreased stability of watershed and soils
- Decreased or degraded wildlife habitat
- Increase in potential for invasive species spread
- Overall disruptions to ecological function

Sources of regional wildfires are both natural (for example, lightning) and human caused. With increased activity in the Mina rail alignment region of influence, the potential for future human-caused fires increases. Because the BLM administers most of the land in the Mina rail alignment region of influence, the BLM has primary fire-avoidance and fire-fighting responsibilities in the Mina rail alignment region of influence.

Both the proposed railroad project and other reasonably foreseeable future actions would likely implement appropriate fire-avoidance strategies in consultation with the BLM. Potential cumulative impacts from wildfires would be small.

5.3.2.8 Noise and Vibration

5.3.2.8.1 Railroad Noise

In the Mina rail alignment cumulative impacts region of influence, there is an existing branchline extending from Hazen, Nevada, to the Hawthorne Army Depot. The noise associated with railroad operations is part of the existing environment, specifically in the Schurz area where the railroad's presence is very evident. The sounds associated with the existing branchline include wayside noise (noise generated by the cars and locomotives), and horn sounding. The individual operating rules of each railroad require train engineers to sound horns when approaching most grade crossings. Horn sounding is generally not required at private crossings. Wayside noise and horn sounding are common in Schurz and along other portions of the existing branchline.

Hawthorne Army Depot is planning to construct a rail siding, known as the Wabuska Spur, which would increase the Depot's outloading capacity. Increased rail capacity could cause increases in overall rail traffic on the existing branchline and could result in more wayside noise and horn sounding events more frequently near Hawthorne within the Mina rail alignment cumulative impact region of influence.

Transportation of spent nuclear fuel and high-level radioactive waste casks would result in as many as eight one-way trips per week along the Mina rail alignment. Train activity associated with supply and maintenance of the Yucca Mountain Repository is also proposed along the completed railroad (as many as seven one-way trips per week), as is rail line maintenance activity (about two one-way trips per week), for a total of about 17 one-way trips per week. During the construction phase, completed portions of the rail line would also be used to deliver ballast to construction areas.

Potential impacts from noise along the Mina rail alignment would be expected to be small. However, the proposed railroad would introduce or expand noise sources into areas of the Mina rail alignment region of influence that previously had very limited railroad noise. This could result in incremental annoyance effects for some people.

While adverse noise effects could increase for some people in the Mina rail alignment region of influence, railroad construction and operations along the Mina rail alignment would substantially reduce noise impacts for people in Schurz, because the existing rail line through Schurz would be eliminated and replaced by one of Schurz alternative segments. This would provide a substantial reduction in annoyance effects for people in Schurz.

5.3.2.8.2 Urban Noise

Urban noise includes automobiles, construction activities, barking dogs, and other human activities generally within an identifiable community. At present, urban noise in the Mina rail alignment region of influence is limited because there are only a few cities and communities. However, with economic development and growth goals throughout the region of influence, the number and scope of urbanized areas is expected to increase. Urban noise is generally localized and is differentiated from the aircraft and railroad noise sources, which move with the source from one location to another, while urban noise is within identifiable geographic borders associated with the locations of populations.

The proposed railroad would have a very small effect on urbanization in the area, and its effect on urban noise in the Mina rail alignment region of influence would be small. Cumulative impacts related to urban noise would be small.

5.3.2.8.3 Aircraft Noise

Aircraft-related noise from engines and sonic booms is common throughout the Mina rail alignment cumulative impact region of influence, and can cause “startle” and annoyance effects. The noise associated with military aircraft is consistent with the “dominant use” of the area for military and defense-related activities at the Nevada Test and Training Range and Naval Air Station Fallon. Any noise effects associated with the missions for the Nevada Test and Training Range or Naval Air Station Fallow would be considered necessary and unavoidable. Commercial air traffic also contributes to noise impacts in the region of influence.

The proposed railroad would not contribute to cumulative aircraft noise.

5.3.2.8.4 Vibration

Vibration can be perceived on land surfaces and within buildings with certain types of activities. Construction activity is one of the more common sources of vibration, but construction vibration would be very localized and typically minor in scope and duration. In the Mina rail alignment cumulative impacts region of influence, other possible sources of vibration include occasional testing activities at the Nevada Test and Training Range and sonic booms from aircraft-related military activities in the airspace above the region of influence. These events would also tend to be short-term and localized.

Cumulative impacts from vibration would be small.

5.3.2.9 Socioeconomics

The economic roots of the Mina rail alignment cumulative impacts region of influence have traditionally been based on mineral development, military operations and support, and livestock grazing. These activities will continue to be the primary economic drivers in the Mina rail alignment cumulative impacts region of influence. Additionally, the expansion of the Reno-Carson City metropolitan area in the northern reaches of the Mina rail alignment cumulative impacts region of influence will continue to occur, providing additional economic inputs. While a railroad in the Mina rail alignment would be a major development in the region of influence, its long-term economic development potential would be limited and would primarily be related to construction activities. If the Shared-Use Option were chosen and implemented, there would be greater potential for positive economic development benefits compared to the Proposed Action.

Population growth in the Mina rail alignment cumulative impacts region of influence has generally been stagnant in much of the area. However, growth and development is desired by many in the region. It is uncertain if there is sufficient economic development growth potential in these areas to support the desired growth. It is possible that some areas would grow at the expense of other areas, or that recently developed plans for growth turn out to be unrealistic. Provision of housing to meet market demand is a private-sector activity, with the private housing sector assumed to build to the needed level to meet housing demand at the appropriate locations. One of the factors that will affect how and where growth occurs is the availability of infrastructure to support the growth. Beyond the traditional infrastructure needs like roads, sewer, water, and public buildings, modern infrastructure such as the availability of fiber-optic lines might also affect growth patterns. For example, the availability of fiber-optic lines or other high-technology infrastructure is likely to be a substantial growth discriminator for both businesses and individuals. The locations of and extent to which factors such as fiber-optic lines would ultimately affect growth cannot be predicted at this time.

The potential future BLM land disposals identified in Section 5.3.2.2.4, if implemented, could have the potential to provide land for private-sector projects such as housing, industrial or commercial facilities, or other developments. In contrast to specific developments proposed on BLM land disposals in the Caliente rail alignment region of influence, such growth in the Mina rail alignment region of influence is not currently planned and the market for this type of developmental stimulus is uncertain.

The State of Nevada has developed population projections for the Mina rail alignment cumulative impacts region of influence (DIRS 178807-Hardcastle 2006, all) as follows:

- Esmeralda County is projected to have a small decrease in population from 2005 to 2026.
- Nye County is projected to add mover than 32,000 persons from 2005 to 2026.
- Lyon County is projected to add more than 41,000 persons from 2005 to 2026.
- Mineral County is projected to have a small decrease in population from 2005 to 2026.

The Nevada State Demographer develops population projections for Nevada counties, which are always subject to change with new information.

Nye County's projected growth continues a recent trend, with growth in Pahrump very evident over the past several years. Growth in Pahrump is being driven by low-cost land, proximity to the Las Vegas metropolitan area, and relocation of retirees to the area. Growth in Nye County is also linked directly to existing and future Yucca Mountain Site operations. Growth in Lyon County is due largely to its proximity to Carson City and Reno.

As discussed in Section 4.3.9, Socioeconomics, DOE used an economic model to estimate potential socioeconomic impacts of the proposed railroad (DIRS 182251-REMI 2007, all). The model includes consideration of construction and operations employment and wages, project-related spending, and other parameters that could affect the socioeconomic environment. The model included a future baseline of socioeconomic parameters that would represent a cumulative impacts baseline without the proposed railroad.

Consistent with the methodology established in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, p. 4-43), most of the construction workers for the proposed Mina rail alignment are assumed to be residents of Clark County. This assumption is made because the construction sectors in Nye, Esmeralda, Lyon and Mineral Counties are not large enough to provide sufficient workers for the construction activities. Under this scenario, Clark County is projected to attain the largest levels of construction-related employment, income, and spending effects from the proposed project, followed by Mineral, Nye, Esmeralda, and Lyon Counties. Mineral County would experience the largest employment percentage increase during construction with an estimated increase of about 6 percent above baseline conditions.

The socioeconomic analysis also considers a second scenario, which assumes that half of the construction workers for the Mina rail alignment reside in the combined Washoe County-Carson City area, and the other half reside in Clark County. This second scenario is considered because Washoe County and Carson City might be more likely than Clark County to supply construction workers for the northern portions of the Mina rail alignment. With this second scenario, the beneficial economic effects on Clark County would obviously be reduced, while the Washoe County-Carson City area would gain some of these beneficial aspects of proposed railroad project. In any case, the overall effects of the proposed railroad along the Mina rail alignment on the Clark County or Washoe County economies would still be relatively small.

Employee locations for the operations phase would follow the same general pattern and relative magnitude of the construction phase, but there would be fewer operations jobs than construction jobs. Gains in employment during the operations phase would be felt most strongly in Esmeralda County, where the peak percentage change in average annual employment is projected to be 6.3 percent above baseline conditions during full operations. Mineral County is the only other county in the region of influence projected to experience more than a 1 percent change in average annual employment at any point during the operations phase (2.6 percent).

Population changes that would result from construction and operation of the proposed Mina rail alignment are also projected to generally follow this pattern. During the construction phase, the upper bound of increase to population would be about 3 percent or less of the future cumulative population baseline in all four counties. The operations phase population change would have the largest percentage increase compared to the cumulative baseline in Esmeralda County (about 7-percent average annual increase over the baseline). There are no projected impacts to population on the Walker River Paiute Reservation.

Strains on housing infrastructure during the construction phase would not be anticipated because most construction workers could be housed in construction camps at strategic locations along the proposed Mina rail alignment, rather than in nearby communities. Contractors might elect to use commercially available facilities for housing construction personnel at locations such as Hawthorne, Tonopah, Goldfield, Beatty, and Pahrump. There would be enough vacant housing stock in these locations to absorb both construction and operations personnel.

Some infrastructure impacts would be expected where construction activities or operating facilities were near communities. For example, construction workers, including those from the proposed Mina rail alignment, could strain the existing health care service capacity in the Mina rail alignment region of influence, and particularly in Hawthorne, Goldfield, and Tonopah. The operations-related population gains could also result in identifiable effects on health and education-related services.

The road network in the Mina rail alignment region of influence consists generally of two-lane highways and unpaved roads. U.S. Highway 95 is the major north-south highway in the region of influence. In rural, less populated parts of the Mina rail alignment cumulative impacts region of influence, roads are adequate to handle existing and projected future traffic flow. However, the array of new and proposed activities throughout the Mina rail alignment region of influence would have the potential to strain parts of the existing roadway infrastructure.

Railroad project-related road traffic would result in small increases in some areas but railroad construction would not materially affect traffic volumes on local roads because most construction materials would be transported using rail, and most construction employees and contractors would be housed in construction camps linked to the work site by access roads. There could be some traffic delays at existing rail-highway grade crossings, and grade separation might be necessary for some crossings in Churchill, Lyon, and Mineral counties. However, cumulative traffic levels in the region would likely continue to increase as overall regional growth and development occurs.

Any road improvement and maintenance responsibilities in the region of influence are handled by the Nevada Department of Transportation through a Statewide Transportation Plan and a Statewide Transportation Improvement Program. The Statewide Transportation Improvement Program includes a 3-year list of federally funded and regionally important non-federally funded transportation projects and programs consistent with the goals and strategies of the Statewide Transportation Plan. Routine highway improvements and maintenance projects for the period 2006 through 2015 have been identified for Lyon, Mineral, Esmeralda, and Nye Counties as part of the Nevada Department of Transportation planning processes. The level of cumulative traffic changes would generally not be sufficient for major upgrades of regional roads.

Overall, the proposed railroad project would have a small impact on economic development and growth, housing and community infrastructure, and traffic in the Mina rail alignment region of influence. While there is some limited potential for induced growth impacts, the specific locations and scope of these actions is unknown at this time, and any such actions are projected to be small. Cumulative impacts to socioeconomics in the Mina rail alignment region of influence would be small.

5.3.2.10 Occupational and Public Health and Safety

5.3.2.10.1 Nonradiological Health and Safety

Throughout the Mina rail alignment region of influence, continuing and reasonably foreseeable activities have the potential to result in occupational injuries or fatalities including, but not necessarily limited to sources such as tripping, being cut on equipment or material, dropping heavy objects, and catching clothing in moving machine parts, and other types of accidents. Other occupational risks include biological hazards, dust and soils hazards, air quality hazards, transportation accidents, and noise hazards. Biological hazards include potential human health effects from rodent-borne diseases, soil-borne diseases, insect-borne diseases, and venomous animals. Dust and soils hazards include potential human health effects from exposure to inhalable soils and dusts containing hazardous constituents, and potential occupational encounters with unexploded ordnance.

While occupational injuries or fatalities are unavoidable with human activity, public and private facilities within the Mina rail alignment cumulative activity area are highly regulated. There is a substantial regulatory framework for occupational health and safety, with the Occupational Safety and Health Administration programs and regulations forming the basis for protection of workers. Through DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, the Department has prescribed the Occupational Safety and Health Act Standards that contractors are to meet in their work at government-owned, contractor-operated facilities. The Department of Labor, Bureau of Labor Statistics, measures occupational incident rates, including total recordable cases, lost workday cases, and fatalities, associated with the work environment.

There are no data on injury/illness incident rates for the Mina rail alignment cumulative impacts region of influence; however, injury/illness incidence rates in Nevada generally run higher than those in the United States as a whole. The economic segments with the highest injury/illness incidence rates in Nevada are construction and goods-producing industries.

Additional traffic is especially a concern with the construction phases of reasonably foreseeable projects. The construction phase of a project not only brings construction workers to the work sites, but also means an increase in slow-moving and bulky traffic involving the transportation of construction equipment. Use of trucks for hauling hazardous or other dangerous materials is also an increasing concern as traffic increases on the road network. To minimize traffic impacts at the entrance to the Yucca Mountain Site, a new interchange with U.S. Highway 95 at the site entrance been proposed for both traffic flow and safety reasons. Increased traffic would not necessarily mean an increase in the rate of traffic accidents, but the number of accidents would increase if the rate of traffic accidents stayed the same and traffic increased. Therefore, transportation safety concerns would increase and there could be an increased workload for traffic-accident responders in the Mina rail alignment region of influence with the cumulative growth in traffic.

From a transportation safety standpoint, railcars loaded with live munitions and ordnance currently travel between Wabuska and the Hawthorne Army Depot. A railroad along the Mina rail alignment would reduce health and safety risks associated with accidents involving existing rail traffic because the trains would be routed away from the populated community of Schurz via one of the Schurz alternative segments.

An estimated 9,500 casks would be transported to the repository by rail using the Mina alignment. Nonradiological occupational health and safety impacts are projected as follows:

- Construction and operations activities for the Mina rail alignment are projected to result in approximately 800 recordable incidents, approximately 470 lost-workday accidents, and approximately two fatalities.
- Vehicular-related fatalities related to worker commuting are projected to result in an estimated 13 vehicular-related fatalities for the Mina rail alignment.
- Rail-related accidents and rail-related fatalities related to the movement of cask trains, maintenance trains, and supply trains are projected to result in 16 rail-related accidents and one rail-related fatality for the Mina rail alignment.

Under Module 1, approximately 21,900 casks would be transported to the repository by rail, and under Module 2, approximately 22,600 casks would be transported to the repository by rail. To estimate the cumulative health and safety impacts of Module 1 and Module 2, the impacts of the Proposed Action were increased by the ratio of the number of casks transported in Module 1 or Module 2 versus the Proposed Action. For Module 1, the nonradiological health and safety impacts noted above would increase by a factor of approximately 2.3 over the impacts under the Proposed Action. For Module 2, nonradiological safety impacts would increase by a factor of approximately 2.4 over the impacts of under Proposed Action.

Other regional activities would also cumulatively add to the totals beyond the railroad-related impacts, but cumulative nonradiological health and safety in the Mina rail alignment region of influence would be small within the context of the overall region of influence.

5.3.2.10.2 Radiological Health and Safety

Existing and reasonably foreseeable future activity (such as the Nevada Test Site and Yucca Mountain Repository activity managed by DOE) in the Mina rail alignment region of influence involves the storage, handling, transportation, use, and disposal of radioactive materials and wastes. There is an extensive regulatory framework associated with transportation safety, and the proposed railroad would operate in compliance with these laws and regulations. For example, DOE complies with U.S. Department of Transportation regulations regarding the transportation of radioactive materials. DOE also uses U.S. Environmental Protection Agency protective action guides (identifying projected dose levels at which specified actions should be taken) and actions designed to limit doses and impacts in the event of a transportation accident resulting in releases of radioactive material. The regulatory framework and implementation of appropriate standard operating procedures would reduce the potential for accidents. Coordination of plans for proposed railroad construction and operations with local emergency response providers would be important to limit the potential for accidents, and for an effective response to an accident should one occur.

There is a small risk of radiological impacts to workers and the general public from external radiation exposure during normal operations and incident-free transportation. Staff at the Nevada Test Site and the Yucca Mountain Repository would be separate, and it is not anticipated that there would be cumulative exposures to workers from both operations. The modes of transportation of radioactive wastes for the

Nevada Test Site (shipment by truck) and the Yucca Mountain Repository (shipment by rail) would differ. Radiological impacts associated with rail operations would be higher under Yucca Mountain FEIS Modules 1 or 2 operations compared to the Repository SEIS Proposed Action level of transportation. The radiological risk relationships among the repository, the proposed Mina rail alignment, and Nevada Test Site operations are summarized below.

As part of the Repository SEIS process, DOE estimated that 9 to 28 latent cancer fatalities for members of the public would result from Yucca Mountain Repository construction, operations, monitoring, and closure for the population within the 80-kilometer (50-mile) region of influence of the repository site. The estimated latent cancer fatalities correspond to a total collective dose of 15,000 to 46,000 person-rem, and the projected population within the repository region of influence is 120,000 persons. The region of influence for the Yucca Mountain Repository extends 80 kilometers (50 miles) to the northwest from the repository site boundary along the rail corridor, approximately to Scottys Junction; the remainder of the Mina rail alignment is outside of the Yucca Mountain Repository region of influence. Population within the area where the rail alignment region of influence and the Yucca Mountain repository region of influence coincide (between the repository boundary and the Scottys Junction area) would receive radiation dose from both the repository and from the Mina rail line operation. Members of the public situated along the rail alignment but outside of the region of influence of the Yucca Mountain Repository would receive a negligible radiation dose from the repository.

For members of the public along the rail line, DOE estimated that there could be up to 8.5×10^{-4} latent cancer fatality, corresponding to a collective population dose of 1.4 person-rem, for the Mina rail alignment. Therefore, for members of the public situated along the rail alignment, the radiological impacts of railroad operations would be a very small contribution to the overall radiological impacts of the Yucca Mountain Repository.

The estimated radiological dose to members of the public from Nevada Test Site operations in 2005 was 0.2 mrem per year; the maximum radiation dose was 2.3 mrem per year at the northwest corner of the Nevada Test Site boundary. Dose at off-site populated locations between 20 kilometers and 80 kilometers (12 to 50 miles) from this location would experience much lower radiation doses due to wind dispersion (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-4, p. 8-2). The collective population dose from Nevada Test Site operations was below 0.6 person-rem in 2004 (*Nevada Test Site Environmental Report 2005,* DIRS 182285-Wills 2006, Table 8-3, p. 8-8.) Radiation dose from Nevada Test Site operations would be a very small contribution to the overall radiological impacts of the Yucca Mountain repository.

Operation of the proposed railroad along the Mina rail alignment under the Proposed Action would result in a small contribution to cumulative radiological health and safety impacts. Cumulative radiological impacts in the Mina rail alignment region of influence would be small.

5.3.2.11 Utilities, Energy, and Materials

5.3.2.11.1 Utilities

From a cumulative impacts perspective within the Mina rail alignment region of influence, utility crossings are and will continue to be commonplace with little impact other than minor ground disturbance. Utility and other right-of-way crossings are common to linear projects such as roads, railroads, and pipelines. Land areas for the proposed rail alignment, construction camps, quarries, and access roads would cross or encroach upon existing or proposed utility rights-of-way in a variety of locations. Land areas for operations support facilities could also encroach upon existing or proposed utility rights-of-way. This situation would be typical for other rights-of-way in the region. The crossings would be accomplished with small impact using standard engineering procedures and appropriate design details.

Many regional activities, including the proposed railroad, would increase demands on public water systems, wastewater systems, telecommunications systems, electric power systems, and other utilities. However, regional service providers are projected to be able to adjust to any increasing demand, and overall cumulative impacts to utilities would be small.

5.3.2.11.2 Energy and Materials Usage

Large projects such as pipelines, transmission lines, and power plants, that could occur within the Mina rail alignment cumulative impacts region of influence require materials and energy to construct and operate. Energy and material resources necessary for construction or operation of these projects are often obtained within regional or, in some cases, national markets.

For this Rail Alignment EIS, DOE analyzed cumulative energy and materials supply and demand from a regional perspective. Energy and materials (for example, steel and concrete) that would be needed for railroad construction and operations are not constrained in regional markets, and railroad needs would represent a small percentage of the cumulative annual materials use within the Mina rail alignment cumulative impacts region of influence.

While the regional markets for various construction-related materials and energy sources will continue to grow as the region develops, there is no evidence of potential limits to growth from constrained material or energy supplies. Cumulative impacts from energy and materials usage in the Mina rail alignment region of influence would be small.

5.3.2.12 Hazardous Materials and Waste

5.3.2.12.1 DOE Waste-Management Activities

DOE has had existing waste management programs at the Nevada Test Site for several decades. While the Site missions have changed over time (with an emerging focus on national security, energy, and environmental issues), waste management and disposal at the Site has been one of the primary long-term land uses. There are two active waste management and disposal sites on the Nevada Test Site:

- Area 5 occupies 2.9 square kilometers (720 acres) and is in Frenchman Flat north of Mercury, Nevada.
- Area 3 occupies 0.53 square kilometer (130 acres) north of Mercury in Yucca Flat.

Environmental restoration efforts are under way at various locations throughout the Nevada Test Site. The Nevada Test Site waste-management program currently includes management and disposal operations for hazardous waste, mixed waste, and low-level radioactive waste. Transportation of the waste is accomplished by truck from both on-site and off-site sources. There are no plans for Nevada Test Site activities to include use of the proposed Mina rail alignment for shipment of wastes.

The proposed railroad’s contribution to cumulative impacts associated with DOE waste-management activities on the Nevada Test Site would be small.

At present, Yucca Mountain Repository-development efforts are focused on preparing an application to the U.S. Nuclear Regulatory Commission for a authorization to construct the repository for spent nuclear fuel and high-level radioactive waste. The Yucca Mountain FEIS (DIRS 155970-DOE 2002, all) and the

Repository SEIS (DOE/EIS-0250F-S1, all) describe proposed operations at the Yucca Mountain Site in detail.

5.3.2.12.2 Sanitary and Construction Wastes

As the populated areas in the Mina rail alignment cumulative impacts region of influence expand and grow, the volume of sanitary waste generated will also expand. Project proponents are legally required to dispose of nonhazardous and nonradiological construction and other solid waste in appropriately permitted solid waste landfills. Nevada has 24 operating municipal landfills with a combined capacity to accept more than 11,000 metric tons (12,000 tons) of waste per day. However, the number of operating landfills has decreased substantially over the past 15 years, and while there is sufficient capacity to accept waste for the State of Nevada as a whole, there are some areas such as Pahrump that have limited capacity for future years.

Construction- and operations-related waste that would be associated with the proposed Mina rail alignment would add only a fraction of a percent to the total waste stream in the state. If there were a constraint to landfill capacity at some future time, additional land would be needed to expand or open a new landfill. Because of the relative scarcity of private land in the Mina rail alignment region of influence, any land used for this purpose might need to come from BLM-administered federal land. As an alternative to local government landfill provisions, private companies can also be expected to seek business opportunities to provide solid-and hazardous-waste management, transportation, and disposal.

DOE would store and use hazardous materials (such as oil, gasoline and solvents) during the Mina rail alignment construction, and would control and manage these materials in accordance with the extensive federal and state regulatory framework. Other major projects would have similar waste streams, and project plans and requirements would call for disposal of such wastes in permitted facilities and materials management according to accepted industry practices.

The proposed railroad's contribution to impacts from the generation and management of sanitary and construction wastes would be small. Cumulative impacts to waste disposal facilities in the Mina rail alignment region of influence would be small.

5.3.2.13 Cultural Resources

Cultural resources include historic and archeological sites, buildings, structures, landscapes, and objects. Most reasonably foreseeable projects in the Mina rail alignment cultural resources region of influence will involve at least some ground disturbance. With that ground disturbance, cultural resources could be destroyed, damaged, or discovered for recovery or mitigation. As part of the evaluation of proposed projects on federal land, the existing regulatory framework requires that cultural resources be identified and protected. With information on the location of a proposed project and the estimated extent of ground disturbance, cultural resource specialists can be called on to perform appropriate surveys and inventories of cultural resources in the potentially disturbed area. Once discovered, the sites of cultural resources are kept confidential to reduce the potential for vandalism or theft of the resources.

Because cultural resources are typically on or below the ground, they can be damaged by other activities such as off-highway vehicle use. As the major land manager in the Mina rail alignment region of influence, the BLM has an extensive cultural resource management program and manages federal land with protection of cultural resources as a key management objective. Once ground is disturbed and facilities are constructed on the land, the opportunity for identification of cultural resources is usually lost. Therefore, the BLM and other land managers in the area (for example, DOE on the Nevada Test Site and the U.S. Air Force on the Nevada Test and Training Range) employ cultural resource specialists and involve tribal representatives, as appropriate. Commonly, mitigation for any ground disturbance in the

Mina rail alignment region of influence includes the involvement of these cultural resource specialists as potential cultural resources are discovered. Other activities occurring on federal land, such as off-road vehicle use and rock collecting, can cause unintended adverse impacts to cultural resources. Mission activities occurring at the Nevada Test Site, the Nevada Test and Training Range, and the Yucca Mountain Repository also could cause unintended adverse impacts to cultural resources.

The problem of vandalism to and theft of cultural resources is prevalent throughout the western United States. Land-management agencies such as the BLM make extensive attempts to protect locations of cultural resources, but the areas to be managed are often so vast that patrols by law enforcement are not effective in protecting these sites. DOE, the BLM, and other federal agencies in the Mina rail alignment region of influence are committed to public education and employee training regarding the protection of cultural resources.

Visitors may also be drawn to the area for purposes of curiosity and sight-seeing. Based on the extent of cultural resource site finds on BLM-administered land and on the Nevada Test Site, and data collected to date on the proposed Mina rail alignment, there could be a large number of cultural resources in the Mina rail alignment region of influence. Also, it is likely that only a portion of any currently undiscovered sites would ultimately be found eligible for the *National Register of Historic Places*.

The railroad would be a major new construction project introduced into a remote area. Beyond the implications of ground disturbance and permanent and temporary use areas, railroad construction and operations would bring employees, visitors, and equipment into an area where prior access was limited. If right-of-way roads remain open to the public, there could be an increase in off-road vehicles traveling along newly constructed roads and illegal use of lands. As the number of visitors increases, so does the potential for vandalism and damage to cultural resources. There is an extensive regulatory framework to manage and protect cultural resources.

Impacts to cultural resources in the Mina rail alignment region of influence would be small because the Department would conduct intensive field surveys and implement mitigation measures, including avoidance. Other project proponents would be subject to the same regulatory framework and BLM policies and procedures. Cumulative impacts to cultural resources in the Mina rail alignment region of influence would be small.

5.3.2.14 Paleontological Resources

Regional protection, management, and impact issues relative to paleontological resources are similar to those of cultural resources. Any type of ground disturbance could disturb or destroy known or unknown paleontological resources. Impacts to paleontological resources would generally be measured by physical damage to fossil-bearing formations through excavation or surface disturbance. The primary cumulative impact mechanisms that could affect paleontological resources include excavations or surface disturbances associated with approval and implementation of BLM rights-of-way, off-highway vehicle use, minerals development, land disposals, and special designations. Many BLM management activities, however, serve to protect and mitigate impacts to paleontological resources. Knowledge of the outcrop pattern of geologic units, and the kinds and quality of the fossils produced by such units, is a critical management tool for land-use decision-making where fossils might be involved. Potential effects on paleontological resources from ground disturbance would continue to be a major regional concern of BLM from both resource management planning and rights-of-way evaluation perspectives. Most formations the rail line would cross are volcanic and would not contain paleontological resources.

Any paleontological resources are considered valuable and are often collected for their cultural, scientific, and recreational values. Therefore, these resources are sometimes removed from federal lands. While common invertebrate fossils such as plants, mollusks, and trilobites can be collected for personal use in reasonable quantities, the lack of regular site monitoring and public education about fossil collecting has led to increased illegal commercial taking of paleontological resources. Paleontological resources are also vulnerable to intentional or unintentional vandalism. The specific locations of some identified paleontological resources are kept confidential to avoid vandalism or theft.

The most likely locations of currently unknown paleontological resources can be identified based on geological characteristics, and potential impacts can be avoided or minimized through careful project planning and implementation. Most formations the rail line would cross are volcanic and would not contain paleontological resources. Therefore, the proposed railroad project would not contribute to cumulative impacts to paleontological resources.

5.3.2.15 Environmental Justice

5.3.2.15.1 Potential Effects to Low-Income and Minority Populations

Environmental justice impacts result when high and adverse human health or environmental impacts fall disproportionately on low-income and minority populations. If high and adverse impacts are found to have disproportionate impacts on environmental justice populations as compared to the general population of the area, the impacts would be mitigated to the extent practicable by the federal agencies involved in the proposed action.

Based on individual and group values, beliefs, and goals, there is a difference in perspective as to the potential effects of activities in the Mina rail alignment region of influence on low-income and/or minority populations among the different stakeholders and other interested parties. The American Indian Resource Document (DIRS 174205-Kane et al. 2005) discusses cultural resources, American Indian values and their relationship to environmental justice, and broader American Indian values. DOE considers the American Indian Writers Subgroup conclusions to be responsible opposing viewpoints for purposes of its environmental justice responsibilities. DOE has concluded that there are no identifiable environmental or human health impacts associated with the proposed railroad that would disproportionately affect low-income or minority populations. Additionally, there are no identified effects to special pathways (such as subsistence hunting and gathering) in the Mina rail alignment region of influence.

The largest concentration of low-income or minority populations along the Mina rail corridor occurs in Mineral County and on the Walker River Paiute Reservation. The corridor would cross American Indian tribal lands, with the four Schurz alternative segments almost entirely on the Walker River Paiute Reservation (DIRS 180222-BSC 2006). There are approximately 1.4 square kilometers (350 acres) of reservation lands in the corridor (DIRS 180222-BSC 2006). The population of the reservation, estimated to be 853 persons in 2000, is low-income and consists mainly of American Indians, a minority population. The poverty rate in Mineral County is 15 percent, which exceeds the rate of poverty (11 percent) in the State of Nevada, while the poverty rate of Walker River Paiute Reservation residents is 32 percent, nearly three times the rate of poverty in the state. The only moderate or large impacts that were identified relate to noise impacts from construction. These impacts would not occur on the Walker River Paiute Reservation; therefore, there would be no large and adverse effects that would disproportionately affect a low income or minority community and there are no special pathways that would result in disproportionately large and adverse effects to low income or minority communities.

DOE has concluded that there are no identifiable human health or environmental impacts associated with the proposed railroad that would disproportionately affect low-income or minority populations, nor has the Department identified any special pathways for impacts (such as subsistence hunting and gathering) in the Caliente region of influence.

Cumulative impacts to low-income or minority populations along the Caliente rail alignment would be would be small, if any.

5.3.2.15.2 Economic Opportunity

Existing and reasonably foreseeable projects and activities in the Mina rail alignment region of influence would present economic opportunities for some persons in the area. Economic opportunities include employment, wages, revenue from business operation, and other economic stimuli associated with growth and development. DOE and other project proponents in the Mina rail alignment region of influence have a legally mandated equal opportunity approach to these economic opportunities. Any potential for economic gain would be distributed equally to persons or businesses in the area that seek employment or business opportunity. While not all persons would gain economically from the cumulative group of projects and activities, the opportunity for gain does not favor one population group or another based on minority or income status.

Because there would be small changes in long-term population attributable to activities in the corridor, impacts or stresses to the housing stock, infrastructure systems, or social services would be unlikely. Socioeconomic impacts from railroad construction and operations along the Mina rail corridor would be small overall and would be unlikely to adversely or disproportionately affect the low-income or minority populations along the corridor.

5.4 Combined Repository and Nevada Rail Transportation Impacts

This section presents the total estimated environmental impacts for the proposed construction, operation, monitoring, and closure of the repository combined with the environmental impacts from the proposed Nevada transportation activities. As construction along the rail alignment approached the physical location of the repository and its surface facilities, the potential for impacts to overlap would increase.

Table 5-4 provides an overview of the total combined impacts of the proposed repository and railroad in Nevada within overlapping regions of influence. In most instances, DOE evaluated the potential impacts qualitatively and judged them to be small. However, there are several air quality and groundwater impacts from the repository and the railroad actions that DOE was able to sum and quantify:

- Air Quality. The air quality impacts from simultaneous construction of the proposed repository and of the railroad and associated rail facilities would not produce criteria air pollutant concentrations that exceeded the regulatory limit at the boundary of the analyzed repository land withdrawal area.
- Groundwater. Groundwater withdrawals would occur for both the repository and railroad actions from the same hydrographic area, specifically Area 227A, Jackass Flats. DOE has analyzed water demand from both actions to gauge overall impacts to groundwater resources in the Jackass Flats area. The highest combined annual water demand for railroad and repository activities would be below the Nevada State Engineer's ruling of perennial yield (the amount that can be withdrawn annually without depleting reserves) for the Jackass Flats hydrographic area. The combined demand would also be lower than the lowest estimated perennial yield for the western two-thirds of this hydrographic area. Coupled with the demand for Nevada Test Site activities in Jackass Flats, the total annual water demand would exceed the lowest estimated value of perennial yield for the western two-thirds of the hydrographic area during only one year. However, this estimated total combined water demand would still be below estimated values of perennial yield for the entire hydrographic area for all years. The combined repository and railroad actions would withdraw groundwater that would

Table 5-4. Summary of combined repository and Nevada railroad impacts (page 1 of 3).

Resource area	Summary of repository and Nevada rail transportation impacts that occur within overlapping regions of influence
Land use and ownership	About 12 square kilometers of disturbed land; 600 square kilometers of land withdrawn from public use.
Air quality	Nye County is the only location where Nevada rail transportation impacts would overlap the repository region of influence. The Nevada rail transportation emissions would be distributed over the entire county and only the southern portion of the emissions from Nye County would be within the repository region of influence. Modeled concentrations of criteria pollutants at the boundary of the repository land withdrawal area would not exceed regulatory limits during simultaneous construction of the repository and railroad. Concentrations of all criteria air pollutants except for particulate matter would be less than 6 percent of the regulatory limit. Concentrations of $PM_{2.5}$ would not exceed 37 percent, and concentrations of PM_{10} would not exceed 84 percent of the regulatory limit. The simultaneous operation of the repository and railroad would not exceed regulatory limits.
Hydrology	
Surface water	At least two of the drainage channels and floodplains (Busted Butte Wash and Drill Hole Wash) the rail line would cross would also be affected by construction of repository surface facilities.
Groundwater	Water identified for rail line construction includes 572 acre-feet (over 4 years) plus 6 acre-feet per year for operations, all from the same groundwater basin as for repository activities. A peak annual water demand of 530 acre-feet would result from the combined Nevada rail transportation and repository needs, but this high level would last only 1 year. The average annual water demand for the combined construction period would be 400 acre-feet. All of the combined water demand levels would be below the lowest estimate of the groundwater basin's perennial yield (580 acre-feet). The year of highest water demand would not result in a well drawdown that could affect the nearest public or private wells. Modeling for the Yucca Mountain FEIS showed small to moderate impacts from the Proposed Action groundwater withdrawals that are still applicable. The model's assumed withdrawal rate of 430 acre-feet per year is lower than the peak water demand, but over the life of the project, is still conservatively high.
Biological resources and soils	Loss of up to 12 square kilometers of desert soil, habitat, and vegetation, but no loss of rare or unique habitat or vegetation; adverse impacts to individual threatened desert tortoises and loss of a small amount of low-density tortoise habitat, but no adverse impacts to the species as a whole; reasonable and prudent measures would minimize impacts.
Cultural resources	Small potential for impacts; including three National Register-eligible prehistoric sites; opposing American Indian viewpoint.

Table 5-4. Summary of combined repository and Nevada railroad impacts (page 2 of 3).

Resource area	Summary of repository and Nevada rail transportation impacts in overlapping regions of influence
Socioeconomics	
New jobs (percent of workforce in affected counties	Peak increases would be small, less than 1 percent in the region, Clark County, and Nye County when construction of repository and the railroad overlap.
Peak real disposable income (million dollars)	For repository: In Clark County (2034), $58.3 million; in Nye County (2035) $27.5 million. For railroad: In Clark County (2011) $100.6 million; in Nye County (2012) $9.6 million.
Peak incremental gross regional product (million dollars)	For repository: In Clark County (2034), $98.7 million; in Nye County (2034) $68.9 million. For railroad: In Clark County (2012), $154.5 million; in Nye County (2012), $42.8 million.
Occupational and public health and safety	
Public, radiological	
Maximally exposure individual (probability of a latent cancer fatality)	Not applicable
Population (latent cancer fatalities)	Not applicable
Public, nonradiological	
Fatalities due to emissions	Not applicable
Workers (involved and noninvolved)	
Radiological (latent cancer fatalities)	Not applicable
Nonradiological fatalities (includes commuting traffic fatalities)	Not applicable
Accidents	
Public, Radiological	
Maximally exposed individual (probability of a latent cancer fatality)	Not applicable
Population (latent cancer fatalities)	Not applicable
Workers	Not applicable
Noise and vibration	Impacts to public would be small due to large distances from the repository to residences; workers exposed to elevated noise levels; controls and protection would be used as necessary.
Aesthetics	The exhaust ventilation stacks on the crest of Yucca Mountain could be an aesthetic aggravation to American Indians. If the Federal Aviation Administration required beacons atop the stacks, they could be visible for a great distance, especially west of Yucca Mountain.

Table 5-4. Summary of combined repository and Nevada railroad impacts (page 3 of 3).

Resource area	Summary of repository and Nevada rail transportation impacts in overlapping regions of influence
Utilities, energy, materials, and site services	Use of materials would be small in comparison to regional use; some effect on public water systems and public wastewater treatment facilities due to population growth from construction and operations employment; annual fossil-fuel use would be less than 7 percent of state-wide use during construction and less than 2 percent of state-wide use during operation; electric power delivery system to the Yucca Mountain site would have to be enhanced.
Waste and hazardous materials	Small impacts from nonhazardous waste (solid and industrial waste) disposal to disposal capacities of local solid waste facilities near Yucca Mountain in Nye, Esmeralda, Clark, and Lincoln counties.
Environmental justice	No high and adverse impact to population as a whole; no specific pathways for minority populations; therefore no high and adverse impacts to minorities and low income populations; opposing American Indian viewpoint.
Manufacturing repository components	Not applicable.
Airspace restrictions	Small impacts to airspace use; airspace restriction could be lifted once operations have been completed.

otherwise move into aquifers of the Amargosa Desert, but the combined water demand for the railroad, the repository, and Nevada Test Site activities in Jackass Flats would have, at most, small impacts on the availability of groundwater in the Amargosa Desert area in comparison with the quantities of water already being withdrawn there.

6. STATUTORY, REGULATORY, AND OTHER APPLICABLE REQUIREMENTS

This chapter identifies the permits and approvals, Federal Government and State of Nevada regulations, and Executive and DOE Orders that could apply to construction and operation of the proposed railroad.

Glossary terms are shown in ***bold italics***.

During proposed ***railroad*** construction and operations, the U.S. Department of Energy (DOE or the Department) would comply with applicable requirements, and has developed and is implementing a comprehensive approach to the permitting and approval processes that would ensure compliance.

As illustrated in Figure 6-1, compliance with regulatory requirements is the second step in the DOE approach to avoiding, minimizing or reducing environmental ***impacts***.

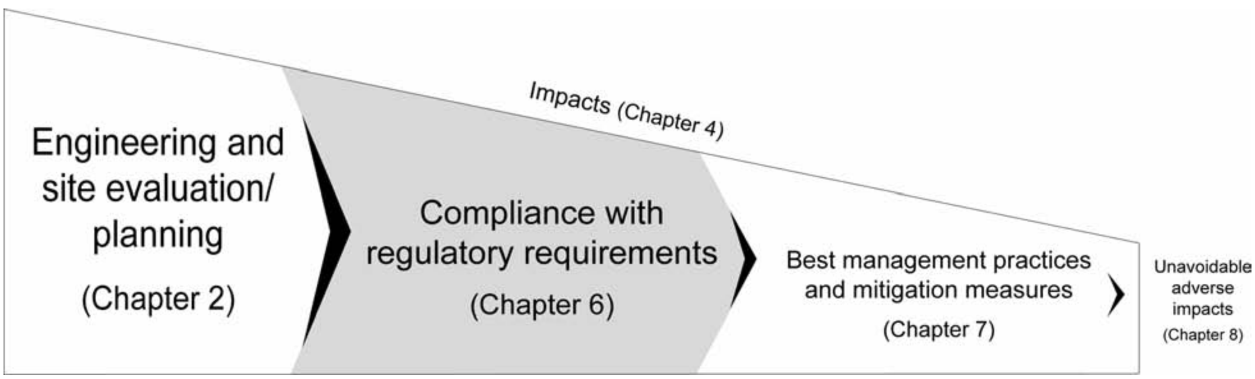


Figure 6-1. Multi-step approach to avoid, minimize, or reduce environmental impacts.

The chapter is organized as follows:

- Section 6.1 summarizes statutes and regulations that establish or affect DOE authority to construct and operate the proposed railroad.
- Section 6.2 identifies Surface Transportation Board (STB) requirements.
- Section 6.3 summarizes statutes and regulations that establish environmental protection requirements that could apply to construction and operation of the railroad.
- Section 6.4 identifies potentially applicable DOE Orders.
- Section 6.5 identifies U.S. Department of the Interior, Bureau of Indian Affairs, requirements.
- Section 6.6 identifies U.S. Department of the Interior, Bureau of Land Management (BLM), requirements.
- Section 6.7 identifies U.S. Army requirements.

Appendix A provides copies of the applicable *Federal Register* (*FR*) notices. Appendix B describes interagency and intergovernmental interactions.

6.1 Statutes and Regulations Establishing or Relating to DOE Authority to Propose, Construct, and Operate a Railroad in Nevada for Shipment of Spent Nuclear Fuel and High-Level Radioactive Waste to the Repository at Yucca Mountain

This section summarizes the statutes and regulations that establish or affect DOE authority to propose, construct, and operate the proposed railroad.

6.1.1 NUCLEAR WASTE POLICY ACT, AS AMENDED (42 UNITED STATES CODE [U.S.C.] 10101 *et seq.*)

The Nuclear Waste Policy Act, as amended (NWPA), establishes the Federal Government's responsibility for the ***disposal*** of ***spent nuclear fuel*** and ***high-level radioactive waste*** and generators' responsibility to bear the costs of disposal. The NWPA identified the ***Yucca Mountain Site*** in Nye County, Nevada, as the only site to be studied as a potential location for a ***geologic repository***. As part of its obligations under the NWPA, DOE is responsible for developing a system to transport spent nuclear fuel and high-level ***radioactive*** waste to the repository. On April 8, 2004, DOE published *Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV* (69 *FR* 18557) announcing the selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* 155970 (DIRS 155970-DOE 2002, all) as the mode of transportation for shipping spent nuclear fuel and high-level radioactive waste to Yucca Mountain and selected the Caliente ***rail corridor*** to evaluate alignments for a ***rail line***.

6.1.2 YUCCA MOUNTAIN DEVELOPMENT ACT OF 2002 (PUBLIC LAW 107-200)

On February 15, 2002, President George W. Bush approved the Secretary of Energy's recommendation of Yucca Mountain as the site for the development of a repository for the disposal of spent nuclear fuel and high-level radioactive waste. The House of Representatives approved the Yucca Mountain Site on May 8, 2002, as did the Senate on July 9, 2002. This approval of the site at Yucca Mountain became known as the Yucca Mountain Development Act, which the President signed into law on July 23, 2002. This Act is a joint resolution of the House of Representatives and Senate approving the site at Yucca Mountain, Nevada, for the development of a repository for the disposal of spent nuclear fuel and high-level radioactive waste, pursuant to the Nuclear Waste Policy Act of 1982, as amended.

6.1.3 ATOMIC ENERGY ACT, AS AMENDED (42 U.S.C. 2011 *et seq.*)

The Atomic Energy Act of 1954, as amended, provides fundamental jurisdictional authority to DOE and the U.S. Nuclear Regulatory Commission (NRC) over governmental and commercial use of nuclear materials. This Atomic Energy Act ensures proper management, production, possession, and use of radioactive materials. In accordance with the Atomic Energy Act, DOE established a system of requirements issued as DOE Orders.

The Atomic Energy Act gives the Nuclear Regulatory Commission specific authority to regulate the possession, transfer, ***storage***, and disposal of nuclear materials, and aspects of transportation packaging design for radioactive materials, including testing for packaging certification. Nuclear Regulatory Commission regulations applicable to the transportation of radioactive materials (10 Code of Federal Regulations [CFR] Parts 71 and 73) require that shipping ***casks*** meet specified performance criteria under both normal transport and hypothetical ***accident*** conditions. DOE and Nuclear Regulatory Commission regulations applicable to protection against ***radiation*** (10 CFR Parts 20 and 835) address occupational ***dose*** limits, public dose limits, survey and monitoring procedures, ***exposure*** controls, respiratory protection and controls, precautionary procedures, and related topics. DOE would comply with all applicable radiation protection regulations during operation of the proposed railroad.

6.2 Surface Transportation Board Requirements

If DOE selected the ***Shared-Use Option*** as part of the ***Proposed Action***, DOE would have to apply to the STB for a license to construct and operate the proposed rail line (known as a "certificate of public convenience and necessity"). If DOE did not select the Shared-Use Option, the STB would have no regulatory authority related to the Proposed Action. The Shared-Use Option involves operating the proposed railroad as a common-carrier railroad – one that holds itself out to the public for service and has an obligation to provide rail service to any and all shippers that request service along that line.

The STB has exclusive jurisdiction over the construction, acquisition, and operation of common-carrier railroads pursuant to the Interstate Commerce Act (as amended by the ICC Termination Act of 1995 [Public Law 104-88, 109 Stat. 803 (1995)]). To operate the proposed railroad under the Shared-Use Option, DOE would have to apply for a "license of public convenience and necessity" issued under 49 U.S.C. 10901 or under 49 U.S.C. 10502. The regulations prescribing how to apply for a license to construct and operate a rail line are provided in 49 CFR Part 1150. If the Department sought a license from the STB, the STB would subject the proposal to a careful review, including preparation of the environmental documentation required to meet STB obligations under the National Environmental Policy Act (NEPA), as provided in 49 CFR Part 1105.

The STB has jurisdiction over common-carrier rail lines that are part of the interstate rail network. This jurisdiction includes facilities and structures that are an integral part of rail transportation [49 U.S.C. 10501(b); 49 U.S.C. 10102(9)]. Section 10501(b) also states that "the remedies provided under this part are exclusive and preempt the remedies provided under federal and state law." The purpose of Section 10501(b) is to prevent a patchwork of local regulation from unreasonably interfering with interstate commerce. Thus, Section 10501(b) does not permit dual state and federal regulation of railroads or activities related to rail transportation at railroad facilities. This statutory framework, with supporting case law, supports the STB broad preemption authority.

The STB preemption authority applies to state or local regulation of matters directly related to the STB, and state or local pre-clearance or permitting requirements – such as zoning ordinances and environmental and land-use permitting requirements – that could be used to deny or defeat a railroad's ability to conduct its operations. Thus, a local or state body cannot deny a carrier the right to construct, develop, and maintain facilities or conduct operations, because this denial would create irreconcilable conflict with the STB's exclusive jurisdiction over such facilities and operations.

While exempt from traditional permitting, zoning, and land-use processes for railroad operations, railroads such as the one DOE proposes are not necessarily exempt from other applicable laws. The states retain the police powers reserved by the 10th Amendment of the U.S. Constitution. Pursuant to the Commerce Clause, Article I, Section 8 of the U.S. Constitution, states can take appropriate actions to protect public health and safety so long as their actions do not regulate operations or unreasonably interfere with interstate commerce.

STB environmental regulations are set forth in 49 CFR Part 1105. These rules require consideration of various environmental statutes, including NEPA, the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq*.), and the Energy Policy and Conservation Act (42 U.S.C. 6361; Public Law 94-163). These rules combine the STB's former environmental and energy regulations; revise and clarify environmental and historic requirements; require service of environmental reports on certain state, federal, and local agencies; and reclassify and clarify the types of actions for which environmental and other historic reports and analyses are required. For railroads providing service to commercial interests, these regulations enable applicants, interested parties, and STB environmental staff to better identify and more expeditiously resolve environmental concerns associated with proposed actions. If DOE implemented the Shared-Use Option, this Rail Alignment EIS is intended to satisfy the STB environmental analysis requirements provided for in 49 CFR Parts 1105 and 1150.

6.3 Potential Statutes, Regulations, and Executive Orders Regarding Environmental Protection Requirements

This section summarizes, according to environmental topic, the statutes, regulations, and Executive Orders that set environmental protection requirements that could apply to construction and operation of the proposed railroad.

Table 6-1 is organized by environmental topic and is a comprehensive summary of the regulatory actions DOE could take for construction and operation of the proposed railroad. This table lists the permits, licenses, approvals, statutes or regulations, and agency associated with each regulatory action. Table 6-2 lists applicable federal codified regulations, Executive Orders, and other documents and directives.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 1 of 4).

Regulatory action	Statute or regulation[a]	Agency	Activity
Air Quality			
Air quality operating permit	NAC 445B.287 *et seq.*	Nevada Division of Environmental Protection	Demonstrate control of surface disturbances and emissions of criteria pollutants.
Water Quality and Use			
Stormwater discharge permit and other National Pollutant Discharge Elimination System permits	40 CFR Part 122 NAC 445A.266	U.S. Environmental Protection Agency Nevada Division of Environmental Protection	Control of stormwater discharges and point-source discharges.
Temporary permit to work in waterways (rolling stock permit)	NRS 445A.485 NAC 445A.266 through 445A.272	Nevada Division of Environmental Protection	Work in waterways of the state.
Section 404, permit to discharge dredge or fill materials to waters of the United States	Clean Water Act, Section 404 33 CFR Part 323	U.S. Army Corps of Engineers	Discharge dredge or fill materials into waters of the United States for bridges and culverts in interstate streams, dry washes, and wetlands.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 2 of 4).

Regulatory action	Statute or regulation[a]	Agency	Activity
Water Quality and Use (continued)			
Section 401, water quality certification by State of Nevada	Clean Water Act, Section 401 40 CFR 131	U.S. Army Corps of Engineers Nevada Division of Environmental Protection, Bureau of Water Quality Planning	Section 401 review requires state certification prior to issuance of Section 404 permit to discharge dredge or fill materials to waters of the United States. The request is made by U.S. Army Corps of Engineers to Nevada Division of Environmental Protection, Bureau of Water Quality Planning, to certify that the proposed activity will not violate state or federal water standards.
Water appropriation permit	NRS 533.324 through 533.435	Nevada State Engineer	Drill wells or use existing wells to withdraw groundwater to support rail construction.
Underground water and wells	NAC 534	Nevada State Engineer	Drill wells and use wells to withdraw groundwater to support rail construction.
Septic/sewage disposal permit	40 CFR Part 122 NAC 445A.810 through 445A.925 NAC 444.750 through 444.828	U.S. Environmental Protection Agency Nevada Division of Environmental Protection	Construct and operate temporary or permanent sanitary-sewage collection systems for construction camps and railroad operations facilities.
Hazardous Materials			
Hazardous materials storage permit	NAC 459 NAC 477.323	Nevada State Fire Marshal	Store and use hazardous materials, including explosives, associated with construction and operation of the proposed railroad.
Hazardous waste generation, storage, transportation, and disposal permit	Resource Conservation and Recovery Act (42 U.S.C. 6962), Subtitle C 40 CFR Part 261 40 CFR Part 262 40 CFR Part 263 40 CFR Part 264 40 CFR Part 268 40 CFR Part 270 40 CFR Part 273 40 CFR Part 279 NRS 459.400 to 459.600	U.S. Environmental Protection Agency Nevada Division of Environmental Protection	Transport, handle, treat, store, and dispose of Resource Conservation and Recovery Act hazardous wastes used during rail construction and operation.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 3 of 4).

Regulatory action	Statute or regulation[a]	Agency	Activity
Hazardous Materials (continued)			
Hazardous waste transportation approval, exemption, or permit	Hazardous Materials Transportation Act (49 U.S.C. 1801) 49 CFR Parts 171 to 180	U.S. Department of Transportation	Shipment of hazardous waste, including spent nuclear fuel and high-level radioactive waste.
Type B package approval	10 CFR Part 71	U.S. Nuclear Regulatory Commission	Shipment of spent nuclear fuel and high-level radioactive waste.
Cultural Resources			
Protection of cultural resources and development of programmatic agreement	National Historic Preservation Act (16 U.S.C. 470 *et seq.*) The Archaeological Resources Protection Act (16 U.S.C. 470aa *et seq.*) The Antiquities Act (16 U.S.C. 431 through 433) The American Indian Religious Freedom Act (42 U.S.C. 1996) The Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq.*) 36 CFR Part 79 36 CFR Part 800	Advisory Council on Historic Preservation Nevada State Historic Preservation Office	Protect cultural resources; applicable to all activities that disturb the land.
Ecology and Habitat			
Endangered species consultation	50 CFR Part 402	U.S. Fish and Wildlife Service	Protect listed threatened and endangered species and designated critical habitat; applicable to all activities that disturb the habitat of threatened and endangered species.
Land and Water Use			
Free-use permit for sand and gravel	43 CFR Part 3600	Bureau of Land Management	Use sand, stone, and gravel from public lands during construction of the rail line.

Table 6-1. Potential permits, licenses, and approvals necessary for construction and operation of the proposed railroad in the State of Nevada (page 4 of 4).

Regulatory Action	Statute or Regulation[a]	Agency	Activity
Land and Water Use (continued)			
Right-of-way reservations	43 CFR Part 2800	Bureau of Land Management	Obtain rights-of-way for access to land that is needed for construction, operation, and access to the rail line, roads, construction camps, borrow pits, and other facilities.
Permit for a ***public water system***	NAC 445A.602 through 445A.612	Nevada Division of Environmental Protection	Construct and operate a public water-supply system at construction camps and some railroad operations facilities.
Construction			
Communication system authorization	Communications Act 47 CFR Part 17 47 CFR Part 24	Federal Communications Commission	Construct and operate a radio system and install fiber optics.
Operating permit for construction/labor camps	NRS 444.130 *et seq.*	Nevada State Health Division	Maintain specified conditions for construction and labor camps in Nevada.
Permit to cross state highways (occupancy permit)	NRS 408.423 NRS 408.423 through 408.427 NAC 703.455	Nevada Department of Transportation Nevada Public Utilities Commission	Construct rail line across a state highway or occupy a highway right-of-way. Applies also to construction of access roads, water pipelines, and other infrastructure that would intersect highway rights-of-way.

a. CFR = Code of Federal Regulations; NAC = Nevada Administrative Code; NRS = Nevada Revised Statutes; RCRA = Resource Conservation and Recovery Act.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 1 of 11).

Regulation/Order	Title	Subject
Regulation[a]		
7 CFR Part 658	Farmland Protection Policy Act	Law minimizes the extent to which federal programs contribute to the unnecessary conversion of farmland to nonagricultural uses.
10 CFR Part 20	Standards for Protection Against Radiation	Standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the Nuclear Regulatory Commission.
10 CFR Part 34	Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations	Requirements for the issuance of licenses for the use of sealed sources containing byproduct material and radiation safety requirements for persons using sealed sources in industrial radiography.
10 CFR Part 71	Packaging and Transportation of Radioactive Material	Requirements for packaging, preparation for shipment, and transportation of licensed fissile material.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 2 of 11).

Regulation/Order	Title	Subject
10 CFR Part 73	Physical Protection of Plants and Materials	Requirements for the establishment and maintenance of a physical protection system which have capabilities for the protection of special nuclear material.
10 CFR Part 75	Safeguards on Nuclear Material–Implementation of U.S./International Atomic Energy Agency Agreement	Establishes a system of nuclear material accounting and nuclear material control to implement the agreement between the United States and the International Atomic Energy Agency for the Application of Safeguards in the United States.
10 CFR Part 830	Nuclear Safety Management	Standards for governing the conduct of DOE contractors, DOE personnel, and other persons conducting activities (including providing items and services) that affect the safety of DOE nuclear facilities.
10 CFR Part 835	Occupational Radiation Protection	Radiation protection standards, limits, and program requirements for protecting individuals from ionizing radiation resulting from the conduct of DOE activities.
10 CFR Part 860	Trespassing on Department of Energy Property	Requirements for the protection and security of facilities, installations and real property subject to the jurisdiction or administration, or in the custody of, DOE.
10 CFR Part 1010	Conduct of Employees	Standards for conduct of employees of the Department of Energy, excluding employees of the Federal Energy Regulatory Commission.
10 CFR Part 1021	National Environmental Policy Act Implementing Procedures	Establishes the procedures that the Department of Energy (DOE) shall use to comply with section 102(2) of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. 4332(2)) and the Council on Environmental Quality (CEQ) regulations for implementing the procedural provisions of NEPA (40 CFR parts 1500-1508). To be used in conjunction with the CEQ Regulations.
10 CFR Part 1022	Compliance with Floodplain/Wetland Environmental Review Requirements	Policy and procedures for discharging DOE responsibilities under Executive Order 11988 and Executive Order 11990, including: DOE policy regarding the consideration of floodplain and wetland factors in DOE planning and decisionmaking; and DOE procedures for identifying proposed actions located in a floodplain or wetland, providing opportunity for early public review of such proposed actions, preparing floodplain or wetland assessments, and issuing statements of findings for actions in a floodplain.
25 CFR Part 162	Leases and Permits	Policies and procedures for lease of tribal lands, Bureau of Indian Affairs.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 3 of 11).

Regulation/Order	Title	Subject
25 CFR Part 169	Rights-of-Way Over Indian Lands	Procedures, terms, and conditions under which rights-of-way over and across tribal land, individually owned land, and government-owned land may be granted.
29 CFR Part 1910	Occupational Safety and Health Standards	Standards for industry and business for occupational safety and health.
29 CFR Part 1926	Safety and Health Regulations for Construction	Standards for safety and health for construction activities.
29 CFR Part 1960	Recordkeeping and Reporting	Basic program elements for occupational safety and health programs and related matters for federal employees.
33 CFR Part 323	Permits for Discharges of Dredged or Fill Material into Waters of the United States	Policies, practices, and procedures, to be followed by the Army Corps of Engineers to review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act.
36 CFR Part 79	Curation of Federally-Owned and Administered Archaeological Collections	Standards, procedures and guidelines to be followed by federal agencies to preserve collections of prehistoric and historic material remains, and associated records, recovered under the authority of the Antiquities Act, the Reservoir Salvage Act, section 110 of the National Historic Preservation, Act or the Archaeological Resources Protection Act.
36 CFR Part 296	Protection of Archaeological Resources: Uniform Regulations	Standards and procedures for federal land managers to provide protection for archaeological resources, located on public lands and Indian lands of the United States.
36 CFR Part 800	Protection of Historic and Cultural Properties	Procedures for federal agencies to meet statutory responsibilities for historic preservation concerns with the needs of historic properties.
40 CFR Part 50	National Primary and Secondary Ambient Air Quality Standards	National primary and secondary ambient air quality standards.
40 CFR Part 60	Standards of Performance for New Stationary Sources	Air standards of performance for new stationary Sources.
40 CFR Part 61	National Emission Standards for Hazardous Air Pollutants	Emission standards for hazardous air pollutants.
40 CFR Part 63	National Emission Standards for Hazardous Air Pollutants for Source Categories	Emission standards for hazardous air pollutants for source categories.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 4 of 11).

Regulation/Order	Title	Subject
40 CFR Part 68	Chemical Accident Prevention Provisions	List of regulated substances and threshold quantities, and accident prevention regulations, the petition process for adding or deleting substances to the list of regulated substances, the requirements for owners or operators of stationary sources concerning the prevention of accidental releases, and the State accidental release prevention programs.
40 CFR Part 112	Oil Pollution Prevention	Procedures, methods, equipment, and other requirements to prevent the discharge of oil from non-transportation-related onshore and offshore facilities into or upon the navigable waters of the United States or adjoining shorelines.
40 CFR Part 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System	Permit programs for the National Pollutant Discharge Elimination System that requires permits for the discharge of "pollutants" from any "point source" into "waters of the United States."
40 CFR Part 125	Criteria and Standards for National Pollutant Discharge Elimination System	Criteria and standards for technology-based treatment requirements for permits under the National Pollutant Discharge Elimination System.
40 CFR Part 131	Water Quality Standards	Requirements and procedures for developing, reviewing, revising, and approving water quality standards by the states for Section 404 Permits for Discharges of Dredged or Fill Material into Waters of the United States.
40 CFR Part 136	Guidelines for Establishing Test Procedures for Analysis of Pollutants	Guidelines for test procedures for analysis of pollutants to be used to perform measurements of waste constituents specified for a state having an approved National Pollutant Discharge Elimination System program.
40 CFR Part 141	National Primary Drinking Water Regulations	Primary standards for public drinking water supplies, including maximum contaminant levels, and sampling and analysis, monitoring and reporting, and recordkeeping requirements.
40 CFR Part 142	National Primary Drinking Water Regulations Implementation	Regulations for the implementation and enforcement of the national primary drinking water regulations contained in 40 CFR Part 141.
40 CFR Part 143	National Secondary Drinking Water Regulations	Secondary standards for public drinking water supplies that primarily affect the aesthetic qualities relating to the public acceptance of drinking water.
40 CFR Part 260	Hazardous Waste Management System: General	Definitions of terms, general standards, and overview information applicable to parts 260 through 265 and 268 that sets forth the requirements for hazardous waste generators, transporters, or owners or operators of treatment, storage, or disposal facilities.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 5 of 11).

Regulation/Order	Title	Subject
40 CFR Part 261	Identification and Listing of Hazardous Waste	Standards and criteria for identifying the characteristics of hazardous waste and for listing hazardous waste.
40 CFR Part 262	Standards Applicable to Generators of Hazardous Waste	Standards for generators of hazardous waste.
40 CFR Part 263	Standards Applicable to Transporters of Hazardous Waste	Standards for transporters of hazardous waste.
40 CFR Part 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Standards for hazardous waste treatment, storage, and disposal facilities.
40 CFR Part 265	Interim Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Interim standards for hazardous waste treatment, storage, and disposal facilities.
40 CFR Part 268	Land Disposal Restrictions	Identifies hazardous wastes that are restricted from land disposal and defines treatment requirements for which an otherwise prohibited waste may be land disposed.
40 CFR Part 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program	Hazardous waste permit requirements, including application requirements, standard permit conditions, and monitoring and reporting requirements.
40 CFR Part 273	Standards for Universal Waste Management	Requirements for managing universal waste, including batteries, pesticides, thermostats, and lamps.
40 CFR Part 279	Standards for the Management of Used Oil	Standards for used oil generators, transporters, transfer facilities, collection centers, and processors and re-refineries.
40 CFR Part 302	Designation, Reportable Quantities, and Notification	Standards for designation, reportable quantities, and notification requirements for hazardous substances.
40 CFR Part 355	Emergency Planning and Notification	Establishes the list of extremely hazardous substances, threshold planning quantities, and facility notification responsibilities necessary for the development and implementation of state and local emergency response plans.
40 CFR Part 370	Hazardous Chemical Reporting: Community Right-to-Know	Reporting requirements that provide the public with important information on the hazardous chemicals in their communities for the purpose of enhancing community awareness of chemical hazards and facilitating development of state and local emergency response plans.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 6 of 11).

Regulation/Order	Title	Subject
40 CFR Part 372	Toxic Release Chemical Reporting: Community Right-to-Know	Requirements for informing the public and the communities surrounding covered facilities about the release of toxic chemicals under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986.
40 CFR Part 503	Standards for the Use or Disposal of Sewage Sludge	General requirements, pollutant limits, management practices, and operational standards for the final use or disposal of sewage sludge generated during the treatment of domestic sewage in a treatment works.
40 CFR Parts 1500 through 1508	Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act	Regulations applicable to and binding on all federal agencies for implementing the procedural provisions of the National Environmental Policy Act.
41 CFR Part 101	Federal Property Management Regulations	Introductory material concerning the Federal Property Management Regulations System: its content, types, publication, authority, applicability, numbering, deviation procedure, as well as agency consultation, implementation, and supplementation.
43 CFR Part 3	Preservation of American Antiquities	Permit requirements for the preservation of ruins, archeological sites, historic and prehistoric monuments and structures, objects of antiquity, historic landmarks, and other objects of historic and scientific interest.
43 CFR Part 7	Protection of Archaeological Resources	Implementing provisions of the Archaeological Resources Protection Act of 1979, as amended, by establishing uniform definitions, standards, and procedures to be followed by federal land managers in providing protection for archaeological resources, located on public lands and Indian lands of the United States.
43 CFR Part 1600	Planning, Programming, Budgeting	Establishes a process for the development, approval, maintenance, amendment, and revision of resource management plans, and the use of existing plans for public lands administered by the Bureau of Land Management.
43 CFR Part 2300	Land Withdrawals	Procedures implementing the Secretary of the Interior's authority to process federal land withdrawal applications and, where appropriate, to make, modify, or extend federal land withdrawals.
43 CFR Part 2800	Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act	Grants for necessary transportation or other systems and facilities which are in the public interest and which require the use of public lands for the purposes identified in 43 U.S.C. 1761, and administering, amending, assigning, renewing, and terminating them.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 7 of 11).

Regulation/Order	Title	Subject
43 CFR Part 3600	Mineral Materials Disposal	Procedures for the exploration, development, and disposal of mineral material resources on the public lands, and for the protection of the resources and the environment.
43 CFR Part 3620	Free Use of Petrified Wood	Terms and conditions for persons collecting limited quantities of petrified wood for noncommercial purposes consistent with the preservation of significant deposits as a public recreational resource.
47 CFR Part 17	Construction, Marking, and Lighting of Antenna Structures	Standards for construction, marking, lighting, maintenance, and inspection of antenna structures.
47 CFR Part 24	Personal Communications Services	Conditions under which portions of the radio spectrum are made available and licensed for personal communications.
49 CFR Part 40	Procedures for Transportation Workplace Drug and Alcohol Testing Programs	Procedures for conducting workplace drug and alcohol testing for the federally regulated transportation industry.
49 CFR Part 107	Hazardous Materials Program Procedures	Procedures and permits for the transportation of hazardous materials.
49 CFR Part 171	General Information, Regulations, and Definitions	General information, regulations, and definitions for the safe and secure transportation of hazardous materials in commerce.
49 CFR Part 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements	Listing and classification of materials that the Department of Transportation has designated as hazardous materials for purposes of transportation and prescribes the requirements for shipping papers, packaging, marking, labeling, and transport vehicle placarding applicable to the shipment and transportation of those materials.
49 CFR Part 173	Shippers-General Requirements for Shipments and Packaging	Requirements for preparing hazardous materials for shipment by air, highway, rail, or water, and inspection, testing, and retesting responsibilities for persons who retest, recondition, maintain, repair, and rebuild containers used or intended for use in the transportation of hazardous materials.
49 CFR Part 174	Carriage By Rail	Handling, loading, and operating requirements for transport of hazardous and radioactive materials by rail.
49 CFR Part 177	Carriage By Public Highway	Requirements for transportation of hazardous materials by private, common, or contract carriers by motor vehicle, including hazardous materials training.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 8 of 11).

Regulation/Order	Title	Subject
49 CFR Part 178	Specifications for Packaging	Manufacturing and testing specifications for packaging and containers used for the transportation of hazardous materials in commerce.
49 CFR Part 179	Specifications for Tank Cars	Specifications for tanks that are mounted on or form part of a tank car and which are to be marked with a Department of Transportation specification.
49 CFR Part 180	Continuing Qualification and Maintenance of Packaging	Requirements for the maintenance, reconditioning, repair, inspection, and testing of packaging, and any other function having an effect on the continuing qualification and use of a packaging.
49 CFR Part 210	Rail Noise Emission Compliance Regulations	Inspection and testing requirements for railcars for compliance with the Railroad Noise Emission Standards established by the Environmental Protection Agency in 40 CFR part 201.
49 CFR Part 213	Track Safety Standards	Minimum safety requirements for railroad track that is part of the general railroad system of transportation.
49 CFR Part 214	Railroad Workplace Safety	Minimum federal safety standards for railroad employees involved in railroad inspection, maintenance, and construction activities.
49 CFR Part 215	Railroad Freight Car Safety Standards	Minimum federal safety standards for railroad freight cars.
49 CFR Part 217	Railroad Operating Rules	Railroad operating rules and practices with respect to trains and other rolling equipment in the railroad industry, and each railroad is required to instruct its employees in operating practices.
49 CFR Part 218	Railroad Operating Practices	Minimum requirements for railroad operating rules and practices. Each railroad may prescribe additional or more stringent requirements in its operating rules, timetables, timetable special instructions, and other special instructions.
49 CFR Part 219	Control of Alcohol and Drug Use	Minimum federal safety standards for control of alcohol and drug use by rail line employees.
49 CFR Part 220	Railroad Communications	Wireless and radio communication procedures for trains and rail line workers.
49 CFR Part 221	Rear End Marking Device–Passenger, Commuter, and Freight Trains	Minimum requirements governing highly visible marking devices for the trailing end of the rear car of all passenger, commuter, and freight trains.
49 CFR Part 223	Safety Glazing Standards–Locomotives, Passenger Cars, and Cabooses	Minimum requirements for glazing materials in order to protect railroad employees and railroad passengers from injury as a result of objects striking the windows of locomotives, cabooses, and passenger cars.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 9 of 11).

Regulation/Order	Title	Subject
Regulation (continued)		
49 CFR Part 225	Railroad Accidents/Incidents: Reports, Classification, and Investigations	Reporting, classification, and investigation procedures for rail line accidents and incidents.
49 CFR Part 228	Hours of Service of Railroad Employees	Records and reporting requirements for railroad employees hours of service and construction of sleeping quarters.
49 CFR Part 229	Railroad Locomotive Safety Standards	Minimum safety requirements for locomotives.
49 CFR Part 231	Railroad Safety Appliance Standards	Safety standards for locomotives and railcars.
49 CFR Part 232	Brake System Safety Standards for Freight and Other Non-passenger Trains and Equipment	Requirements for railroad power brakes and drawbars for freight and other nonpassenger trains.
49 CFR Part 233	Signal Systems Reporting Requirements	Reporting requirements for railroad signal systems.
49 CFR Part 234	Grade Crossing Signal System Safety	Inspection, testing, and maintenance requirements for rail crossing signal systems.
49 CFR Part 235	Instructions Governing Applications for Approval of a Discontinuance or Material Modification of a Signal System or Relief from the Requirements of Part 236	Provides applications for approval to discontinue or materially modify block signal systems, interlockings, traffic control systems, automatic train stop, train control, or cab signal systems, or other similar appliances, devices, methods, or systems.
49 CFR Part 236	Rules, Standards and Instructions Governing the Installation, Inspection, Maintenance, and Repair of Signal and Train Control Systems, Devices, and Appliances	Rules, standards and instructions for the installation, inspection, maintenance, and repair of signal and train control systems, devices, and appliances.
49 CFR Part 240	Qualification and Certification of Locomotive Engineers	Qualification and certification requirements for locomotive engineers.
49 CFR Part 395	Hours of Service of Drivers	Hours of service requirements for drivers of commercial motor vehicles.
49 CFR Part 1005	Principles and Practices for the Investigation and Voluntary Disposition of Loss and Damage Claims and Processing Salvage	Principles and practices for the investigation and voluntary disposition of loss and damage claims and processing salvage.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 10 of 11).

Regulation/Order	Title	Subject
49 CFR Part 1035	Bills of Lading	Requirements for uniform bills of lading.
49 CFR Part 1104	Filing with the Board-Copies-Verification-Service-Pleadings	Requirements for filing of pleading and other documents with the Surface Transportation Board.
49 CFR Part 1105	Procedures for Implementation of Environmental Laws	Procedures for implementation of environmental laws by the Surface Transportation Board.
49 CFR Part 1150	Certificate to Construct, Acquire, or Operate Railroad Lines	Administrative practices and procedures to obtain certification for construction, acquisition, or operation of railroad lines.
50 CFR Part 15	Wild Bird Conservation Act	Standards for the protection of wild birds.
50 CFR Part 17	Endangered and Threatened Wildlife and Plants	Standards for the protection of endangered and threatened wildlife and plants.
50 CFR Part 402	Interagency Cooperation–Endangered Species Act of 1973, as Amended	Interprets and implements the Endangered Species Act of 1973, as amended.
Executive Orders		
Executive Order 11514	*Protection and Enhancement of Environmental Quality*	The federal government shall provide leadership in protecting and enhancing the quality of the Nation's environment to sustain and enrich human life. Federal agencies shall initiate measures needed to direct their policies, plans, and programs so as to meet national environmental goals.
Executive Order 11593	*Protection and Enhancement of the Cultural Environment*	The federal government shall provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation and institute procedures to assure that federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historical, architectural or archaeological significance.
Executive Order 11988	*Floodplain Management*	Federal agencies shall provide leadership and take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing, and disposing of federal lands and facilities.
Executive Order 11990	*Protection of Wetlands*	Federal agencies shall provide leadership and shall take action to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for acquiring, managing, and disposing of federal lands and facilities.
Executive Order 12088	*Federal Compliance with Pollution Control Standards*	Federal agencies are responsible for compliance with applicable pollution control standards.

Table 6-2. Potentially applicable federal regulations and Executive Orders (page 11 of 11).

Regulation/Order	Title	Subject
Executive Order 12898	*Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*	Federal agencies shall make achieving ***environmental justice*** part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on ***minority populations*** and ***low-income populations***.
Executive Order 13007	*Indian Sacred Sites*	In managing federal lands, each executive branch agency with statutory or administrative responsibility for the management of federal lands shall accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites.
Executive Order 13112	*Invasive Species*	Federal agencies shall prevent the introduction of invasive species and provide for their control, and to minimize the economic, ecological, and human health impacts that invasive species cause.
Executive Order 13132	*Federalism*	Establishes policy to guarantee the division of governmental responsibilities between the national government and the states, and to ensure that the principles of federalism guide the executive departments and agencies in the formulation and implementation of policies.
Executive Order 13175	*Consultation and Coordination with Indian Tribal Governments*	Federal agencies shall establish regular and meaningful consultation and collaboration with Indian tribal governments in the development of regulatory practices on federal matters that significantly or uniquely affect their communities; to reduce the imposition of unfunded mandates upon Indian tribal governments; and to streamline the application process for and increase the availability of waivers to Indian tribal governments.
Executive Order 13186	*Responsibilities of Federal Agencies to Protect Migratory Birds*	The United States recognizes that migratory birds are of great ecological and economic value to this country and to other countries. They contribute to biological diversity and bring tremendous enjoyment to millions of Americans who study, watch, feed, or hunt these birds throughout the United States and other countries. The United States has recognized the critical importance of this shared resource by ratifying international, bilateral conventions for the conservation of migratory birds.
Executive Order 13423	*Strengthening Federal Environmental, Energy, and Transportation Management*	Federal agencies must conduct their environmental, transportation, and energy-related activities under the law in support of their respective missions in an environmentally, economically and fiscally sound, integrated, continuously improving, efficient, and sustainable manner.

a. CFR = Code of Federal Regulations.

Table 6-3 lists applicable State of Nevada codes and statutes. Sections 6.3.1 through 6.3.8 are organized by environmental topic and describe the laws, regulations, Executive Orders, State of Nevada codes and statutes, and regulatory actions potentially applicable to construction and operation of the proposed railroad facilities.

Table 6-3. Potentially applicable State of Nevada codes and statutes (page 1 of 3).

Code or statute[a]	Title	Subject
NAC 408	Highways and Roads Installation and Relocation of Facilities and Encroachments	Requirements for design and location, permits, etc.
NAC 444 - Sanitation		
NAC 444.550 through 444.566	Labor Camps	Standards for living and sleeping quarters; cooking and eating, sanitary, and laundry facilities; lighting; and operating permits
NAC 444.8618	Disposal of Hazardous Waste Hazardous Waste Generator Identification Number	Information concerning an application for EPA identification number
NAC 444.850 through 444.8746	Disposal of Hazardous Waste	Standards of practice, variances, and administrative penalties
NAC 445A	Water Controls	Permits, certification of laboratories to analyze substances in water, water pollution control, public water systems, and underground injection control
NAC 445A.226 through 445A.22755	Action Levels for Contaminated Sites	Remediation standards and monitoring requirements for soil, groundwater, and surface-water contamination
NAC 445A.228 through 445A.263	Discharge Permits	Requirements, establishment of effluent limitations, schedules of compliance, inspection, sampling, and monitoring
NAC 445A.266 through 445A.272	General Permits	Requirements for discharge and procedures for application for general permits
NAC 445A.305 through 445A.340	Diffuse Sources	Administration of controls by municipality, determination of new sources of water pollution, state and local handbooks of best management practices, and requirements for permits to construct or grade and forlogging
NAC 445A.345 through 445A.348	Notification of Release of Pollutant	Notice required and use of information in criminal prosecution
NAC 445A.591 through 445A.6731	Drinking Water Systems	Operation of ***community water system*** or nontransient water system; permits to operate privately owned systems; certification of operators; and design, construction, operation, and maintenance
NAC 445A.810 through 445A.925	Underground Injection Control Permits	Permits and construction, operation, monitoring, and abandonment
NAC 445B.001 through 455B.899	Air Pollution Control	Permits, air emissions control program, clean air mercury rule program, and emissions from engines
NAC 445C.010 through 445C.120	Environmental Requirements	Requirements to enter into and contents of an environmental audit agreement
NAC 459	Hazardous Materials	Hazardous materials

Table 6-3. Potentially applicable State of Nevada codes and statutes (page 2 of 3).

Code or statute[a]	Title	Subject
NAC 459.952 through 459.95528	Regulation of Highly Hazardous Substances and Explosives	Requirements, permits, hazard assessments, prevention programs, emergency response programs, and enforcement
NAC 459.975 through 459.991	Transportation of Hazardous Materials on Public Highways	Transportation of hazardous materials on public highways permits
NAC 459.9912 through 459.99184	Planning for and Responding to Discharge of Hazardous Materials	Emergency planning funding for local emergency planning committees, funding for state agencies, and payment of fees
NAC 459.9921 through 459.999	Storage Tanks	Storage tank requirements, registration, monitoring, and corrective action
NAC 472	State Forester Firewarden	Fire retardant roofing materials
NAC 477.010 and 477.290	State Fire Marshal – General Provisions	Definitions and severability
NAC 477.323	Permit to Store Hazardous Material	Permit required; issuance, expiration, renewal, suspension, reinstatement and revocation of permit; fees; criminal investigation; plan for termination
NAC 477.710	Use of Explosives in Blasting	Certificate required; qualifications; exemptions; renewal of certificate; fees
NAC 477.920	Miscellaneous Requirements	Fire suppression systems in buildings in rural areas
NAC 503	Hunting, Fishing, and Trapping Miscellaneous Protective Measures	Classification and taking of wildlife; possession, transportation, importation, exportation, and release of wildlife; hunting and trapping generally; raptors; fishing; depredation; and dredging permits
NAC 504.520	Alteration of a Stream System or Watershed	Approval of Department required to alter stream system or watershed to detriment of wildlife habitat; application for approval
NAC 527	Protection and Preservation of Timbered Lands, Trees, and Flora	Nevada Natural Heritage Program, permits, compliance with plan, revocation of permit, and protection of cacti and yucca
NAC 534	Underground Water and Wells	License to drill well; duties of well drillers; drilling, construction, and plugging of wells and boreholes; waivers; and enforcement
NAC 555	Control of Insects, Pests, and Noxious Weeds	Classification of weeds, weed control districts, regulation of nurseries and nursery stock, custom application of pesticides, certified applicators, and rodent control districts
NAC 586.018	Pesticides	Restricted-use pesticides: Application by or under supervision of certified applicator
NAC 703	Public Utilities Commission of Nevada	Application for privileges, rights, and authority and practice before the public utilities commission
NAC 705	Railroads	Standards and requirements for health and safety and transportation of hazardous materials by rail
NRS 408	Highways, Roads, and Transportation Facilities	Planning; financing highways and roads; improvement of county roads; state highway system; and construction, improvement, and maintenance of highways
NRS 444.130 through 444.200	Sanitation/Construction and Labor Camps	Requirements for conditions

Table 6-3. Potentially applicable State of Nevada codes and statutes (page 3 of 3).

Code or statute[a]	Title	Subject
NRS 444.440 through 444.620	Collection and Disposal of Solid Waste	Collection and disposal of solid waste
NRS 444.570 through 444.650	Disposal of Solid Waste	Disposal of solid waste and sewage
NRS 445A	Water Controls	Concentration of fluoride in water, water pollution control, and public water systems
NRS 445B	Air Pollution	State environmental commission, local hearing board, provisions for enforcement, program for control of air pollution, penalties, and control of emissions from engines
NRS 459.400 through 459.600	Disposal of Hazardous Waste	Disposal of hazardous waste
NRS 533.324 through 533.455	Appropriation of Public Waters: Applications, Permits and Certificates	Environmental permits and transfer of water from county of origin to another county
NRS 704	Regulation of Public Utilities Generally	Rates and schedules, general standards and practices, etc.
NRS 705	Railroads and Monorails	Railroads and monorails

a. NAC = Nevada Administrative Code; NRS = Nevada Revised Statutes.

6.3.1 NATIONAL ENVIRONMENTAL POLICY ACT, AS AMENDED (42 U.S.C. 4321 *et seq.*)

The National Environmental Policy Act (NEPA) of 1969, as amended (42 U.S.C. 4321 *et seq.*), requires federal agencies to integrate environmental values into their decision-making process by considering the environmental impacts of proposed federal actions and reasonable ***alternatives*** to those actions. The Act establishes policy, sets goals (in Section 101), and provides means (in Section 102) for carrying out the policy. Section 102(2) contains action-forcing provisions to ensure that federal agencies follow the letter and spirit of the Act. For major federal actions significantly affecting the quality of the human ***environment***, Section 102(2)(C) of NEPA requires federal agencies to prepare a detailed statement that includes the environmental impacts of the proposed action and other specified information. DOE promulgated regulations (10 CFR Part 1021) and issued DOE Order 451.1B, National Environmental Policy Act Compliance Program, to ensure compliance with Section 102(2) of NEPA.

DOE would construct and operate the proposed railroad in compliance with NEPA and promulgated DOE regulations.

6.3.2 HAZARDOUS MATERIALS PACKAGING, HANDLING, AND TRANSPORTATION (49 CFR PARTS 172 AND 173; 10 CFR PARTS 71 AND 73)

The ***shipment*** of ***nuclear waste*** is highly regulated and subject to the utmost scrutiny. DOE follows the strict U.S. Department of Transportation and U.S. Nuclear Regulatory Commission transportation rules, including the use of Commission-certified transportation casks, advance route approvals and notification, and shipment escorts. The Department also tracks its shipments by satellite 24 hours a day. DOE follows these precautions carefully now and will follow any others that might be required in the future, whether by the U.S. Congress, the Department of Transportation, or the Nuclear Regulatory Commission.

In addition, the Department would follow DOE Order 460.1B, which establishes safety requirements for the proper packaging and transportation of DOE/National Nuclear Security Administration offsite shipments and onsite transfers of hazardous materials and for modal transport.

The Department of Transportation is responsible for developing and implementing transportation-safety standards for hazardous materials, including radioactive materials. The Department of Transportation has established standards and requirements for packaging, transporting, and handling radioactive materials for all modes of transportation (49 CFR Parts 172 and 173). The regulations also specify safety requirements for vehicles and transportation operations, training for personnel who perform handling and transportation of hazardous materials, and liability insurance requirements for carriers. For all spent nuclear fuel and high-level radioactive waste shipments, DOE would comply with the requirements for identification, labeling, packaging, marking, placarding, and preparation of shipping papers set forth by the Department of Transportation in 49 CFR Parts 172 and 173.

The Nuclear Regulatory Commission regulates the packaging- and transportation-related operations of its licensees, including commercial shippers of radioactive materials. It sets design and performance standards for packaging (***shipping casks***) that contain materials with high levels of ***radioactivity***.

The Department of Transportation, by agreement with the Nuclear Regulatory Commission, accepts the Commission standards of 10 CFR Part 71 for packaging. The Commission also establishes safeguards and security regulations to minimize the possibility of theft, diversion, or attack on shipments of radioactive materials (10 CFR Part 73). Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training of public safety officials of appropriate units of local governments and American Indian tribes through whose jurisdictions DOE plans to transport spent nuclear fuel or high-level radioactive waste.

6.3.2.1 Hazardous Materials Transportation Act, as Amended (49 U.S.C. 1801)

The Hazardous Materials Transportation Act of 1975, as amended (49 U.S.C. 1801), gives the U.S. Department of Transportation authority to regulate the transport of hazardous materials, including radioactive materials. Under these regulations, the Department of Transportation regulates the interstate and intrastate shipment of hazardous materials, including spent nuclear fuel and high-level radioactive waste, by land, air, and navigable water. As outlined in a 1979 memorandum of understanding with the U.S. Nuclear Regulatory Commission (44 *FR* 38690, July 2, 1979), the Department of Transportation specifically regulates carriers of spent nuclear fuel and the conditions of transport such as routing, handling, storage, and vehicle and driver requirements. It also regulates the labeling, classification, and marking of transportation packages for radioactive materials.

Department of Transportation regulations include requirements for carriers, drivers, vehicles, routing, packaging, labeling, marking, placarding of vehicles, shipping papers, training, and emergency response. The requirements specify the maximum ***dose rate*** associated with radioactive material shipments and the maximum allowable levels of radioactive surface ***contamination*** on packages and vehicles. Department of Transportation regulations also include requirements to protect the health and safety of transportation workers.

6.3.2.2 Low-Level Radioactive Waste Policy Act, as Amended (42 U.S.C. 2021b *et seq.*)

In 1980 Congress passed the Low-Level Radioactive Waste Policy Act to establish federal policy on nuclear waste disposal, the foundation of which is the idea that the states are responsible for the disposal of ***low-level radioactive waste*** generated within their borders (except for certain federal waste). The desire to restrict access to disposal facilities was a driving force behind the adoption of the 1980 Act and the subsequent Low-Level Radioactive Waste Policy Act of 1985, as amended (42 U.S.C. 2021b *et seq.*).

The 1985 amendments clarified the right of Congressionally approved compacts to control access to their disposal facilities. This Act gives states the responsibility to dispose of low-level radioactive waste generated within their borders and allows them to form compacts to establish facilities to serve a group of states. The Act provides that the facilities will be regulated by the U.S. Nuclear Regulatory Commission or by states that have entered into agreements with the Commission under Section 274 of the Atomic Energy Act. The Act also requires the Commission to establish standards for determining when ***radionuclides*** are present in waste streams in sufficiently low concentrations or quantities as to be "below regulatory concern." Whereas Congress maintains authority over the disposal of high-level nuclear waste and ***transuranic waste***, states are responsible for low-level radioactive waste, which, unlike spent nuclear reactor fuel or high-level radioactive waste, emits a low level of radiation that decays fairly rapidly. Most low-level radioactive waste (97 percent) does not require special ***shielding*** during handling or transportation for the protection of workers or the surrounding community, and it can include such things as contaminated clothing, tools, or equipment.

6.3.2.3 U.S. Nuclear Regulatory Commission Radioactive Material Packaging and Transportation (10 CFR Parts 71 and 73)

Pursuant to 10 CFR Part 71, the U.S. Nuclear Regulatory Commission regulates the packaging and transport of spent nuclear fuel for its licensees, including commercial shippers of radioactive material and the DOE Office of Civilian Radioactive Waste Management. Under an agreement with the Department of Transportation, the Commission sets standards for packaging of radioactive materials, including spent nuclear fuel and high-level radioactive waste. These wastes must meet Type B packaging standards, which require that packages be designed and built to retain their radioactive contents in both normal and accident conditions.

The demonstration of compliance with these requirements applies a combination of calculation methods, computer modeling techniques, and physical testing to the design features of the package. DOE would present the results of the analyses and tests to the Nuclear Regulatory Commission in a safety analysis report for packaging. The Commission would review the safety analysis report, and if approved, would then issue a certificate of compliance to allow spent nuclear fuel or high-level radioactive waste to be shipped to the repository.

The regulations at 10 CFR Part 73 govern safeguards and physical security during the transit of shipments of spent nuclear fuel and specify requirements for carrier personnel, communications, notification of state governors, escorts, and route planning for such shipments. DOE carefully follows the Department of Transportation and the Nuclear Regulatory Commission transportation rules and will follow or exceed any others that may be established in the future, whether by the U.S. Congress, the Department of Transportation, or the Nuclear Regulatory Commission.

6.3.2.4 Emergency Planning and Community Right-to-Know Act (42 U.S.C. 1001 *et seq.*)

Under Subtitle A of the Emergency Planning and Community Right-to-Know Act of 1986 (42 U.S.C. 1001 *et seq.*), which is also known as the Superfund Amendments and Reauthorization Act, Title III, federal agencies must provide information on hazardous and toxic chemicals to state emergency response commissions, local emergency planning committees, and the U.S. Environmental Protection Agency. The goal of providing this information about inventories of specific chemicals used or stored, and descriptions of releases that could occur at work sites, is to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances. The Emergency Planning and Community Right-to-Know Act, codified at 40 CFR Parts 302 through 372, requires agencies to provide reports on material safety data sheets, emergency and ***hazardous chemical*** inventory, and toxic chemical releases to appropriate local, state, and federal agencies. These regulations also require facilities that store, dispense, use, or handle extremely hazardous materials in excess of specified thresholds, to report quantity data to specific agencies and organizations. Nevada Administrative Code, Chapters 459 and 477, establish the permitting requirements for highly hazardous substances and hazardous materials, respectively.

6.3.3 AIR QUALITY

6.3.3.1 Clean Air Act, as Amended (42 U.S.C. 7401 *et seq.*)

The Clean Air Act of 1970, as amended (42 U.S.C. 7401 *et seq.*), is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." The Act requires:

- Federal agencies with jurisdiction over any property or endeavor that might result in the discharge of air pollutants to comply with "all federal, state, interstate, and local requirements" related to the control and abatement of air pollution in accordance with 42 U.S.C. 7401, Section 118.
- The Environmental Protection Agency to establish national ***ambient air quality standards*** to protect public health from any known or anticipated adverse effects of a regulated pollutant (42 U.S.C. 7409).
- The Environmental Protection Agency to establish national standards of performance for new or modified stationary sources of atmospheric pollutants (42 U.S.C. 7411) and the evaluation of specific emission increases to prevent a significant deterioration in ***air quality*** (42 U.S.C. 7470).

6.3.3.2 National Primary and Secondary Ambient Air Quality Standards (40 CFR Part 50)

Under the Clean Air Act, the Environmental Protection Agency has established national ***ambient air*** quality standards at 40 CFR Part 50 to protect the public health and the environment. The national ambient air quality standards identify six pollutant types as criteria pollutants: ***nitrogen dioxide***, ***ozone***, lead, ***carbon monoxide***, ***particulate matter***, and ***sulfur dioxide***. The Environmental Protection Agency calls these "criteria" air pollutants because it regulates them from the development of human health-based and/or environmentally based criteria (science-based guidelines) in setting permissible levels.

The Clean Air Act specifically regulates emissions of hazardous air pollutants, including radionuclides, through the national emission standards for ***hazardous air pollutants*** program (40 CFR Parts 61 and 63).

6.3.3.3 Nevada Revised Statutes: Air Pollution (Title 40, Chapter 445B)

Nevada Revised Statutes, Chapter 445B, Air Pollution, and regulations in the Nevada Administrative Code implement state and federal Clean Air Act provisions, identify the requirements for permits for each air pollution source unless it is specifically exempted, and identify ongoing monitoring requirements. DOE would need operating permits from the Nevada Division of Environmental Protection, Bureau of Air Pollution Control, for the control of gaseous and particulate emissions from construction and operation of the proposed railroad.

6.3.4 WATER QUALITY

6.3.4.1 Clean Water Act, as Amended (33 U.S.C. 1251 *et seq.*)

The Clean Water Act regulates the discharge of pollutants into the Nation's surface waters, including lakes, rivers, streams, ***wetlands***, and coastal areas. Passed in 1972 and amended in 1977 and 1987, the Clean Water Act was originally known as the Federal Water Pollution Control Act. The Clean Water Act is administered by the U.S. Environmental Protection Agency, which sets water quality standards, handles enforcement, and helps state and local governments develop their own pollution control plans. The purpose of the Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) is to "restore and maintain the chemical, physical, and biological integrity of the Nation's water." The U.S. Environmental Protection Agency delegated the State of Nevada the authority to implement and enforce most programs in the state under the Clean Water Act; exceptions include those addressed by Section 404 of the Act, which is administered by the U.S. Army Corps of Engineers, and described in this section.

This Act prohibits the "discharge of toxic pollutants in toxic amounts" to navigable ***waters of the United States***. Section 313 of the Act requires all departments and agencies of the Federal Government engaged in any activity that might result in a discharge or runoff of pollutants to surface waters to comply with federal, state, interstate, and local requirements. The Act applies to activities at and along the Caliente ***rail alignment*** and the Mina rail alignment that could affect waterways. Under the Clean Water Act, the State of Nevada sets water quality standards, and the U.S. Environmental Protection Agency and the State of Nevada regulate and issue permits for point-source discharges as part of the National Pollutant Discharge Elimination System permitting program. The Environmental Protection Agency regulations for this program are codified at 40 CFR Part 122, and Nevada rules for this program are codified at Nevada Administrative Code, Chapter 445A. If construction or operation of the proposed railroad in Nevada would result in point-source discharges, DOE would need to obtain a National Pollutant Discharge Elimination System permit from the Nevada Division of Environmental Protection, Bureau of Water Pollution Control.

Section 402(p) of the Clean Water Act requires the Environmental Protection Agency to establish regulations and requires individual states to issue permits for stormwater discharges associated with industrial activity, including construction activities that could disturb 20,000 or more square meters (5 or more acres) (40 CFR Part 122). Stormwater discharge permits are designed to control the degradation of surface water and ***groundwater*** primarily from erosion and sedimentation. Nevada rules for this program are codified at Nevada Administrative Code, Chapter 445A. Stormwater permits issued from the Nevada Bureau of Water Pollution Control regulate the discharge of stormwater from facilities. The Proposed Action includes rail line ***construction and operations support facilities*** that would have discharges of stormwater. DOE would need to obtain permits for these discharges. Additionally, construction and operation of septic and sanitary-sewage collection systems would require permits from the Nevada Bureau of Water Pollution Control.

Jurisdictional waters of the United States are subject to regulation by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Jurisdictional waters of the United States include navigable and interstate waters, intrastate waters with a connection to interstate commerce and tributaries to such waters, and wetlands that are adjacent to waters of the United States. Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Construction activities, such as those for the proposed railroad, that would impact waters of the United States are regulated under this program.

The basic premise of the Section 404 permitting program is that no discharge of dredged or fill material into jurisdictional waters will be permitted if a practicable alternative exists that is less damaging to the aquatic environment, or the Nation's waters would be significantly degraded. In other words, it must be demonstrated that, to the extent practicable, steps have been taken to avoid impacts and that potential impacts on jurisdictional waters have been minimized and compensation is provided for any remaining unavoidable impacts (if required). Proposed activities are regulated through a permit review process.

An evaluation under Section 404(b)(1) of the Clean Water Act would analyze and describe the potential impacts from any proposed discharges of dredged or fill material into jurisdictional waters that would result from construction and operation of the proposed railroad. To complete the 404(b)(1) analysis, DOE would be required to identify the appropriate and applicable steps that would be taken during construction to minimize potential adverse impacts. These steps would include actions taken to reduce the potential for increased erosion and subsequent sedimentation and to ensure that any downstream water would not experience increases in sediment loading or turbidity that would threaten the beneficial use of that stream.

Section 404(r) of the Clean Water Act states that the discharge of dredged or fill material as part of the construction of a federal project specifically authorized by Congress is not prohibited or subject to regulation under Section 404 of the Clean Water Act so long as certain conditions are met. One of those conditions is to publish in an EIS information on the effects of such discharge, including an analysis of alternatives as required by Section 404(b)(1) of the Clean Water Act. If DOE determines that it will comply with Section 404(r), an alternatives analysis that meets the requirements of Sections 404(b)(1) and 404(r) will be published in the Final EIS. Otherwise, DOE would apply to the U.S. Army Corps of Engineers for a permit to fill jurisdictional waters of the United States.

Sections 401 and 405 of the Water Quality Act of 1987 and Public Law 100-4 added Section 402(p) to the Clean Water Act. Section 401 provides states with the opportunity to review and approve, condition, or deny all federal permits or licenses that might result in a discharge to state or tribal waters, including wetlands. The major federal permit subject to Section 401 review is a Section 404 permit. Every applicant for a Section 404 permit must request state certification that the proposed activity will not violate state or federal water quality standards. Construction of the proposed railroad would require the discharge of dredged or fill materials for bridges and culverts into United States waters via interstate streams and dry ***washes***. DOE would follow the requirements of Section 401 in requesting state certification. The proposed construction activities would not exceed State of Nevada water quality standards or otherwise violate a state requirement.

6.3.4.2 Safe Drinking Water Act, as Amended (42 U.S.C. 300 *et seq.*)

The Safe Drinking Water Act of 1974, as amended (42 U.S.C. 300(f) *et seq.*), gives the U.S. Environmental Protection Agency the responsibility and authority to regulate public drinking-water supplies by establishing drinking-water standards, delegating authority for enforcement of drinking-water standards to the states, and protecting ***aquifers*** from pollution hazards. The Nevada Division of Environmental Protection, Bureau of Safe Drinking Water, is the state agency responsible for enforcement. Environmental Protection Agency regulations for this program are codified at 40 CFR Part 141, and Nevada rules for this program are codified at Nevada Administrative Code, Chapter 445A. Operating permits are required for public water distribution systems, which are classified as a public water supply if each serves 15 connections or 25 people for more than 60 days per year. Because public water distribution systems would be located along the rail line at ***construction camps*** and railroad operations support facilities, DOE would have to obtain operating permits for these systems.

6.3.4.3 Nevada Revised Statutes: Water Controls (Title 40, Chapter 445A)

Nevada Revised Statutes, Chapter 445A, Water Controls, classifies the waters of the state, establishes standards for the quality of all waters in the state, and specifies permit and notification provisions for stormwater discharges and for other discharges to the waters of the state according to provisions of the Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) and the Safe Drinking Water Act of 1974 (42 U.S.C. 300 *et seq.*). These statutes and regulations in the Nevada Administrative Code set drinking water standards, specifications for certification, and conditions for issuance of variance and exemptions; set standards and requirements for the construction of wells and other water-supply systems; establish the different classes of wells and aquifer exemptions; and establish requirements for well operation and monitoring, plugging, and abandonment activities.

Additionally, the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, requires a temporary permit to work in waterways of the state (that is, a rolling stock permit) before using equipment in waters of the state, including dry washes, that could directly discharge pollutants into waters of the state. Construction of the rail line would require installation of drainage ***culverts*** or bridges to cross some of the washes and streambeds and other construction activities in channels. DOE would have to obtain a permit for such work.

6.3.4.4 Nevada Revised Statutes: Adjudication of Vested Water Rights, Appropriation of Public Waters; Underground Water and Wells (Title 48, Chapters 533 and 534)

Nevada Revised Statutes, Chapters 533 and 534, and accompanying regulations in the Nevada Administrative Code, Chapters 533 and 534, establish permitting procedures for appropriating public waters of the state, including underground waters for beneficial use. The withdrawal of underground water in Nevada requires a permit from the Nevada State Engineer. DOE intends to meet water needs through construction of new wells and would need to apply for water rights with the Nevada State Engineer for construction of wells along the proposed rail alignment.

6.3.4.5 Floodplain Management and Protection of Wetlands (Executive Orders 11988 and 11990)

Executive Order 11988 requires federal agencies to ensure that the agency evaluates the potential effects of any proposed action on ***floodplains***; to ensure that planning programs and budget requests reflect consideration of flood hazards and floodplain management; and to prescribe procedures to implement the policies and requirements of the Order. Federal agencies are required to reduce risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains.

Executive Order 11990 requires that federal agencies "…take action to minimize the destruction, loss, or degradation of wetlands," and to consider wetland protection in decision making. It should be noted that exclusion of isolated (nonjurisdictional) wetlands is not indicated in the Executive Order.

DOE issued regulations that implement these Executive Orders (10 CFR Part 1022, Compliance with Floodplain/Wetlands Environmental Review Requirements). In accordance with this regulation, specifically 10 CFR 1022.11(d), DOE must prepare a floodplain assessment for proposed actions that would take place in floodplains and a wetlands assessment for proposed actions that would take place in wetlands. DOE must also avoid to the extent possible the long- and short-term adverse impacts associated with the destruction of wetlands and the occupancy and modification of floodplains and wetlands, and avoid direct and indirect support of floodplain and wetlands development wherever there is a practicable alternative.

To meet the requirements of 10 CFR Part 1022, Appendix F, Floodplain and Wetlands Assessment, includes a detailed analysis of floodplains and wetlands within the Caliente and Mina rail alignments regions of influence.

6.3.5 POLLUTION PREVENTION AND CONTROL

6.3.5.1 Pollution Prevention Act (42 U.S.C. 13101 *et seq.*)

The Pollution Prevention Act of 1990 (42 U.S.C. 13101 *et seq.*) establishes a national policy for waste management and pollution control that focuses first on source reduction, and then on environmentally safe waste recycling, treatment, and disposal. Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management,* directs federal agencies to implement sustainable practices for pollution and waste prevention and recycling.

6.3.5.2 Comprehensive Environmental Response, Compensation, and Liability Act, as Amended (42 U.S.C. 9601 *et seq.*)

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act (42 U.S.C. 9601 *et seq.*), authorizes the U.S. Environmental Protection Agency to require responsible site owners, operators, arrangers, and transporters to clean up releases of hazardous substances, including certain radioactive substances. Under this Act, the Environmental Protection Agency has the authority to regulate hazardous substances at rail line construction zones in the event of a release or a “substantial threat of a release.” DOE would report any releases greater than reportable quantities of hazardous substances (as codified in 40 CFR Part 302 under the Comprehensive Environmental Response, Compensation, and Liability Act) to the National Response Center, extremely hazardous substances (as codified in 40 CFR Part 355 under the Emergency Planning and Community Right-to-Know Act) to the State Emergency Response Commission contacts for Nevada, and substances classified as both hazardous and extremely hazardous to both the National Response Center and the State Emergency Response Commission contacts for Nevada. Nevada Administrative Code, Sections 445A.226 through 445A.22755, provide action levels for contaminated sites, including levels for groundwater, surface water, and soil. In the event of a release of hazardous substances during construction and operation of the proposed railroad, DOE would clean up releases in a manner that complies with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended.

6.3.5.3 Resource Conservation and Recovery Act, as Amended (42 U.S.C. 6901 *et seq.*)

The treatment, storage, and disposal of hazardous and nonhazardous waste is regulated by the provisions of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 and the Hazardous and Solid Waste Amendments of 1984 (42 U.S.C. 6901 *et seq.*), and applicable state laws. Environmental Protection Agency regulations implementing the ***hazardous waste*** portions of the Resource Conservation and Recovery Act define hazardous wastes and specify requirements for their transportation, handling, treatment, storage, and disposal (40 CFR Parts 260 through 272). Immediate response actions and cleanup of spills are specified in 40 CFR Part 263.

Subtitle C of the Resource Conservation and Recovery Act requires that Resource Conservation and Recovery Act hazardous wastes be characterized and managed. DOE would track the amount of hazardous wastes that would be generated each month during proposed railroad construction and operations, including a log of materials and weight of all generated hazardous wastes. DOE would monitor waste-generator status and would comply in accordance with the applicable Subtitle C regulations. Nevada Administrative Code, Sections 444.850 to 444.8746, are the governing requirements for wastes generated under Subtitle C.

Subtitle D of the Resource Conservation and Recovery Act sets forth definitions, methods of disposal, and special requirements for solid-waste collection, transportation standards; and classification of landfills. Subtitle D focuses on state and local governments as the primary planning, regulating, and implementing entities for the management of nonhazardous solid waste, such as household garbage and nonhazardous industrial solid waste. The governing requirements for wastes generated in Nevada under Subtitle D are Nevada Revised Statutes, Sections 444.440 to 444.620, and Nevada Administrative Code, Sections 444.570 to 444.7499. DOE plans to dispose of solid waste from railroad construction and operations at commercial or municipal landfill facilities that meet Subtitle D requirements.

6.3.5.4 Federal Insecticide, Fungicide, and Rodenticide Act, as Amended (7 U.S.C. 136 *et seq.*)

The primary focus of the Federal Insecticide, Fungicide, and Rodenticide Act of 1948, as amended (7 U.S.C. 136 *et seq.*), and the Act's implementing regulations (40 CFR Parts 152 through 186), is to provide federal control of pesticide distribution, sale, and use. The Nevada Pesticides Act, Nevada Administrative Code, Chapter 586, and Nevada Revised Statutes, Sections 586.010 through 586.450, also regulate pesticide distribution and use, and require registration with the state. DOE would comply with federal and state laws in the application and storage of pesticides during construction and operation of the proposed railroad.

6.3.5.5 Noise Control Act, as Amended (42 U.S.C. 4901 *et seq.*)

Section 4 of the Noise Control Act of 1972, as amended (42 U.S.C. 4901 *et seq.*), directs federal agencies to carry out programs in their jurisdictions "to the fullest extent within their authority" and in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare. This law provides requirements related to noise that would be generated by construction and operations activities associated with the proposed railroad. The STB, a cooperating agency on this Rail Alignment EIS, has environmental review regulations for noise analysis (49 CFR 1105.7e(6)) with the following criteria:

- An increase in noise exposure as measured by day-night average noise level of 3 ***A-weighted decibels*** or more.
- An increase to a noise level of 65 A-weighted decibels ***day-night average noise level*** or greater.

DOE used these environmental review regulations to analyze potential train noise for this Rail Alignment EIS.

6.3.5.6 Strengthening Federal Environmental, Energy, and Transportation Management (Executive Order 13423)

Executive Order 13423 sets goals for federal agencies in the areas of energy efficiency, acquisition, renewable energy, toxics reductions, recycling, renewable energy, sustainable buildings, electronics stewardship, fleets, and water conservation. In addition, this Order requires more widespread use of Environmental Management Systems as the framework in which to manager and continually improve these sustainable practices. DOE would comply with the provisions of this Order during construction and operation of the proposed railroad.

6.3.6 CULTURAL RESOURCES

To meet federal historic preservation laws and regulations and NEPA (40 CFR 1500 through 1508) mandates, DOE would identify and evaluate all cultural resources in the regions of influence along the Caliente rail alignment and the Mina rail alignment, including prehistoric, historic, and American Indian, and assess the potential for adverse impacts during construction and operation of the proposed railroad. The National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq.*), is the primary source of regulatory requirements for the protection of cultural resources (see Section 6.3.6.1). Sections 6.3.6.2 through 6.3.6.8 describe other sources of regulatory requirements.

6.3.6.1 National Historic Preservation, as Amended (16 U.S.C. 470 *et seq.*)

The National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 *et seq.*), provides for the placement of sites with significant national historic value on the *National Register of Historic Places*. It requires no permits or certifications. In this Rail Alignment EIS, DOE evaluated proposed railroad construction activities that could have a potential effect on historic resources pursuant to a programmatic agreement with the BLM, the STB, and the Nevada State Historic Preservation Office (DIRS 176912-Wenker et al. 2006, all). The programmatic agreement provides that, prior to commencement of any ground-disturbing construction activities, an appropriate level of field investigation including on-the-ground intensive surveys, evaluations of all recorded resources on the *National Register of Historic Places*, assessments of adverse effects, and applicable ***mitigation*** of identified impacts be completed. The BLM manages most of the land over which DOE would construct the proposed railroad; therefore, relevant provisions of the programmatic agreement would apply. Additionally, in cooperation with the BLM and the STB, the programmatic agreement requires DOE to make a good faith effort to consult with tribes and identify affected ethnic groups, to identify properties of traditional religious and cultural importance, inform the consulting parties of the eligibility of properties for listing on the *National Register of Historic Places*, and suggest appropriate treatment to avoid adverse impacts to historic properties. Appendix B of this Rail Alignment EIS describes the consultation process.

6.3.6.2 American Antiquities Act (16 U.S.C. 431 *et seq.*)

The American Antiquities Act of 1906 (16 U.S.C. 431 *et seq.*) protects historic and prehistoric ruins, monuments, and objects of antiquity including vertebrate paleontological resources, on federally owned or controlled lands. If historic or prehistoric ruins or objects were found during construction of the proposed railroad, DOE would follow provisions of this Act to minimize or mitigate adverse effects.

6.3.6.3 Archaeological Resources Protection Act, as Amended (16 U.S.C. 470aa *et seq.*)

The Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa *et seq.*), requires a permit for excavation or removal of archaeological resources from publicly held or American Indian lands. The Act requires that excavations further archaeological knowledge in the public interest, and that the resources removed remain the property of the United States. Requirements of this Act would apply to any proposed excavation activity that resulted in identification of archaeological resources.

6.3.6.4 Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq.*)

The Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001 *et seq.*) directs the Secretary of the Interior to guide the repatriation of federal archaeological collections and collections that are culturally affiliated with American Indian tribes and held by museums that receive federal funding. Actions required by this law include establishing a review committee with monitoring and policy-making responsibilities, developing regulations for repatriation, including procedures for identifying lineal descent or cultural affiliation needed for claims, overseeing museum programs designed to meet the inventory requirements and deadlines of this law, and developing procedures to handle unexpected discoveries of graves or grave artifacts during activities on federal or tribal land. DOE would follow the provisions of this Act if any excavations associated with the proposed railroad construction led to unexpected discoveries of American Indian graves or grave artifacts.

6.3.6.5 American Indian Religious Freedom Act (42 U.S.C. 1996)

The American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996) reaffirms American Indian religious freedom under the First Amendment of the U.S. Constitution, and establishes policy to protect and preserve the inherent and Constitutional right of American Indians to believe, express, and exercise their traditional religions. This law ensures the protection of sacred locations and access of American Indians to those sacred locations and traditional resources that are integral to the practice of their religions. It also establishes requirements that would apply to American Indian sacred locations, traditional resources, or traditional religious practices potentially affected by construction and operation of the proposed railroad.

6.3.6.6 Protection and Enhancement of the Cultural Environment (Executive Order 11593)

Executive Order 11593 directs federal executive agencies to locate, catalog, and nominate properties under their jurisdiction or control to the *National Register of Historic Places*. DOE would follow the provisions of this Order during construction of the proposed railroad.

6.3.6.7 Indian Sacred Sites (Executive Order 13007)

Executive Order 13007 directs federal agencies, to the extent permitted by law and not inconsistent with agency missions, to avoid adverse effects to sacred sites and to provide access to those sites to American Indians for religious practices. The Order directs agencies to plan projects in a manner that allows protection of and access to sacred sites to the extent compatible with the project. DOE would follow the provisions of this Order during construction and operation of the proposed railroad.

6.3.6.8 Consultation and Coordination with Indian Tribal Governments (Executive Order 13175)

Executive Order 13175 directs federal agencies to establish regular and meaningful consultation and collaboration with tribal governments in developing federal policies that have tribal implications, to strengthen U.S. government-to-government relationships with American Indian tribes, and to reduce the imposition of unfunded mandates on tribal governments. DOE has and will continue to follow the provisions of this Order during construction and operation of the proposed railroad through regular consultation with the Consolidated Group of Tribes and Organizations, which consists of officially appointed tribal representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE.

6.3.7 BIOLOGICAL RESOURCES

6.3.7.1 Endangered Species Act, as Amended (16 U.S.C. 1531 *et seq.*)

The Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*), provides for the conservation of ***threatened*** and ***endangered species*** and the ***ecosystems*** upon which those species rely. If construction or operation of the proposed railroad could affect threatened or endangered species, or their designated critical ***habitat***, DOE would be required to assess the potential impact and develop measures to minimize the impact. If there would be potential adverse impacts to a listed species or designated critical habitat, DOE would be required to consult formally with the U.S. Fish and Wildlife Service in compliance with Section 7 of the Act. As part of the Section 7 consultation, DOE would have to prepare a Biological Assessment and provide it to the Fish and Wildlife Service. The Fish and Wildlife Service would then prepare a Biological Opinion making a determination as to whether the Proposed Action would jeopardize the continued existence of the species under consideration. If the Fish and Wildlife Service rendered a non-jeopardy opinion, but a finding that some individuals could be killed or otherwise harmed incidentally by the Proposed Action, the Fish and Wildlife Service could determine that such losses are not prohibited, so long as measures outlined in a permit to incidentally take a listed species were followed. The permit would include limits on the taking of a listed species and its designated critical habitat and mandatory terms and conditions for minimizing the take. Regulations implementing the applicable interagency consultation process of the Endangered Species Act are codified at 50 CFR Part 402.

If the Fish and Wildlife Service determines that the proposed federal action jeopardizes a listed species or adversely modifies its designated critical habitat, the Secretary of the Interior suggests alternatives to the proposed action that would not violate the action. Then federal agencies must decide whether to modify the project as suggested, abandon it, or file an application for an exemption. Regulations that describe the exemption process are found in 50 CFR Parts 450 through 453.

6.3.7.2 Fish and Wildlife Coordination Act, as Amended (16 U.S.C. 661 *et seq.*)

The Fish and Wildlife Coordination Act of 1934, as amended (16 U.S.C. 661 *et seq.*), promotes effectual planning and cooperation between federal, state, public, and private agencies for the conservation and rehabilitation of the Nation's fish and wildlife, and authorizes the U.S. Department of the Interior to provide assistance. The Act requires that when a department or agency of the U.S. Government modifies the waters, or channel of a body of water, the department or agency must consult with the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and the state agency that administers wildlife resources in the affected state. DOE consultation with appropriate federal and State of Nevada agencies regarding construction and operation of the proposed railroad would be in compliance with the requirements of this Act.

6.3.7.3 Migratory Bird Treaty Act, as Amended (16 U.S.C. 703 seq.)

The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 *et seq.*), protects birds that have common migration patterns between the United States, Canada, Mexico, Japan, and Russia. It also regulates the take and harvest of migratory birds. All species of birds found along the proposed rail alignments are protected by the Migratory Bird Treaty Act with the exceptions of European starlings (*Sturnus vulgaris*), rock doves (pigeons; *Columba livia*), and house sparrows (*Passer domesticus*), and any game species having legal harvest seasons set by the Nevada Department of Wildlife. DOE would implement methods during proposed railroad construction and operation, including surveys for nesting birds and restrictions on the timing of construction, to prevent the take of migratory birds.

6.3.7.4 Bald and Golden Eagle Protection Act, as Amended (16 U.S.C. 668 through 668d)

The Bald and Golden Eagle Protection Act of 1940, as amended (16 U.S.C. 668 through 668d), makes it illegal to take, pursue, molest, or disturb bald eagles (American, *Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), their nests, or their eggs anywhere in the United States (Sections 668 and 668c). The U.S. Department of the Interior regulates activities that might adversely affect bald and golden eagles.

6.3.7.5 The Wild Free-Roaming Horses and Burros Act, as Amended (16 U.S.C. 1331 *et seq.*)

The Wild Free-Roaming Horses and Burros Act of 1971, as amended (16 U.S.C. 1331 *et seq.*), requires the protection, management, and control of wild free-roaming horses and burros on ***public lands***. The Act states that "wild free-roaming horses and burros shall be protected from capture, branding, harassment, or death; and to accomplish this they are to be considered in the area where presently found, as an integral part of the natural system of the public lands." DOE would construct and operate the railroad in compliance with the provisions of this Act.

6.3.7.6 National Wildlife Refuge System Administration Act, as Amended (16 U.S.C. 668dd)

The National Wildlife Refuge System Administration Act of 1966, as amended (16 U.S.C. 668dd), provides guidelines for the administration and management of lands, including "wildlife refuges, areas for the protection and conservation of fish and wildlife that are threatened with extinction, wildlife ranges, game ranges, wildlife management areas, or waterfowl production areas." If use of lands for the proposed railroad could affect lands in the National Wildlife Refuge System, DOE would consult with the U.S. Fish and Wildlife Service. Regulations implementing the Act are codified at 50 CFR Parts 25 and 27 through 29.

6.3.7.7 Nevada Revised Statutes: Protection and Preservation of Timbered Lands, Trees, and Flora (Title 47, Chapter 527)

Nevada Revised Statutes, Chapter 527, specifies protection of the indigenous flora of the State of Nevada. If the state determines that a species or subspecies of native flora is threatened with extinction, that species or subspecies is to be placed on the state list of fully protected species. No member of the species or subspecies may be taken or destroyed unless an authorized state official issues a special permit.

6.3.7.8 Nevada Revised Statutes: Hunting, Fishing, and Trapping; Miscellaneous Protective Measures (Title 45, Chapter 503)

Nevada Revised Statutes, Chapter 503, Hunting, Fishing, and Trapping, Miscellaneous Protective Measures, and Nevada Administrative Code, Chapter 503, Sections 010 through 104, specify procedures for the classification and protection of wildlife. No member of a species classified as protected may be hunted, taken, or possessed without first obtaining a permit or written authorization from the Nevada Department of Wildlife. Nevada Revised Statute, Chapter 527, Protection and Preservation of Timbered

Lands, Trees, and Flora, also applies to the permit requirement. No protected species would be hunted, taken, or possessed during construction or operation of the proposed railroad.

6.3.7.9 Nevada Revised Statutes: Control of Insects, Pests, and Noxious Weeds (Title 49, Chapter 555)

Nevada Revised Statutes, Chapter 555, Control of Insects, Pests, and Noxious Weeds, specifies the laws by which the Nevada Department of Agriculture designates and regulates ***noxious weeds*** and pests. Clearing vegetation and disturbing the soil during construction would create habitat for colonization by noxious weeds present along the rail line. DOE would minimize such impacts, in compliance with the provisions in this Nevada Statute, by developing and implementing a weed management program, which could include reclamation of disturbed areas that would enhance the recovery of native vegetation and reduce colonization by exotic species.

6.3.7.10 Invasive Species (Executive Order 13112)

Executive Order 13112 directs federal agencies to act to prevent the introduction of, or to monitor and control, nonnative or invasive plant species, to provide for restoration of ***native plant species***, to conduct research, to promote educational activities, and to exercise care in taking actions that could promote the introduction or spread of ***invasive species***. DOE would minimize such impacts, in compliance with the provisions in this Executive Order, by developing and implementing a weed management program.

6.3.7.11 Responsibilities of Federal Agencies to Protect Migratory Birds (Executive Order 13186)

Executive Order 13186 requires federal agencies to avoid or minimize the negative impacts of their actions on migratory birds and to take active steps to protect birds and their habitats. The Order directs each federal agency whose action has, or is likely to have, a negative impact on migratory bird populations to develop an agreement with the U.S. Fish and Wildlife Service to conserve those birds. The Order directs agencies to avoid or minimize the impact on migratory bird populations, to take reasonable steps that include restoring and enhancing bird habitats, to prevent or abate pollution that would affect birds, and to incorporate migratory bird conservation into agency planning processes when possible. The Order also requires environmental analyses of federal actions to evaluate effects of those actions on migratory birds, to control the spread and establishment in the wild of exotic animals and plants that could harm migratory birds and their habitats, and either to provide advance notice of actions that could result in the taking of migratory birds or to report annually to the U.S. Fish and Wildlife Service on the numbers of each species taken during the conduct of agency actions. Section 4.12 of this Rail Alignment EIS, Biological Resources, discusses potential impacts to migratory birds. DOE would implement methods during proposed railroad construction and operation, including surveys for nesting birds and restrictions on the timing of construction, to prevent the take of migratory birds.

6.3.8 LAND USE

Land uses that could be affected by the proposed railroad are under the jurisdiction of federal, state, county, and municipal plans and policies. Lincoln, Nye, and Esmeralda Counties have land-use plans (*Lincoln County Master Plan* [DIRS 174520-State of Nevada 2001, all]; *Adoption of the Nye County Comprehensive Plan* [DIRS 147994-McRae 1994, all]; *Master Plan Esmeralda County, Nevada* [DIRS 176770-Duval et al. 1976, all]). Approximately 99 percent of the lands along the Caliente and Mina rail alignments are BLM-administered public lands. The BLM administers the uses of lands along the Caliente rail alignment through ***resource management plans*** including the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), the *Draft Ely Resource*

Management Plan (when it is finalized; DIRS 174518-BLM 2005, all), and the *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (DIRS 176043-BLM 1998, all). The BLM administers the uses of lands along the Mina rail alignment through the *Carson City Field Office Consolidated Resource Management Plan* (DIRS 179560-BLM 2001, all), the *Tonopah Resource Management Plan and Record of Decision* (DIRS 173224-BLM 1997, all), and the *Record of Decision for the Approved Las Vegas Resource Management Plan and Final Environmental Impact Statement* (DIRS 176043-BLM 1998, all).

6.3.8.1 Federal Land Policy and Management Act (43 U.S.C. 1701 *et seq.*)

The Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq*.) established procedures for acquiring access to public lands. The regulations regarding withdrawals of public-domain land from public use, as codified in 43 CFR Part 2300, and the establishment of right-of-way reservations, as codified in 43 CFR Part 2800, primarily govern access to, and use of, BLM-administered lands. Section 6.6 describes this Act.

6.3.8.2 Materials Act (30 U.S.C. 601 *et seq.*)

The Materials Act of 1947 (30 U.S.C. 601 *et seq.*) authorizes land management agencies such as the BLM to make common varieties of sand, stone, and gravel from public lands available to federal and state agencies under a ***free-use permit***. Regulations implementing the Materials Act are codified at 43 CFR Part 3600. To use common varieties of sand, stone, and gravel from public lands during construction of the proposed railroad, DOE would obtain free-use permits from the BLM.

6.3.8.3 Taylor Grazing Act, as Amended (43 U.S.C. 315 *et seq.*)

The Taylor Grazing Act of 1943, as amended (43 U.S.C. 315 *et seq.*), establishes processes by which the BLM grants and administers grazing rights. Regulations implementing the Taylor Grazing Act are codified at 43 CFR Parts 2300 and 4100 and include provisions for the agency to consider in administering grazing rights.

6.3.8.4 Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*)

The Farmland Protection Policy Act of 1981 (7 U.S.C. 4201 *et seq.*) seeks to minimize the extent to which federal programs contribute to the unnecessary and irreversible conversion to nonagricultural uses of farmlands with soils that are identified as prime and unique or of statewide and local importance. To comply with this law, DOE has coordinated with the U.S. Department of Agriculture, Natural Resources Conservation Service, to identify ***prime farmlands*** that could be affected by the proposed action and to evaluate impacts to those lands. Regulations implementing the Farmland Protection Policy Act are codified at 7 CFR Part 658.

6.3.8.5 Uniform Relocation Assistance and Real Property Acquisition Policies Act (42 U.S.C. 4651 *et seq.*)

The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (42 U.S.C. 4651 *et seq.*) encourages and expedites the acquisition of real property by agreements with owners; avoids litigation, including condemnation actions where possible, and relieves congestion in the courts; provides for consistent treatment of owners; and promotes public confidence in federal land-acquisition practices. For those portions of the rail line that would cross private land, DOE could negotiate a long-term lease with the landowner or transfer the land to federal ownership in accordance with this Act.

6.3.8.6 General Mining Law, as Amended (30 U.S.C. 22 through 54)

The Mining Law of 1872, as amended (30 U.S.C. 29; 43 CFR 3860) (30 U.S.C. 22 through 54), was one of a number of public land laws passed by Congress in the late 1800s to encourage settlement, development, and private ownership of the public-domain lands in the western United States. The Mining Law of 1872 enables public citizens and the mining industry the right to claim, settle on, develop mineral resources, and acquire title to public lands administered by the BLM and the U.S. Forest Service (an agency of the U.S. Department of Agriculture).

The Mining Law Administration program managed by the BLM involves primarily the last three elements: recordation, maintenance (annual work/surface management), and mineral patents. Surface management on National Forest System lands is administered by the Forest Service.

6.3.9 CONSTRUCTION- AND OPERATIONS-RELATED STATUTES AND REGULATIONS

6.3.9.1 Communications Act, as Amended (47 U.S.C. 308 *et seq.*)

The Communications Act of 1934, as amended by the Telecommunications Act of 1996 (47 U.S.C. 308 *et seq.*), and regulations of the Federal Communications Commission require an agency to obtain Federal Communications Commission permission to construct a private broadcasting system. DOE would need to obtain permission to use an assigned frequency, and the Federal Communications Commission would have to approve the design and location of the system prior to construction. The communication system for the proposed railroad would consist of a fiber optic cable along the length of the line with broadcasting antenna located within the ***operations right-of-way*** at sufficient intervals to allow complete coverage of train-to-dispatch radio communications. DOE would obtain Federal Communications Commission approval to construct and operate this radio system and install a fiber optics line.

6.3.9.2 Construction Camp Permits (Title 40, Chapter 444.130; NAC 444.550 through 444.566)

The Nevada State Health Division specifies conditions and requires permits for construction and labor camps in Nevada (Nevada Revised Statutes, Chapter 444.130 *et seq.*, and Nevada Administration Code, Chapters 444.550 through 444.566). These statutes and regulations are designed to maintain sanitary and healthy conditions at construction and labor camps in Nevada. They would apply to the design and operation of construction camps that DOE would establish during construction of the proposed railroad.

6.3.9.3 Occupancy Permits to Cross State Highways

The Nevada Department of Transportation and the Nevada Public Utilities Commission regulate rail crossings of public highways. The Nevada Department of Transportation requires an occupancy permit to place a facility (including a railway) within a right-of-way of a state highway (Nevada Administrative Code, Section 408.427). The Public Utilities Commission must approve the placement of railroad tracks across public highways prior to construction of the tracks (Nevada Administrative Code, Section 703.455). DOE would have to obtain similar approvals for construction of access roads, water pipelines, and other ***infrastructure*** that would intersect highway rights-of-way.

The STB would regulate the proposed railroad if DOE implemented the Shared-Use Option. In this case, the Federal Railroad Safety Act of 1970, as amended (49 U.S.C. 20106 *et seq.*), could preempt Nevada regulations related to railroad safety. However, DOE would still design and construct highway crossings to address the concerns of Nevada regulatory agencies.

6.4 U.S. Department of Energy Orders

Under the authority of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 through 2259), DOE is responsible for establishing a comprehensive health, safety, and environmental program for its activities and facilities. DOE has established a framework for managing its facilities through the promulgation of regulations and the issuance of DOE Orders that set forth policies, programs, and procedures for implementing activities. DOE Orders are a component of DOE Directives that also include Policies, Notices, Manuals, and Guides, all of which are intended to direct, guide, inform, and instruct employees in the performance of their jobs, and enable them to work effectively within the Department and with agencies, contractors, and the public. Table 6-4 lists DOE Orders that could be relevant to construction and operation of the proposed railroad.

Table 6-4. Potentially applicable DOE Orders (page 1 of 2).

Order number and date of last revision	Subject	Description[a]
151.1C 11/02/05	Comprehensive Emergency Management System	Establishes requirements for emergency planning, preparedness, response, recovery, and readiness assurance activities and describes the approach for effectively integrating these activities under a comprehensive, all-emergency concept.
231.1A 06/03/04	Environment, Safety, and Health Reporting	Establishes the requirements procedures for information with environmental protection, safety, or protection significance for DOE operations.
252.1 11/19/99	Technical Standards	Requires that appropriate voluntary consensus standards (codes and standards) be selected, used, and adhered to for the design, testing, etc., of the proposed railroad.
413.3 07/28/06	Project Management	Demonstrates that DOE will support the development of documentation for the critical-decision process.
414.1C 06/17/05	Quality Assurance	Establishes an effective quality assurance management system using the performance requirements of this Order, coupled with technical standards, where appropriate.
420.1B 12/22/05	Facility Safety	Where no specific requirements are specified concerning natural phenomena hazard mitigation, requires model building codes or national consensus industry standards to be used in the design of the proposed railroad facilities.
430.1B 09/24/03	Life-Cycle Asset Management, Building Codes, and Value Engineering	Establishes procedures to follow in all phases of the management of DOE facilities.
430.2A 04/15/02	Energy Management	Requires design for the proposed railroad to be in compliance with the energy management plan, sustainable design, and water efficiency required by this Order.
440.1A 03/27/98	Worker Protection Management for DOE, Federal and Contractor Employees, and Fire Protection	Establishes a comprehensive worker protection program that ensures that DOE and its contractor employees have an effective worker protection program to reduce or prevent injuries, illnesses, and accidental losses by providing DOE, federal, and contractor workers with a safe and healthful workplace.
450.1 01/03/07	Environmental Protection Program	Establishes DOE policy to conduct its operations in an environmentally safe and sound manner and to conduct its activities in compliance with applicable laws and regulations through implementation of environmental management systems at DOE sites.

Table 6-4. Potentially applicable DOE Orders (page 2 of 2).

Order number and date of last revision	Subject	Description[a]
451.1B[b] 09/28/01	NEPA Compliance Program	Establishes DOE requirements and responsibilities for complying with NEPA.
460.1B 4/4/03	Packaging and Transportation Safety	Establishes requirements and assigns responsibilities for the safe transport of hazardous materials, hazardous substances, hazardous wastes, and radioactive materials.
460.2A 12/22/04	Transportation and Packaging Management	Establishes DOE polices and requirements to supplement applicable laws, rules, regulations, and other DOE Orders for materials, transportation and packaging operations.
470.2B 10/31/02	Independent Oversight and Performance Assurance Program	Prescribes the requirements and responsibilities to enhance safeguards and security; cyber security; emergency management; environment, safety, and health programs; and other critical functions by providing an independent evaluation of the adequacy of DOE policy and the effectiveness of line management performance.
470.4 08/26/05	Safeguards and Security System Design	Requires the design of the proposed railroad facilities to provide site-specific safeguards and security protection or to tailor the physical protection elements in a number of areas, as described in the Order.
5400.5 01/07/93	Protection of Public from Radiation Risks	Establishes standards and requirements for operations of DOE and DOE contractors for protection of members of the public and the environment against undue risk from radiation.
5480.19 10/23/01	Conduct of Operations Requirements for DOE Facilities	Provides requirements and guidelines for departments to use in developing directives, plans, and procedures for conducting operations at DOE facilities that should result in improved quality and uniformity of operations.

a. DOE = U.S. Department of Energy; NEPA = National Environmental Policy Act.
b. DOE Order 451.1B was modified by a DOE Notice (DOE N 451.1, 10/6/06).

6.5 Bureau of Indian Affairs Requirements

The regulations at 25 CFR Part 169 prescribe the procedures, terms, and conditions under which the U.S. Department of the Interior, Bureau of Indian Affairs, may grand rights-of-way over and across tribal land, individually owned land, and Federal Government-owned land; subsection 169.23 outlines that rights-of-way for railroads shall not exceed 50 feet in width on each side of the centerline of the railroad, except where there are heavy ***cuts*** and ***fills***, when they shall not exceed 100 feet in width. The regulations at 25 CFR Part 162 identify the conditions and authorities under which the Bureau of Indian Affairs may lease certain interests in Indian land and Federal Government land.

6.6 Bureau of Land Management Requirements

As a cooperating agency, the BLM may adopt this Rail Alignment EIS for the disclosure and analysis of potential environmental impacts, as required by NEPA.

The Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 *et seq*.) established procedures for acquiring access to public lands. The regulations regarding ***withdrawals*** of public-domain land from public use, as codified at 43 CFR Part 2300, and the establishment of right-of-way reservations, as codified at 43 CFR Part 2800, primarily govern access to, and use of, BLM-administered lands. Construction and operation of a proposed railroad along either the Caliente rail alignment or the Mina rail alignment would require access to BLM-administered lands through application to the BLM for a

right-of-way grant. A right-of-way grant is an instrument issued pursuant to Title V of the Federal Land Policy and Management Act authorizing the use of a right-of-way over, upon, under, or through public lands for construction, operation, maintenance, and termination of a project.

The BLM-authorized officer considers whether the application is in compliance with the purpose for which the public lands are managed and the public interest. The Federal Land Policy and Management Act requires the authorized officer, prior to issuing a right-of-way grant or temporary-use permit, to perform the following tasks:

- Complete an environmental analysis in accordance with NEPA using the Council on Environmental Quality regulatory provisions for implementing NEPA (40 CFR Parts 1500 through 1508) as the review guidelines.
- Determine compliance of the applicant's proposed plan with applicable federal and state laws.
- Consult with all other federal, state, and local agencies having an interest.
- Take any other action necessary to fully evaluate and make a decision to approve or deny the application and prescribe suitable terms and conditions for the grant (reservation) or permit.

The BLM-authorized officer may hold public meetings on an application for a right-of-way grant if it is determined that such meetings are appropriate and that sufficient public interest exists to warrant the time and expense for such meetings.

Requirements of the application for a right-of-way grant are outlined at 43 CFR 2802.3. Requirements include a description of the proposal and a map (aerial photo or equivalent) showing the approximate location of the proposed right-of-way and facilities on public lands and existing improvements adjacent to the proposal. The BLM-authorized officer may require the applicant to submit additional information such as a description of the ***common segments*** and ***alternative segments*** considered; a statement of need and economic feasibility of the proposal; and a statement of the environmental, social, and economic effects of the proposal.

The regulations specify that all right-of-way grants assigned under 43 CFR Part 2800 contain terms, conditions, and stipulations as required by the authorized officer regarding extent, duration, survey, location, construction, operation, maintenance, use, and termination. Stipulations typically include the following requirements:

- Restoration, revegetation, and curtailment of erosion of the surface of the land, or any other rehabilitation measure determined necessary
- Assurance that activities in connection with the grant or permit do not violate applicable air- and water-quality standards or related facility siting standards established by or pursuant to applicable federal or state law
- Controls or prevention of damage to scenic, aesthetic, cultural, and environmental values including damage to fish and wildlife habitat, damage to federal property, and hazards to public health and safety
- Compliance with state standards for public health and safety, environmental protection and siting, construction, operation, and maintenance, when those standards are more stringent than federal standards

The Federal Land Policy and Management Act, by which the government accomplishes most federal land withdrawals, contains a detailed procedure for application, review, and study by the BLM of the withdrawal of public domain land. The BLM submits the application to the Secretary of the Interior for approval of the terms and conditions of withdrawal. Withdrawals accomplished through the Act remain valid for no longer than 20 years unless extended after further review and approval by the Secretary of the Interior.

On December 19, 2003, DOE submitted *Application for Administrative Land Withdrawal for Potential Rail Corridor* (DIRS 177745-Arthur 2003, all) to the BLM, pursuant to Section 204 of the Federal Land Policy and Management Act. The purpose of the application was to withdraw 124.9 square kilometers (308,600 acres) of public land encompassing the Caliente rail corridor from ***surface entry*** and new ***mining claims*** for 20 years to evaluate the land for potential construction and operation of the proposed railroad. On December 29, 2003, the BLM issued a notice in the *Federal Register* of the proposed land withdrawal (*Notice of Proposed Withdrawal and Opportunity for Public Meeting*; *Nevada*, 68 *FR* 74965).

The notice segregated the land from surface entry and mining for a period of up to 2 years to allow a ***case file*** containing various studies and analyses to be prepared to support a final decision on the withdrawal application. The action would not transfer the land to DOE control. The BLM would continue to manage the withdrawal area in compliance with BLM resource management plans. In a May 21, 2004, Notice of Public Meetings, the BLM invited the public to submit written comments and gave notice of two public scoping meetings on the proposed land withdrawal and possible land-use plan amendments (*Notice of Public Meetings; Notice of Intent to Amend the Caliente Management Framework Plan, Schell Management Framework Plan, Tonopah Resource Management Plan, and the Las Vegas Resource Management Plan; Nevada*; 69 *FR* 29323). Separately from this Rail Alignment EIS, DOE prepared and released an environmental assessment in December 2005, *Environmental Assessment for the Proposed Withdrawal of Public Lands Within and Surrounding the Caliente Rail Corridor, Nevada* (DIRS 176452-DOE 2005, all), proposing the continued segregated effect of the land by withdrawing the land for a preferred period of 10 years. On December 28, 2005, the BLM withdrew the requested lands, subject to valid existing rights, from settlement, sale, location, or entry under general land laws, including the United States mining laws (30 U.S.C. Chapter 2), but not from leasing under the mineral leasing laws (for example, the Mineral Leasing Act of 1920, as amended [30 U.S.C. 181 *et seq.*]), for a period of 10 years (70 *FR* 76854).

DOE initiated a further application for land withdrawal and requested that the Secretary of the Interior withdraw a total of 84.19 square kilometers (208,037 acres) of public lands from surface entry and mining through December 27, 2015. Thereby the BLM issued a notice on January 10, 2007 in the *Federal Register* of this application by DOE (*Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada*; 72 *FR* 1235). This notice included an additional 27.78 square kilometers (68,646 acres) of public lands for evaluation along the Caliente rail corridor, and 56.41 square kilometers (139,391 acres) of public lands for the purpose of evaluating the potential construction, operation, and maintenance of a rail line along a suite of alternative segments and common segments referred to by the DOE as the "Mina Route." The expiration date for this proposed withdrawal is the same (December 27, 2015) as in the earlier December 28, 2005 BLM land withdrawal.

Implementation of the Proposed Action along the Caliente rail alignment or the Mina rail alignment would require a BLM right-of-way grant for use and access to BLM-administered lands that would be disturbed for rail line construction and operation. The BLM may issue a right-of-way grant for temporary or long-term use of land, and before issuing a right-of-way grant, must complete an environmental analysis in accordance with the National Environmental Policy Act of 1969. As a cooperating agency in the preparation of this Rail Alignment EIS, the BLM may adopt this document as authorized by 40 CFR 1501 to satisfy the NEPA requirements for the right-of-way application.

6.7 U.S. Army Requirements

The U.S. Army is a consulting agency to DOE in the preparation of this Rail Alignment EIS. Under the Mina Implementing Alternative (the nonpreferred alternative), DOE would need to construct and operate the ***Staging Yard*** on the Hawthorne Army Depot in Mineral County. DOE would do so in conformance with existing permits issued to the Hawthorne Army Depot by the State of Nevada, Division of Environmental Protection. Table 6-5 lists the permits for the main site at the Hawthorne Army Depot.

Table 6-5. Permits for the Hawthorne Army Depot main site at Hawthorne, Nevada, issued by the State of Nevada, Division of Environmental Protection.[a]

Permit	Type	Permit number
Class I, Title V, Main Base	Air	AP9711-0863.01
Class I Construction, hazardous waste generator	Air	AP9711-1145
Class I Construction, Bulk Energetics Demilitarization System	Air	AP9711-1489
Wastewater, Plasma Ordnance Demilitarization System	Groundwater	NEV2003516
Wastewater, Western Area Demilitarization Facility	National Pollutant Discharge Elimination System	NV0021946
Stormwater	Clean Water Act	NVR050000
Treatment storage and disposal system, storage open burn, incineration	Resource Conservation and Recovery Act, C	HW0017
Solid-waste and fill	Resource Conservation and Recovery Act, D	Waiver No. SWMI-09-68
Solid-waste landfill	Resource Conservation and Recovery Act, D	SW-1209702
Drinking water	Solid Waste Disposal Act	MI-0357-12C
Water Treatment Facility	Groundwater	NEV2004524

a. Source: DIRS 181385-Millsap 2007, all.

CHAPTER 7. BEST MANAGEMENT PRACTICES AND MITIGATION

This chapter describes the best management practices DOE would implement to help avoid impacts to environmental resources and the measures the Department would consider to mitigate adverse impacts from constructing and operating the proposed railroad under the Caliente Implementing Alternative or the Mina Implementing Alternative, as appropriate. Mitigation measures include only those actions that would be above and beyond compliance with statutory and regulatory requirements and implementation of best management practices DOE has incorporated into the Proposed Action.

Glossary terms are shown in ***bold italics***.

During planning and design of the proposed railroad, the U.S. Department of Energy (DOE or the Department) used various engineering and site evaluation and planning measures to avoid, minimize, or otherwise reduce environmental ***impacts***. These measures included the elimination of certain ***alternative segments*** as unreasonable and moving the location of specific segments. The Department took many of these actions in response to comments received during the scoping periods for this Rail Alignment EIS. As the environmental analyses have progressed, DOE has refined the Caliente ***rail alignment*** and the Mina rail alignment to avoid certain sensitive environmental features and reduce potential impacts to sensitive areas by limiting the project's ***footprint*** in such areas. Chapter 2 and Appendix C describe this process.

As described in Chapter 2 and shown in Figure 7-1, engineering and site evaluation and planning represent the initial step toward avoiding, minimizing, or otherwise reducing the environmental impacts of the Proposed Action.

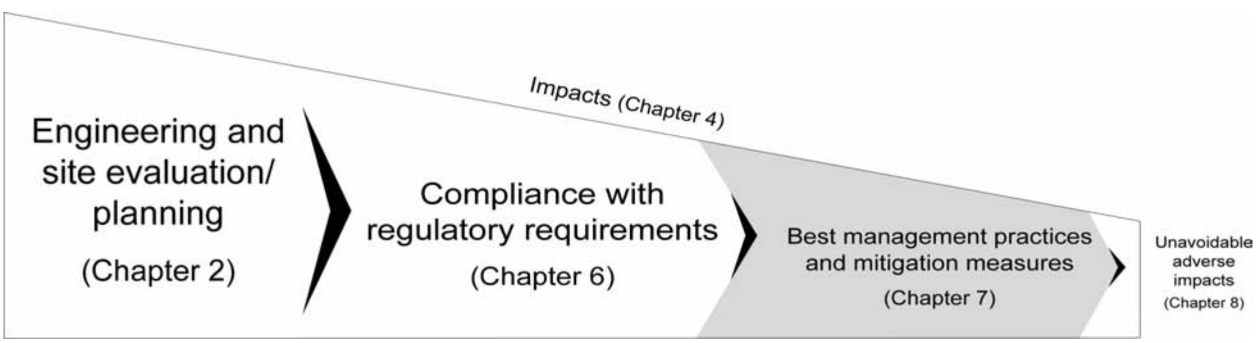


Figure 7-1. Multi-step approach to avoid, minimize, or reduce environmental impacts.

In addition to engineering and site evaluation and planning practices, DOE must also comply with all applicable environmental requirements (see Chapter 6). DOE incorporated a variety of best management practices into the ***Proposed Action*** that relate to these requirements and would further reduce the environmental impacts of constructing and operating the proposed ***railroad***.

After consideration of engineering and site evaluation and planning measures, compliance with environmental requirements, and application of best management practices, DOE would also consider various ***mitigation*** measures to further avoid, minimize, rectify, reduce, or compensate for any remaining adverse environmental impacts. DOE regards mitigation measures as activities or actions that would be above and beyond compliance with statutory and regulatory requirements and the application of the best management practices DOE has incorporated into the Proposed Action.

7.1 Representative Best Management Practices

> **Best Management Practices**
>
> Practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that DOE would implement as part of the Proposed Action to facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the adverse impacts of an action on human health and the environment.

As part of the Proposed Action, DOE would implement appropriate best management practices to prevent or minimize environmental impacts. Table 7-1 lists, but does not limit, such practices. Some of the representative best management practices listed in Table 7-1 could change depending on the requirements included in permits and ***right-of-way grants*** applicable to construction and operation of the proposed railroad. The table identifies the affected resource area(s) for each best management practice, the requirement(s) the practice would support (see Chapter 6), and the purpose of the practice.

7.2 Mitigation

As the agency responsible for administering the federal lands over which the proposed railroad would cross, the Bureau of Land Management (BLM), an agency of the U.S. Department of the Interior, would have a substantial role in development of any necessary mitigation measures and monitoring requirements on the affected lands.

7.2.1 MITIGATION ACTION PLAN

> **Mitigation** (40 CFR 1508.20) includes:
>
> Avoiding the impact altogether by not taking a certain action or parts of an action.
>
> Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
>
> Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
>
> Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
>
> Compensating for the impact by replacing or providing substitute resources or environments.

DOE regulations at 10 Code of Federal Regulations (CFR) 1021.331 requires the preparation of a mitigation action plan when DOE identifies mitigation commitments in the ***Record of Decision*** for this Rail Alignment EIS. If a mitigation action plan is necessary, it would follow the Record of Decision and would provide details about mitigation commitments and provisions provided in the Record of Decision, if any. DOE must prepare the mitigation action plan before it could take any action authorized by the Record of Decision that would be subject to a mitigation measure or commitment. The Plan would contain:

- An introduction describing the basis, function, and organization of the Plan
- A summary of the impacts to be mitigated
- A description of specific mitigation measures

- A description of the Mitigation Action Plan monitoring and reporting system that DOE would implement to ensure that elements of the Plan were met and were effective
- A schedule for actions and identification of the responsible parties

7.2.2 MONITORING

If DOE implemented the Proposed Action along the Caliente rail alignment or the Mina rail alignment, the Department would implement any mitigation measures and commitments specified in the Record of Decision. As needed, DOE would adapt mitigation measures to accomplish their intended objectives. As required by 40 CFR 1505.2(c), DOE would adopt and summarize a monitoring and enforcement program where applicable for any mitigation.

7.2.3 MITIGATION MEASURES

Table 7-2 summarizes potential mitigation measures for potential impacts along the proposed railroad. Each mitigation measure is linked to an identified potential impact, and is either location specific or global (applicable to the entire appropriate ***region of influence***), depending on the level of knowledge and degree of certainty regarding the extent, duration, and location of the potential impact. Mitigation measures would continue to evolve with project development and could change or become more specific and refined in a mitigation action plan following a Record of Decision for this Rail Alignment EIS (see Section 7.2.1). Consistent with the definition of mitigation described above, the mitigation measures identified in Table 7-2 include only those actions that would be above and beyond compliance with statutory and regulatory requirements and implementation of best management practices DOE has incorporated into the Proposed Action.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 1 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Prior to ground-disturbing activities, collect data to plan for the restoration of disturbed areas and minimize impacts to sensitive ***habitats***. This could include collecting satellite data to identify previously disturbed land, surveying vegetation, and looking for special status species habitat.	Physical Setting Aesthetic Resources Biological Resources	50 CFR Part 402 – Interagency Cooperation Endangered Species Act Of 1973, as Amended	Minimize impacts to sensitive habitats and species. Promote effective restoration efforts.
General employee training for construction personnel would include a desert tortoise education program. Surveys would be conducted prior to clearing vegetation at previously undisturbed sites within the range of the desert tortoise. For areas within the desert tortoise range, a desert tortoise biologist or environmental monitor would be available during construction activities to help ensure that desert tortoises are not inadvertently harmed. Project activities that may endanger desert tortoises would cease if a tortoise is found on a project site and activities would resume only after a biologist or environmental monitor ensures that the tortoise is not in danger or after the tortoise has been moved to a safe area. The worker education program would also include training to prevent the intentional or unintentional take of sensitive or protected plant and animal species, State of Nevada game species, or wild horses and burros.	Biological Resources	Endangered Species Act Of 1973, as Amended	Minimize impacts to desert tortoises.
Minimize groundbreaking or land clearing activities during the critical nesting period for migratory birds, which the BLM defines as May 1 through July 15. If groundbreaking or land-clearing activities must be conducted during the bird nesting season, DOE would conduct surveys for migratory bird nests prior to any of those activities. All activities that would harm nesting birds or result in nest abandonment would be prohibited.	Biological Resources	Migratory Bird Treaty Act	Avoid harm to migratory birds, their nests, and their young.
Coordinate with local Floodplain Administrators to ensure that new project-related stream and ***floodplain*** crossings are appropriately designed to minimize impacts. DOE would incorporate hydraulic modeling into the engineering design process to ensure that all crossings would be designed to limit adverse impacts.	Surface-Water Resources	10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements	Minimize risks to streams and floodplains.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 2 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Position temporary pipelines to prevent obstructing or redirecting surface runoff and to prevent obstructing natural drainage channels.	Surface-Water Resources	Clean Water Act of 1977 33 CFR Part 323 NAC 445A – Water Controls	Prevent flooding or surface-water ponding.
Require construction contractors to prepare and submit a stormwater pollution prevention plan. This plan would be prepared consistent with state and federal standards for construction activities and would detail practices that would be employed to minimize soil loss and degradation to nearby water resources. Such practices could include those listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all), and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all).	Surface-Water Resources	40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*)	Control site runoff and minimize erosion.
Continue to solicit input from American Indians to identify the potential for impacts to American Indian cultural resources, discuss potential solutions, and avoid adverse impacts. Comply with all regulatory requirements that protect American Indian interests.	Cultural Resources American Indian Interests	Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*	Minimize impacts to American Indian cultural resources.
Conduct final field surveys (an intensive BLM ***Class III inventory***) of the ***construction right-of-way***, as described in the Programmatic Agreement (see Appendix C) between DOE, the BLM, the Surface Transportation Board, and the Nevada State Historic Preservation Office.	Cultural Resources	National Historic Preservation Act, 36 CFR Part 800 – Protection of Historic Properties	Minimize impacts to cultural resources.
Consult with American Indian tribes and protect their access to ***public lands*** that contain American Indian cultural resources.	Cultural Resources American Indian Interests	American Indian Religious Freedom Act of 1978 Executive Order 13007, *Indian Sacred Sites*	Minimize impacts and allow access to sacred American Indian sites.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 3 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Notify all potentially affected utility owners prior to project-related construction activities and coordinate with the owners to minimize impacts to utilities. Consult with utility owners to design the ***rail line*** so that utilities are protected during project-related construction activities. Contact Nevada Underground Service Alert so they can locate and mark underground facilities to prevent possible damage to underground utility lines, injury, property damage, and service outages.	Land Use and Ownership Utilities, Energy, and Materials Occupational and Public Health and Safety	NAC 455 – Excavations and Demolitions	Prevent damage to utilities, avoid and/or minimize disturbances to utility service, and avoid injuries to workers.
Prior to initiation of construction activities in the area, provide appropriate information regarding construction plans and schedules for the proposed rail line to fire departments and other local emergency planning agencies within the project area. Communicate updates and changes in the construction plans to appropriate parties as needed.	Occupational and Public Health and Safety	40 CFR Part 355 – Emergency Planning and Notification	Facilitate local emergency response planning and community awareness.
Prior to initiating any project-related construction activities, develop a spill prevention plan for petroleum products and other hazardous materials during construction activities. Ensure that equipment is available to respond to spills and identify the location of such equipment. In the event of a reportable spill, comply with the spill prevention plan and applicable federal, state, and local regulations pertaining to spill containment and appropriate cleanup. Make the required notifications to the appropriate federal and state environmental agencies in the event of a reportable hazardous materials release.	Hazardous Materials and Waste Occupational and Public Health and Safety Biological Resources Surface-Water Resources Groundwater Resources	40 CFR Part 112 – Oil Pollution Prevention 40 CFR Part 263 – Standards Applicable to Transporters of Hazardous Waste 40 CFR Part 302 – Designation, Reportable Quantities and Notification	Prevent release of oil and chemicals during construction. Establish effective spill response procedures. Minimize adverse environmental effects of a spill. Ensure appropriate cleanup of spilled material.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 4 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Develop internal emergency response plans for use during proposed rail line construction and operations to ensure that appropriate agencies and individuals are notified in case of an emergency. Provide the emergency response plans to appropriate state and local entities prior to any rail construction activities. Ensure such plans fully delineate the roles and responsibilities of all parties.	Hazardous Materials and Waste Occupational and Public Health and Safety	The Nuclear Waste Policy Act of 1982	Facilitate emergency response planning and enhance emergency response capabilities.
Provide fire departments and local emergency response agencies with a toll-free number for the DOE contact, who will be available to answer questions or attend meetings for the purpose of informing emergency-service providers about the project construction and operations. Revise this information, including changes in construction schedule, as appropriate. Before the start of operations, contact any local emergency response agencies to provide them with information concerning the proposed operations to allow them to incorporate the information into local response plans.	Hazardous Materials and Waste Occupational and Public Health and Safety	40 CFR Part 355 – Emergency Planning and Notification 49 CFR Part 172 – Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements NAC 705 – Railroads	Facilitate communication to ensure state and local emergency response efforts are up to date. Ensure local response plans are up to date before the start of operations.
Develop and implement an Ordnance and Explosives Safety Construction Support Program applicable to construction activities. Include ordnance and explosives training for all construction personnel working in the areas designated by the U.S. Department of Defense (DoD) as being at risk of containing unexploded ordnance. DOE may employ a full-time unexploded-ordnance technician to oversee construction activities in areas near the Nevada Test and Training Range.	Hazardous Materials and Waste Occupational and Public Health and Safety	DoD Directive 4715.11 – Environmental and Explosives Safety Management on DoD Active and Inactive Ranges Within the U.S. 29 CFR 1910.120 and 1926.65 – Hazardous Waste Operations and Emergency Response Standard	Identify, evaluate, and control safety and health hazards related to unexploded ordnance on DoD property.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 5 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Pre-construction best management practices			
Adopt a rigorous safety program that would enable workers to avoid the most common accidents.	Occupational and Public Health and Safety	DOE Order O 440.1A, Worker Protection Management for DOE Federal and Contractor Employees 29 CFR Part 1926, *S*afety and Health Regulations for Construction 29 CFR Part 1960, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters	Ensure health and safety of construction workers during construction.
As appropriate, remove and stockpile topsoil that will be needed later for application during reclamation of disturbed areas. Stabilize topsoil stockpiles to prevent erosion. If the topsoil would remain in a stockpile for more than one year, seed with ***native plant species***. Periodically monitor and maintain the topsoil reserve to keep it stable and minimize erosion until it is used during reclamation efforts.	Physical Setting Biological Resources Surface-Water Resources	43 CFR Part 2800 – Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act 40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System	Re-establish the stability and productivity of land subjected to surface disturbances through proper soils management. Preserve native seed stock contained in topsoil. Minimize erosion and control stormwater runoff to maintain water quality.
Construction best management practices			
Phase construction to the extent practicable. Limit grading activities to the phase immediately under construction and limit ground disturbance to areas necessary for project-related construction activities. Identify limits of disturbance on maps and in the field, and convey to construction personnel. Implement erosion and sediment control measures prior to and during construction.	Physical Setting Surface-Water Resources Groundwater Resources Biological Resources	40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System 10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*)	Minimize and control stormwater runoff to maintain water quality. Minimize ground disturbance and disturbance to vegetation, wetlands, streams, floodplains, and other sensitive environments.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 6 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Establish staging and laydown areas for project-related construction material and equipment away from streams and wetlands and in areas that are not environmentally sensitive. Avoid clearing vegetation between the staging area and the waterway or wetlands. When project-related construction activities, such as ***culvert*** and bridge work, require work in streambeds, conduct these activities, to the extent practicable, during minimum-flow conditions. Maintain current drainage patterns to the greatest extent practicable. Prohibit project-related construction vehicles from driving in or crossing streams and/or ***washes*** at locations other than established crossing points. Place heavy equipment on mats when working in wetlands or use other methods to minimize soil disturbance in wetlands.	Physical Setting Surface-Water Resources Biological Resources	10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) NAC 445A – Water Controls Fish and Wildlife Coordination Act	Protect surface-water quality and floodplains. Minimize project-related increases in turbidity and impacts to ***waters of the United States***.
During construction, use temporary barricades, fencing, and/or flagging to demarcate sensitive habitats; contain project-related impacts to the area within the construction right-of-way. When practicable, locate staging areas in previously disturbed sites or in construction right-of-way, and avoid sensitive habitat areas. Fence off areas of habitat for sensitive species or other special resources, such as wetlands, prior to ground-disturbing activities. Inform project workers of all resource protection goals.	Physical Setting Surface-Water Resources Biological Resources	Frequently a Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) permit condition or a result of Section 7 consultation under the Endangered Species Act Of 1973, as Amended	Minimize impacts to sensitive habitats and species.
Use a minimum-width rail line footprint when practicable. DOE would limit disturbance within the construction right-of-way in the areas where it could not completely avoid wetlands.	Surface-Water Resources Biological Resources	10 CFR Part 1022 – Compliance with Floodplain/Wetlands Environmental Review Requirements Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*)	Minimize impacts to wetlands.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 7 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Require periodic inspections of equipment for any fuel, lube oil, hydraulic, or antifreeze leaks. If leaks are found, repair the leak or replace the equipment.	Hazardous Materials and Waste Occupational and Public Health and Safety Surface-Water Resources Groundwater Resources Biological Resources	Pollution Prevention Act of 1990 (42 U.S.C. 133)	Avoid accidental discharge of pollutants.
Use storage tanks, ponds (temporary holding reservoirs), or inflatable bladders along the rail alignment to help manage water ***demand***, such as to control ***groundwater*** withdrawal rates and pumping timetables.	Surface-Water Resources Groundwater Resources	NRS 533.324 through 533.435 – Water Appropriation Permit	Maximize water-use efficiency during construction activities.
Use treated wastewater effluent (***gray water***) produced at the camps for dust suppression and soil compaction to reduce the demands placed on groundwater wells.	Groundwater Resources	NAC 534 – Underground Water and Wells NRS 533.324 through 533.435 – Water Appropriation Permit	Reduce ***aquifer*** drawdown.
If determined through impacts analysis to be possibly or likely required to preclude impacts on an existing well or spring, limit pumping rates or eliminate pumping at a proposed new groundwater withdrawal well, obtain (purchase) additional water from existing water-rights holder(s), relocate a proposed new well to an alternative location, or implement one or more other best management practices as necessary. Alternatively, DOE would negotiate with the existing water-rights holder or domestic water-well owner to access and monitor water levels in the existing well or monitor discharge rates to the spring, where appropriate, to verify the effects, if any, of the proposed groundwater withdrawal on those wells or springs.	Groundwater Resources	NAC 534 – Underground Water and Wells NRS 533.324 through 533.435 – Water Appropriation Permit	To preclude a reduction in flow rate to an existing well or a reduction in discharge rate to a spring.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 8 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Provide alternate sources of water or relocate wells if DOE action prevents access to groundwater. Any action to change the location of an existing water diversion would require the approval of the well owner and/or the holder of the water rights associated with that diversion point and would require a permit from the State of Nevada under Nevada Revised Statutes (NRS) 533.325.	Groundwater Resources	NRS 533.325 – Application to State Engineer for Permit	To ensure continued access to wells and groundwater.
Keep disturbance around known areas of underground utilities to a minimum. Ensure that work crossing any buried utility line would not be started until all material and equipment was available for immediate use. Complete work as quickly as possible; keep exposure of existing utilities to a minimum. Install underground utility crossings within protective casings buried in trenches beneath the rail and surround the utility line with appropriate backfill material.	Utilities, Energy, and Materials Occupational and Public Health and Safety Land Use and Ownership	NAC 455 – Excavations and Demolitions NAC 704A – Facilities Placed Underground	Prevent inadvertent disruption to utilities, destruction of property, and injury to DOE contractors. Ensure future functionality and safety of underground utilities.
Implement ***fugitive dust*** suppression per applicable permits, such as spraying water, the use of crusting agents, or other approved measures to minimize fugitive dust emissions created during project-related construction activities, including activities on haul roads and at quarries.	Aesthetic Resources Air Quality Occupational and Public Health and Safety	40 CFR Part 50 – National Primary and Secondary ***Ambient Air Quality Standards*** 29 CFR 1910-1000 – Occupational Health and Safety Standards	Meet ***ambient air*** quality standards during construction.
Maintain construction equipment to ensure that exhaust and muffler systems and other required pollution-control and noise-control devices are in good working condition. Administer a continuing, effective hearing conservation program in accordance with the Occupational Safety and Health Administration standards.	Air Quality Noise and Vibration Occupational and Public Health and Safety	40 CFR Parts 61 and 63 – National Emission Standards for Hazardous Air Pollutants and Noise Control Act of 1972 Federal Railroad Administration Regulation 49 CFR 229.121 Mine Safety and Health Administration Regulation 30 CFR 62	Minimize exhaust, emissions, and noise during construction and operations.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 9 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Implement construction activities with the goal of minimizing, to the extent practicable, construction-related noise disturbances near any residential areas; coordinate and communicate these goals to construction contractors.	Noise and Vibration Occupational and Public Health and Safety	Noise Control Act of 1972 49 CFR Part 210, Rail Noise Emission Compliance Regulations	Minimize rail line construction noise.
Conduct routine monitoring for occupational dust exposure during quarry construction and operations and during rail alignment construction activities that would potentially expose workers, such as ***ballast*** placement. Apply engineering controls such as the application of water for dust suppression and washing the ballast before placement. An industrial hygienist would take mineral dust measurements to identify potential exposure. Implement the use of personal protective equipment, such as respirators, and other measures to reduce occupational exposure to silica in the event aforementioned activities are not effective in reducing such exposure.	Occupational and Public Health and Safety	29 CFR 1910 – Occupational Safety and Health Standards	To prevent exposure to crystalline silica, ***erionite***, or cristobalite.
Reduce packaging wastes by purchasing supplies in bulk; purchase recycled or recyclable goods; and reuse waste paper and Styrofoam™ as packaging materials and fillers (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Eliminate excessive resource use and trash generation.
Dispose of drill cuttings through land application.	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Prevent overburdening local landfill facilities with waste.
Promote the use of environmentally preferable products such as recovered materials (recycled-content products) and ***bio-based products*** (energy, industrial, and consumer products made from renewable biological resources such as wood, agricultural residues, and fiber crops). Purchase materials and equipment designated as long life, energy efficient, and sustainable if they are reasonably cost-effective and available (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Eliminate excessive resource use and trash generation.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 11 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Practice preventive maintenance, use recycled oil, and use oil additives that improve engine and oil performance.	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Increase the number of lubricating-oil changes to reduce leaks and drips and poor engine performance.
Where practicable, use biodegradable water-based solvents, substitute nonhazardous surfactants for hazardous surfactants for equipment cleaning, and reuse spent solvents. Paint only when necessary and use less-toxic, less-volatile paints.	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of ***hazardous wastes***.
Inspect and replace worn or damaged components. Use sealed components (DIRS 155558-Hoganson 2001, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of hazardous wastes.
Establish and implement a centralized procurement and distribution program to purchase, track, distribute, and manage hazardous and toxic materials. Implement a Hazardous Material Management Program to review hazardous and toxic material requisitions and purchases; and to recommend feasible nonhazardous, biodegradable, or less-toxic substitutes, such as nonhazardous solvents, paints, and cleaning materials (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of wastes.
Implement an Environmental Management System and a Pollution Prevention/Waste Minimization Program, which would include an evaluation of alternatives to eliminate, reduce, or minimize the amounts of hazardous materials used and hazardous wastes generated. As part of the Environmental Management System, regularly perform Pollution Prevention Opportunity Assessments (DIRS 182385-Burns 2007, all).	Hazardous Materials and Waste	Executive Order 13101 – *Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions*	Reduce the production of wastes.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 12 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Construction best management practices			
Salvage extra materials not used as ballast for the rail alignment and use for other construction activities or for regrading during quarry reclamation activities (DIRS 176172-Nevada Rail Partners 2006, Section 3.1).	Hazardous Materials and Waste	Executive Order 13101 – Greening the Government through Waste Prevention, Recycling, and Federal Acquisitions	Reduce the generation of wastes and ***contamination*** of environmental media.
Store and dispose of biosolids (sludge), allowing them to dry according to applicable requirements. DOE would dispose of biosolids at a licensed facility in accordance with all applicable requirements (DIRS 176172-Nevada Rail Partners 2006, p. 4-6).	Hazardous Materials and Waste	40 CFR Part 503 – Standard for the Use or Disposal of Sewage Sludge	Ensure proper treatment and disposal of wastes.
Post-construction, operations, and maintenance best management practices			
Control ***noxious weeds***/***invasive species*** using approved herbicides and other pest-management techniques. Select herbicide products that would minimize impacts to water; apply the smallest effective amount of herbicide to reduce the risk of contamination from runoff and leaching. Adhere to herbicide labeling requirements. Plan to treat between weather fronts (calms) and at the appropriate time of day to avoid high winds and to avoid potential stormwater runoff. Establish buffer widths based on herbicide- and site-specific criteria to minimize impacts to water bodies.	Surface-Water Resources Groundwater Resources Biological Resources Occupational and Public Health and Safety	NAC 555 – Control of Insects, Pests, and Noxious Weeds Executive Order 13112, Invasive Species Federal Insecticide, Fungicide, and Rodenticide Act of 1948 (40 CFR Parts 152 through 186)	Prevent introduction of, or minimize impacts from, insects, pests, and noxious weeds. Minimize the risk of adverse effects to non-target species. Minimize the potential for adverse effects on water quality. Protect occupational and public health and safety.
Once construction is complete, revegetate disturbed areas within the right-of-way not required for operation of the rail line with native species or cover with angular rock fragments to prevent erosion. Use weed-free straw and mulch for revegetation and restoration activities. To the extent practicable, return all stream/wash crossing points to their preconstruction contours and reseed or replant the crossing banks with native species immediately following project-related construction. If weather or season precludes the prompt reestablishment of vegetation, employ measures such as mulching or erosion control blankets to prevent erosion until reseeding can be completed.	Physical Setting Aesthetic Resources Biological Resources Surface-Water Resources	43 CFR Part 2800 – Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act The Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661 *et seq.*) NAC 555 – Control of Insects, Pests, and Noxious Weeds Executive Order 13112, *Invasive Species*	Reduce the visual scope of disturbed areas. Prevent loss of and damage to wildlife resources. Prevent introduction of invasive or exotic species.

Table 7-1. Representative best management practices and their relationships to applicable requirements[a,b] (page 13 of 13).

Best management practice	Related environmental resource area(s)	Associated requirement(s)[c]	Purpose
Post-construction, operations, and maintenance best management practices			
Once construction is complete, eliminate new quarry access roads by removing pavement and regrading road to original contours. Restore quarry walls to a 3-to-1 grade for public safety. Revegetate around quarry.	Physical Setting Biological Resources Surface-Water Resources	NAC 445 – Water Controls NAC 519A – Reclamation of Land Subject to Mining	Restoration of quarry sites. Minimize erosion. Protect public health.
Monitor reclaimed sites to determine whether reclamation success standards are being met.	Physical Setting Biological Resources	43 CFR Part 2800 – Rights-of-Way, Principles and Procedures; Rights-of-Way Under the Federal Land Policy and Management Act and the Mineral Leasing Act	Ensure success of site restoration.
When practical, use proven technologies to reduce idling time of trains.	Air Quality Utilities, Energy, and Materials	40 CFR Parts 61 and 63 – National Emission Standards for Hazardous Air Pollutants	Minimize exhaust emissions during construction and operations and minimize energy required for operations.
Provide training to emergency response units in the vicinity of the proposed rail line on how to respond to incidents potentially involving ***radioactive*** materials.	Hazardous Materials and Waste Occupational and Public Health and Safety	The Nuclear Waste Policy Act Of 1982	Facilitate emergency response planning and enhance emergency response capabilities.

a. Best management practices are the practices, techniques, methods, processes, and activities commonly accepted and used throughout the construction and railroad industries that DOE would implement as part of the Proposed Action to facilitate compliance with applicable requirements and that provide an effective and practicable means of preventing or minimizing the adverse impacts of an action on human health and the environment.

b. Requirements include laws, statutes, codes, regulations, and orders. DOE commits to appropriate best management practices that support implementation of such requirements and specific compliance requirements in project-related activities and approvals.

c. CFR = Code of Federal Regulations; DoD = U.S. Department of Defense; EPA = U.S. Environmental Protection Agency; NAC = Nevada Administrative Code; NRS = Nevada Revised Statutes; U.S.C. = United States Code.

Table 7-2. Potential measures to mitigate potential environmental impacts of constructing and operating the proposed railroad (page 1 of 3).

Environmental resource/project phase	Nature of potential impact	Mitigation measure	Agency jurisdiction	Location
Physical Setting (see Sections 4.2.1 and 4.3.1)				
Construction and operations	Human health risks attributed to ***seismic*** activities	During the construction and operations phases, adopt Railway Engineering and Maintenance-of-Way Association guidelines and implement monitoring procedures to reduce the potential for structural damage and human exposure to seismic hazards. DOE would make use of seismic monitoring with regional networks; early warning systems to identify track disruption; and track inspections immediately before transit of the trains.	DOE[a]	Site-specific as determined through seismic and geotechnical investigations.
Land Use and Ownership (see Sections 4.2.2 and 4.3.2)				
Construction	Land-use conflict	Notify nearby mining lessees/claimants and consult with owners of active local mines and ***mining claims*** to ensure that impacts to mine-related operations are minimized during construction activities.	DOE and BLM[a]	Site-specific dependent upon the locations of mining claims and active mines.
Construction and operations	Segmenting wildlife habitat	Limit fencing on public lands to those areas where safety is a concern, or where it is required for the safety of livestock.	DOE and BLM	Site-specific as determined through coordination with permittees and the BLM.
Construction	Construction schedule	To the extent practicable, minimize the number of road closures due to construction, and limit detours to one mile or less. DOE would inform the public of road closures through various media outlets.	DOE and BLM	Site-specific dependent upon the locations of road closures.
Air Quality and Climate (see Sections 4.2.4 and 4.3.4)				
Operations	Air quality impacts associated with quarries	Acquire additional land and move the public access (fence line) farther away from the quarries.	DOE	Site-specific quarry locations.

Table 7-2. Potential measures to mitigate potential environmental impacts of constructing and operating the proposed railroad (page 2 of 3).

Environmental resource/project phase	Nature of potential impact	Mitigation measure	Agency jurisdiction	Location
Biological Resources (see Sections 4.2.7 and 4.3.7)				
	Growth and/or spreading of noxious weeds and invasive species	Minimize watering of land surfaces for soil stabilization, ballast cleaning, vehicle washing, and dust suppression to the extent possible.	DOE	Various locations as warranted.
	Conifer mortality	Salvage and restore damaged conifers.	DOE	Specific locations as warranted.
	Attract wildlife to areas of active construction	Install a fence around any storage reservoirs. Install removable covers over storage reservoirs or basins as needed.	DOE	Applies to overall project.
Noise and Vibration (see Sections 4.2.8 and 4.3.8)				
	Elevated noise levels resulting from construction activities	Limit major noise producing activities, such as blasting and pile driving, near ***sensitive receptors***.	DOE	Specific locations as warranted.
	Elevated noise levels from operations such as locomotive warning horns	Apply for a Quiet Zone. Install quad gates, or other supplementary safety measures, to provide the level of warning necessary to allow the communities to request a waiver from the Federal Railroad Administration of the requirement to sound the horn at ***at-grade crossings***.	FRA[a]	Specific locations as warranted.
Socioeconomics (see Sections 4.2.9 and 4.3.9)				
	Overextend local law enforcement capacity	Staff ***construction camps*** with security personnel.	DOE	Construction camp sites.
Occupational and Public Health and Safety (see Sections 4.2.10 and 4.3.10)				
	Hantavirus infection of workers	Implement procedures for decontamination of any rodent excreta encountered by construction workers during construction activities.	DOE	Applies to overall project.
	Equipment and property damage and injury	Assign people, a source of water, and a water-tank trailer that would be used to respond to fire emergencies at the camps and construction areas.	DOE	Construction camp sites.

Table 7-2. Potential measures to mitigate potential environmental impacts of constructing and operating the proposed railroad (page 3 of 3).

Environmental resource/project phase	Nature of potential impact	Mitigation measure	Agency jurisdiction	Location
Hazardous Materials and Waste (see Sections 4.2.12 and 4.3.12)				
	Overburdening local landfill facilities with waste	Determine which landfills solid and ***industrial and special wastes*** would be sent to during the construction phase and balance the distribution. Send manageable quantities of ***solid waste*** to local landfills or send the waste to the larger Apex Landfill.	DOE	Applies to construction.
Cultural Resources (see Sections 4.2.13 and 4.3.13)				
	Adverse impacts or disturbances to cultural resources sites	Provide cultural resources training to workers.	DOE and SHPO[a]	Applies to construction and various locations along the rail alignments.
Paleontological Resources (see Sections 4.2.14 and 4.3.14)				
	Disturbance and/or destruction of paleontological resources	Perform pre-disturbance testing of physical resources within the rail line construction right-of-way where there could be a potential for important paleontological resources. Consult with the BLM to develop appropriate measures to minimize damage to paleontological resources during the construction phase if fossils were found.	DOE and BLM	Specific locations along the rail alignments.

a. BLM = Bureau of Land Management; DOE = Department of Energy; FRA = Federal Railroad Administration; SHPO = State Historic Preservation Office.

8. UNAVOIDABLE ADVERSE IMPACTS; SHORT-TERM USES AND LONG-TERM PRODUCTIVITY; IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

In accordance with the National Environmental Policy Act (NEPA), Section 102 (42 U.S.C. 4332), and the Council on Environmental Quality (CEQ) NEPA implementing regulations (40 CFR 1502.16), this chapter addresses:

- Any adverse environmental impacts DOE would not be able to avoid if the Department implemented the Proposed Action along the Caliente rail alignment or the Mina rail alignment.
- The relationship between local short-term uses of the environment within the Caliente rail alignment or Mina rail alignment region of influence and the maintenance and enhancement of long-term productivity.
- Any irreversible and irretrievable commitments of resources if DOE implemented the Proposed Action along the Caliente rail alignment or the Mina rail alignment.

Glossary terms are shown in ***bold italics***.

8.1 Caliente Rail Alignment

During the engineering and site evaluation and planning phase for the proposed ***railroad***, DOE considered many factors to avoid or minimize potential environmental ***impacts*** (see Chapter 2), and would continue to consider these factors during the final design phase. DOE would meet all applicable regulatory requirements during proposed railroad construction and operations along the Caliente ***rail alignment***, and would implement an array of best management practices to ensure compliance with requirements (see Chapter 7, Best Management Practices and Mitigation). Also as described in Chapter 7, DOE could implement measures to mitigate any impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices.

However, there could be unavoidable adverse impacts (adverse impacts are impacts that could be viewed as having disproportionately negative effects); impacts to short-term uses and long-term productivity resources; and/or irreversible and irretrievable commitment of resources, for example:

- DOE could mitigate most potential impacts described in Chapter 4, but there would be some unavoidable impacts, for example, on the use of grazing land.
- Railroad construction would involve ground-disturbing activities that would result in localized ***short-term impacts***

An **irreversible commitment** of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity.

An **irretrievable commitment** of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the utilization opportunities foregone are irretrievable.

to soil, water use, and ***habitat***. These resources would recover over time, and long-term productivity would not be affected.

- An irreversible commitment of resources such as consumption of fossil fuel, and an irretrievable commitment such as a loss of habitat.

This chapter summarizes and consolidates information from Chapter 4, Environmental Impacts, and Chapter 7, Best Management Practices and Mitigation.

8.1.1 UNAVOIDABLE ADVERSE IMPACTS

Engineering and site evaluation and planning are the first steps in undertaking a ***proposed action***. Next follows compliance with all laws, regulatory requirements, and stipulations and conditions of associated permits to minimize environmental and health-related impacts. Best management practices are implemented to maintain compliance with these requirements. Where analyses identify potential environmental impacts, ***mitigation*** measures are implemented to avoid, minimize, rectify, reduce, or compensate for those impacts. Finally, unavoidable adverse impacts may arise where there are no reasonably practicable mitigation measures to entirely eliminate impacts, and there are no reasonably practicable ***alternatives*** to the proposed project that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar significant adverse impacts. Figure 8-1 illustrates how unavoidable adverse impacts may arise and identifies the chapters of this Rail Alignment ***Environmental Impact Statement*** (EIS) where the topic areas shown are discussed.

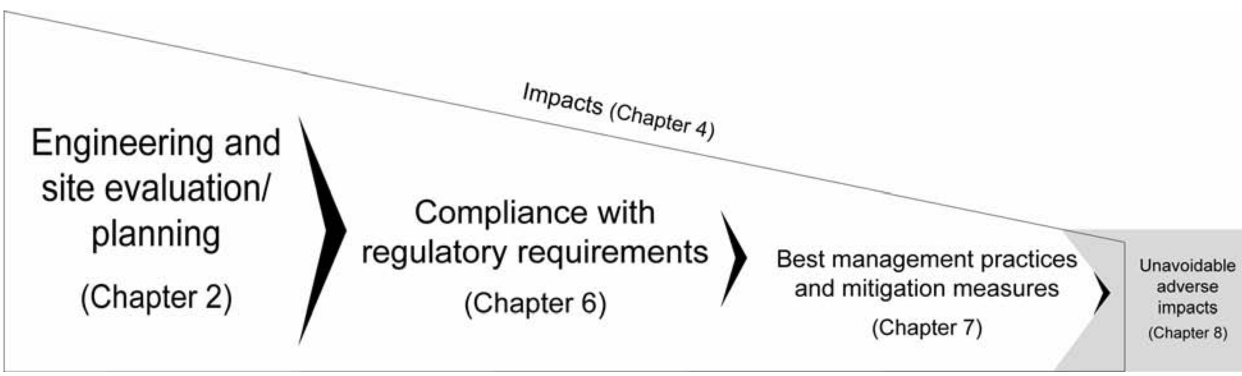


Figure 8-1. How unavoidable adverse impacts might arise.

Unavoidable adverse impacts would not vary substantially among alternative segments along the Caliente rail alignment, or by implementation of the ***Shared-Use Option***. Sections 8.1.1.1 to 8.1.1.15 describe unavoidable adverse impacts, if any, for each environmental resource area evaluated in this Rail Alignment EIS.

8.1.1.1 Physical Setting

Construction of the proposed railroad along the Caliente rail alignment would lead to permanent alterations in topography in the ***rail line construction right-of-way*** as a result of ***cuts*** and ***fills***, and in the locations of potential quarry sites. Cuts and fills would also alter local drainage patterns, and would remain after a possible future abandonment of the railroad. Cuts and fills associated with construction of any of the ***alternative segments*** could result in the loss of topsoil, and an increased potential for erosion. No mineral deposits would be removed; nevertheless, a rail line could unavoidably restrict access to such deposits. The Goldfield alternative segments would cross ***mining areas*** and could displace minerals or limit the boundaries for mining if mineral resources extended under the rail alignment. There would be potential impacts to isolated pockets of unused land classified as ***prime farmland*** along the Caliente or

Eccles alternative segment and Caliente ***common segment*** 1. As required under the Farmland Protection Policy Act (7 United States Code [U.S.C.] 4201 *et seq.*), which directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands, DOE has coordinated with the Natural Resources Conservation Service to minimize any potential conversion of land classified as prime farmland to nonagricultural uses. The 0.22 square kilometer (54 acres) of prime farmland soils along Caliente common segment 1 is in a relatively isolated area in Nye County (see DIRS 182843-Coogan and Bethoney 2007, Part A, plates 107 to 109), and at present is not being farmed. Construction of the proposed railroad along the Caliente rail alignment would result in the loss of a total of 0.43 square kilometer (110 acres) of prime farmland soils. Lincoln and Nye Counties contain approximately 1,500 square kilometers (370,000 acres) of prime farmland soils; thus, the proposed railroad would remove less than 0.1 percent of the prime farmland soils from productive use. Construction activities within the construction right-of-way would result in local soil compaction, which could impact the natural revegetation rate and vegetation types over time.

Any permanent alterations in topography that could not be mitigated could be viewed as unavoidable adverse impacts. As described in Section 4.2.1.2.1, topographic impacts due to major cut and fill and other earthwork processes would primarily occur along the Goldfield alternative segments and common segment 6, and around Bennett Pass, Goldfield Hills, Beatty, and Yucca Mountain. Tables 4-2 to 4-9 in Section 4.2.1 list specific amounts of disturbed surface areas for the Caliente rail alignment alternative segments, common segments, and ***construction and operations support facilities***. Any impacts to physical setting, although unavoidable, would be small.

8.1.1.2 Land Use and Ownership

Use of land along the Caliente rail alignment for construction and operation of the proposed railroad and railroad construction and operations support facilities would involve some long-term changes in land use. The land DOE would use for this project would be managed as a ***right-of-way grant*** obtained from the U.S. Department of the Interior, Bureau of Land Management (BLM). This would not pose a land-use conflict because the rights-of-way would not be in right-of-way avoidance areas. The BLM could establish land management requirements that provide for multiple use, but land used for the proposed railroad and railroad construction and operations support facilities could limit certain other land uses. The multiple-use mandate set forth in the Federal Land Policy and Management Act would continue to apply to the ***public lands*** within the right-of-way, but railroad construction and operations could limit certain future land uses that pose a conflict.

DOE would need to gain access to some private lands. Assuming a ***nominal*** 61-meter (200-foot) right-of-way on either side of the centerline of the rail line, this could result in a loss of about 1 percent of private land compared to the total amount of land that would be required for the project. The parking lot and access road to the Hot Springs Hotel would lie within the Caliente alternative segment construction right-of-way, and the loss of some parking area and the impact of noise during construction and operation of the rail line may cause the hotel to no longer remain viable. If the Caliente alternative segment is selected, DOE would negotiate with the hotel owner to gain access to the land. The Staging Yard at either of the Caliente options (Upland or Indian Cove) would be on private land.

Construction and operation of the proposed railroad along the Caliente rail alignment would directly impact ***grazing allotments*** by transecting parcels and potentially hindering access to forage and water resources. Other potential impacts include allotments being reduced in size and a reduced ability of livestock, wild horses, and burros to range freely across grazing areas. The Eccles-North Staging Yard would be on public land within an active grazing allotment. Even with mitigation, some adverse impacts to the use of grazing land would be unavoidable. Tables 4-23 to 4-30 in Section 4.2.2 summarize potential impacts to land use and ownership for each alternative segment, common segment, and railroad construction and operations support facility.

Construction and operation of the proposed railroad along the Caliente rail alignment would not displace existing or planned land uses over a large area or conflict with land-use plans or goals. Therefore, any impacts to land use and ownership, although unavoidable, would be small.

8.1.1.3 Aesthetic Resources

The ***region of influence*** for aesthetic resources is the ***viewshed*** around all Caliente rail alignment alternative segments, common segments, and railroad construction and operations support facilities, and any additional ***sidings*** that would be added under the Shared-Use Option. Operation of the proposed railroad along the Caliente rail alignment would remain consistent with BLM visual resource management objectives, under which areas of high visual value (Classes I and II) are managed to minimize contrast levels, and areas of lower visual value (Classes III and IV) are allowed higher contrast levels. There would be unavoidable visual changes associated with the proposed rail alignment. Contrast levels that were rated by DOE as none, weak, or moderate would be such that BLM visual resource management objectives would be met. In specific locations such as Garden Valley, which is classified as a more visually sensitive Class II area in the *Draft Ely Resource Management Plan* (DIRS 174518-BLM 2005), BLM visual resource management objectives also would be met.

8.1.1.4 Air Quality

Construction and operation of the proposed railroad along the Caliente rail alignment would cause unavoidable emissions of some ***criteria air pollutants***. Air pollutant concentrations would not exceed the National ***Ambient Air Quality Standards*** during construction and operation of the proposed railroad, with the possible exception of the 24-hour standard for ***particulate matter*** with an aerodynamic diameter less than or equal to 10 micrometers (***PM_{10}***) that DOE modeled as exceeded during quarry operations in South Reveille Valley during rail line construction. However, DOE will be required to obtain a Surface Area Disturbance Permit Dust Control Plan, issued by the State of Nevada, Department of Environmental Protection, prior to quarry development. DOE anticipates that compliance with the requirements of this plan to reduce ***fugitive dust*** emissions would decrease the possibility of exceedance of the ***air quality*** standard—for example, the requirement for cessation of all operations when winds make control of fugitive dust difficult (this was a mitigating attribute not accounted for in the modeling that DOE undertook). DOE could further reduce the possibility of exceeding the 24-hour standards for PM_{10} at a public boundary during quarry operations by acquiring additional land and moving public access farther away.

The highest increase in air pollutant emissions would occur during the construction phase. During the operations phase, the highest increase would occur in the vicinity of the railroad operations support facilities. Fugitive dust emissions from construction-vehicle traffic on unpaved roads, surface disturbance (such as grading, scraping, bulldozing, wind erosion, and quarry excavation activities), and operation of concrete batch plants could cause unavoidable temporary impacts to air quality that, although within permissible limits, could not be completely mitigated. Table 4-53 in Section 4.2.4 summarizes impacts to air quality, which are projected to be small during both construction and operation, with the possible exception in the vicinity of the South Reveille Valley quarry.

Therefore, any impacts to air quality, although unavoidable, would be small.

8.1.1.5 Surface-Water Resources

Regrading, cut and fill activities, and structures such as box ***culverts*** would cause localized changes in drainage patterns throughout the rail line construction right-of-way. Construction of the proposed ***Staging Yard*** and ***Interchange Yard***, whether along the Caliente or Eccles alternative segment, would require channelization of natural drainage surface waters to keep water out of railroad operations support facility sites. Changes in drainage patterns could result in changes in erosion and sedimentation rates or locations. Construction in ***washes*** or other flood-prone areas could reduce the area through which floodwaters naturally flow, resulting in water buildup or ponding on the upstream side of crossings during floods that would slowly drain through the culverts or bridges.

DOE evaluated potential impacts to surface waters by identifying areas where there are drainage channels or water resources. While some changes would be unavoidable, DOE would take steps to ensure the alterations to natural drainage, sedimentation, and erosion would not increase future flood damage, increase the impact of floods on human health and safety, or cause identifiable harm to the functions and values of ***floodplains***. Because hydraulic structures and conveyance systems would be designed to safely convey 50-year or 100-year design storms and minimize concentration of flow, impacts associated with drainage conveyance would be small. The Department would minimize impacts to surface-water resources through the implementation of engineering design standards and best management practices that include erosion control measures. The Caliente alternative segment is adjacent to ***wetlands*** and some wetland fill would be unavoidable. Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the potential quarry siding. Construction of the Staging Yard in Indian Cove would require filling an area of wetlands and in the loss of approximately 0.19 square kilometer (47 acres) of wetland habitat. The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres). DOE would minimize adverse impacts to wetlands (and the functions served by wetlands) and other surface-water resources.

8.1.1.6 Groundwater Resources

Withdrawal of ***groundwater*** from multiple wells for construction of the proposed railroad could cause a short-term decrease in groundwater resources resulting from increased ***demand*** on the host ***aquifer*** at each new well location. Groundwater withdrawal could decrease the amount of water available to a nearby existing well or spring discharge, and/or, in theory, decrease the amount of water available for underflow to a downgradient basin. The impacts of groundwater withdrawals from the proposed water-supply wells at the range of production rates that would be required for the railroad would be localized in nature, small in magnitude compared to existing groundwater inventories, and primarily temporary. Impacts analysis results indicate that short-term withdrawal of water from new water wells at the proposed withdrawal rates could, in some instances, if unmitigated, have some unavoidable impact on existing wells or springs. In those instances, mitigation measures are proposed, such as use of a staggered pumping schedule for the new well, or pumping the new well at a reduced rate over a longer time period, in order to minimize or prevent such impacts on existing groundwater users and uses. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the construction phase, DOE anticipated that this water would be replenished through the natural water cycle following the construction phase. Some of the water used for compaction would return to groundwater aquifers. For these reasons, DOE expects that there would be no adverse ***long-term impacts*** to existing groundwater resources.

8.1.1.7 Biological Resources

There could be unavoidable, short-term, adverse impacts to wildlife, special status species, protected game species, and wild horses and burros. There would be the potential for unavoidable impacts to ***threatened or endangered species*** during rail line construction. Potential impacts to desert tortoise would be moderate because of fragmentation of habitat. There could be localized and minor loss of roosting and foraging habitat for the southwestern willow flycatcher and western yellow-billed cuckoo.

DOE determined that there would be unavoidable impacts to wetlands and ***riparian*** habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove and Upland), and the Eccles alternative segment. Unavoidable impacts to wildlife and wild horses and burros from the operation of the rail line could result from collisions of wildlife with trains and short-term disruption of activities (such as foraging, nesting, and resting). Although such impacts would be unavoidable, long-term impacts would be small. Other unavoidable impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

There could be some unavoidable impacts to special status wildlife or plant species. For example, project activities could result in small but unavoidable adverse impacts to:

- Non-critical habitat for the federally threatened Mojave population of the desert tortoise (*Gopherus agassizii*)
- Habitat for the BLM-designated sensitive southwestern toad (*Bufo microscaphus*) near Caliente and Meadow Valley Wash
- Individual BLM-designated sensitive plants and their habitats, including the Schlesser pincushion (*Sclerocactus schlesseri*) and the White River catseye (*Cryptantha welshii*) along Caliente common segment 1; Eastwood milkweed (*Asclepias eastwoodiana*) near Caliente common segment 3; and the Nevada dune beardtongue (*Penstemon arenarius*) along common segment 5
- Habit for the Chuckwalla lizard (*Sauromalus ater*) documented in the southeastern foothills of Yucca Mountain, adjacent to common segment 6

Nevertheless, DOE has concluded that there would be a small loss of habitats, and potential loss of wildlife from trains and construction traffic would be low. Although such impacts would be unavoidable, long-term impacts would be small.

8.1.1.8 Noise and Vibration

Railroad operations along the Caliente rail alignment would lead to an unavoidable increase in ***ambient noise*** from passing trains in areas of Nevada that are mostly uninhabited. Noise from trains might be noticeable as new noise in residential areas near the rail line in Caliente and Goldfield. Because there is already a substantial amount of train activity in Caliente, additional train noise would be less noticeable there than in other areas where there is no train activity and no train noise at present. DOE estimated noise levels during the operations phase at all sensitive receptor locations along the Caliente rail alignment and found they would be below Surface Transportation Board environmental review criteria for noise analysis. Therefore, DOE has determined that no long-term adverse noise impacts would be expected during railroad operations along the Caliente rail alignment. However, during rail line construction, DOE estimated that noise levels at certain receptor locations near the City of Caliente would be higher than Federal Transit Administration construction noise guidelines. This unavoidable impact would be temporary.

8.1.1.9 Socioeconomics

Construction and operation of the proposed railroad along the Caliente rail alignment would unavoidably impact population, housing, employment, and public services in Lincoln, Nye, Esmeralda, and Clark Counties; traffic; and, to a small extent, local current agriculture, ranching, and mining activities.

Socioeconomic changes during the construction phase would include a brief elevation in project-related employment, temporary population increases, and immediate impact on existing levels of public services (health care, transportation, fire protection, and law enforcement) where construction activities were concentrated near communities. DOE determined that the greatest impacts would be economic, and although unavoidable, would be viewed as beneficial and not adverse. As outlined in Section 4.2.9, Socioeconomics, construction-related impacts in Lincoln, Esmeralda, and Nye Counties would result in small increases in peak employment, increases in ***real disposable income***, and increases in ***gross regional product***. The project would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. DOE analyzed highway ***level of service*** by looking at traffic volume in terms of design hour and peak hour flow during a 4- to 10-year construction phase, and determined that there would be some unavoidable impacts from construction of the ***Rail Equipment Maintenance Yard*** at Yucca Mountain to traffic on U.S. Highway 95 near the entrances to the ***Yucca Mountain Site***. This effect would degrade the level of service during peak traffic hours. However, this level would represent high density but stable traffic flow and constitute a small, but unavoidable, impact. This unavoidable impact would be temporary, lasting only as long as the construction phase (4 to 10 years, with the peak period limited to 2 years).

Impacts to traffic during railroad operations would be considerably lower than construction-related impacts. DOE determined that Rail Equipment Maintenance Yard operations would affect traffic on U.S. Highway 95 near the entrances to the Yucca Mountain Site. However, this level would represent high density but stable traffic flow, and constitute a small, but unavoidable, impact. Elsewhere, there would be no impacts or changes to highway levels of service during the railroad operations phase.

Socioeconomic changes during railroad operations would include increases in project-related employment (particularly associated with railroad operations support facilities); slight long-term population increases; moderate pressure on available housing, and fire-protection and health services in southern Nye County; and continued small impacts on mining, ranching, and agriculture. DOE determined that the greatest economic gains would arise in Lincoln County.

8.1.1.10 Occupational and Public Health and Safety

The possibility of nonradiological industrial hazards (such as exposure to physical hazards, chemicals, dust, and pathogens) causing injury or illness to workers during construction and operations would not be completely unavoidable. However, the potential for such impacts would be very small. DOE has estimated that there could be approximately two fatalities associated with all such hazards during construction and 50 years of railroad operations.

There could be radiological impacts to workers and the public from ***incident-free transportation*** and facility operations. While the impact would be very small, radiological impacts would not be completely unavoidable. DOE estimated that approximately 0.34 ***latent cancer fatality*** would result to workers from incident-free transportation and facility operations, and that approximately 1.4×10^{-4} latent ***cancer*** fatality would result to the public from incident-free transportation and facility operations.

There could be radiological impacts from rail ***accidents*** involving casks. Radiological impacts from accidents are estimated to result in less than one latent cancer fatality.

There could be radiological impacts from sabotage events involving casks. If a sabotage event occurred in a suburban area, the collective ***radiation dose*** to the population is estimated to be 1,800 ***person-rem***. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be one.

By their very nature, roadway accidents are considered unavoidable; however, the projected number of roadway accidents that could be attributed to construction and operation of the proposed railroad would be very small. DOE assessed the potential transportation safety impacts of vehicle traffic on roadways associated with constructing and operating the rail line and facilities. DOE determined that there could be up to six fatalities on roadways for the 335 million vehicle-kilometers (200 million vehicle-miles) traveled over the construction phase, and up to eight fatalities on roadways for the 460 million vehicle-kilometers (288 million vehicle-miles) traveled during the 50-year operations phase.

Also by their nature, rail line accidents are considered unavoidable; however, the projected number of rail accidents that could be attributed to construction and operation of the railroad would be very small. DOE determined that there could be approximately one fatality associated with the construction and operations phases. DOE also assessed the potential transportation safety impacts of rail traffic on the rail line and at ***at-grade crossings*** during the construction and operations phases. The Department estimated that over the construction phase and 50-year operations phase, approximately 16 rail-related accidents could be expected to occur for the entire set of estimated train movements.

8.1.1.11 Utilities, Energy, and Materials

Some interfacing with existing utility rights-of-way, in particular electric utility lines, would be unavoidable. Temporary unavoidable impacts to utilities during the construction phase could include possible short-term service interruptions as service was switched from existing electric-power lines, telecommunication lines, and water pipelines to new lines crossing the proposed railroad, or to lines that were relocated to avoid railroad construction activities.

The two principal electric providers in the project region, Nevada Power Company and Sierra Pacific Power Company, can currently meet peak load demands of 5,800 megawatts and 1,900 megawatts, respectively, through generating capacity or power-purchase capabilities. In 2005, their electricity sales were estimated to be 19 million megawatt-hours and 8.8 million megawatts-hours, respectively. In addition, the smaller Valley Electric Association, Inc. and Lincoln County Power District No. 1 are local area power purchasers and resellers. Over the 4- to 10-year construction phase, the electrical power providers in the project region would have adequate generating capacity or power-purchase capabilities (see Section 3.2.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. Therefore, although energy use would be unavoidable, anticipated electricity demand to meet construction and operations needs would be modest and would not adversely impact other regional needs for electric power.

As described in Section 4.2.11.2.1.3, DOE estimated that annual consumption of diesel fuel during the railroad construction phase would be 117 million liters (31 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5b), which would represent 6.5 percent of diesel fuel used annually in Nevada. As described in Section 4.2.11.2.2.2, DOE estimated that over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed and the annual consumption rate would peak at 4.3 million liters (1.1 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5a), a rate which is less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Although the use of fuel would be unavoidable, its use during either construction or operations would not adversely affect the capacity of national and regional fuel producers and distributors.

The need for construction materials, primarily steel, concrete, and aggregate, would be unavoidable, but would represent a small fraction of available materials (see Table 4-135). The regional and national impacts of meeting such needs would be small. Materials needed during the operations phase would be much less than during the construction phase, remaining considerably below available capacity.

8.1.1.12 Hazardous Materials and Waste

The generation of some general ***solid wastes***, special wastes (construction debris, used tires, and other materials with specific management requirements), and hazardous materials would be unavoidable, primarily during the construction phase. DOE would handle all wastes in accordance with applicable regulations, and would implement best management practices and pollution prevention/waste minimization programs. As described in Section 4.2.12, DOE estimated that 2,300 metric tons (2,500 tons) per year of nonhazardous solid waste (for example, general household waste) would be generated during the construction phase, for a daily rate of about 6.3 metric tons (6.9 tons). Nonrecyclable wastes would be disposed of, which would raise the total amount disposed of in the four-county area of Lincoln, Nye, Esmeralda, and Clark by up to approximately 0.077 percent. In addition, DOE estimated that construction activities would generate approximately 4,020 metric tons (4,380 tons) of ***industrial and special wastes*** per year, for an approximate daily rate of 11 metric tons (12 tons), which would result in an increase of approximately 0.13 percent in waste receipt at local landfills.

DOE estimated that 190 metric tons (210 tons) per year or 0.51 metric ton (0.56 ton) per day of nonhazardous solid waste would be generated at railroad operations support facilities, which would raise the total amount disposed of in the four-county area by less than 0.01 percent. There would be ample disposal capacities to accept the small amounts of ***low-level radioactive wastes*** generated from the ***Cask Maintenance Facility*** of 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) over the 30- to 50-year lifetime of this project (DIRS 181425-MTS 2007, all).

Although the use of disposal facilities would be unavoidable, existing disposal facilities have ample capacity to handle all additional wastes.

8.1.1.13 Cultural Resources

Because of the length of the Caliente rail alignment and the complexity associated with engineering a feasible alignment, DOE used a phased cultural resource identification and evaluation approach, as described in 36 Code of Federal Regulations (CFR) 800.4(b)2, to identify specific cultural resources as is fully described in Section 4.2.13. DOE has surveyed approximately 20 percent of the area for cultural resources. Based on cultural resources already identified, it is reasonable to conclude that there may be undiscovered cultural resources in the Caliente region of influence. The number and extent of identified cultural resource sites throughout the Caliente rail alignment region of influence will continue to increase as more surveys and inventories of potentially disturbed land are completed.

Nevertheless, railroad construction could cause unavoidable disturbance or destruction of cultural resources. Disturbance or destruction could occur during ground-disturbing activities along the rail alignment, at quarries, along temporary access roads, at ***borrow sites***, at temporary ***construction camps***, and at railroad operations support facilities. During construction, larger numbers of workers in the vicinity of the construction camps could increase the potential for impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that were either thought, based on previous archaeological surveys, to occur only at ground surface, or were previously undetected because they were completely underground.

Railroad construction and operation could also lead to unavoidable changes in cultural landscapes, such as changes to ***ethnographic***, rural historic, and historic viewscapes. Cultural landscapes include historic-period Western Shoshone villages and surrounding use areas in the Oasis Valley, the Goldfield area, and Stone Cabin and Reveille Valleys; early ranching operations in the Stone Cabin and Reveille Valleys, and the Mormon settlement of Meadow Wash Valley; and the Goldfield, Clifford, and Reveille Mining Districts.

DOE would further modify the rail alignment, as necessary, to avoid discovered cultural resources. Based on preliminary information and sample surveys, any impacts would likely range from small to moderate because of an extensive effort to avoid or mitigate them.

8.1.1.14 Paleontological Resources

As described in Section 4.2.14, there is a paleontological resource site approximately 4.8 to 8 kilometers (3 to 5 miles) south of where Caliente common segment 1 would cross Bennett Pass, but because of its distance from the rail line, there would be no impacts to the site. There are no other known paleontological resources at or near the remaining portions of the Caliente rail alignment, nor do these areas have a strong potential to contain important paleontological resources. While there could be a potential to uncover previously unknown ***fossils*** during railroad construction, DOE would consult with the BLM to develop appropriate measures to minimize damage to paleontological resources during project-related construction if fossils were found. DOE has not identified any unavoidable adverse impacts.

8.1.1.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Caliente rail alignment would not result in disproportionately high and adverse human health, environmental, ecological, or cultural impacts on ***minority populations***, low-income communities, or American Indian tribes from construction and operation of a railroad along the Caliente rail alignment. DOE has not identified impacts, unavoidable or otherwise, in the context of ***environmental justice***.

8.1.2 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Council on Environmental Quality regulations that implement the procedural requirements of the National Environmental Policy Act (NEPA) require consideration of "the relationship between short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). This includes using " … all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generation of Americans" (NEPA, Section 101, 42 U.S.C. 4331).

This section discusses the short-term use of the environment and the maintenance of its long-term productivity. Chapter 4 provides more detailed discussions of the impacts and resource utilization associated with the Proposed Action and the Shared-Use Option. Construction and operation of the proposed railroad would require short-term uses of land and other resources. Any long-term loss of productivity in disturbed areas would be small. The land-cover types along the proposed rail alignment are widely distributed throughout the region of influence and any loss of vegetation in the disturbed area along the rail alignment would have little impact on the regional productivity of plants and animals. Future long-term land uses such as grazing or mining would not be precluded by the short-term use of the land for the proposed rail line. The relationships between short-term uses and long-term productivity would not be meaningfully altered if either the Proposed Action or Shared-Use Option were implemented, or by the selection of alternative segments within the Caliente rail alignment ***implementing alternative***.

Wetlands or waters that would be filled would not recover in the short term and long-term productivity would be lost permanently. To the extent practicable, DOE would minimize such fill by optimizing final engineering and design and use a minimum-width construction right-of-way whenever possible. Construction of the Staging Yard in Indian Cove would require filling an area of wetlands and in the resultant loss of approximately 0.19 square kilometer (47 acres) of wetland habitat. There would be a long-term loss of productivity to riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove and Upland), and the Eccles alternative segment. The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of a floodplain. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres).

Productivity loss for soils should be limited to the disturbed areas affected by land clearing, grading, and construction. Most disturbed areas not permanently maintained for railroad operations would recover over time, although recovery and a return to natural productivity could be slow for disturbed biological communities in an ***arid*** environment. DOE would revegetate disturbed areas with appropriate native species. Potentially productive soils characterized as prime farmland along Caliente common segment 1 and the Caliente and Eccles alternative segments are found only in isolated pockets and cannot support farming. Therefore, the minimal loss of these soils would not impact long-term productivity.

The areas used for temporary construction camps would likely recover in the short term because they would be unused after construction activities ceased. DOE would implement restoration activities to encourage natural vegetation to grow on these sites. The Department might eventually abandon the proposed railroad and its operations support facilities, although it is unlikely that the rail ***roadbed*** would ever be completely dismantled. The proposed railroad and these facilities could be turned over to commercial carriers, especially if the Shared-Use Option were selected, and could continue to aid economic productivity in the region. Under the Shared-Use Option, the proposed railroad could increase transportation opportunities and lower transportation costs in the region.

The short-term withdrawal of water from the temporary construction wells could have a small impact on groundwater availability. However, DOE has projected that drawdowns would be sufficiently small to preclude impacts on flow rates or discharge rates at existing productive water-supply wells or springs. There would be no long-term impacts to groundwater resource productivity because the construction wells would only be used for a short time.

8.1.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA Section 102 (42 U.S.C. 4332) and Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR 1502.16) require that environmental analyses include identification of: "… any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible commitment of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity, whereas an irretrievable commitment of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the utilization opportunities foregone are irretrievable.

This section describes irreversible and irretrievable commitments of resources associated with implementation of the Proposed Action along the Caliente rail alignment. Sections 8.1.3.1 to 8.1.3.15 discuss resource commitments that could be irreversible and irretrievable. Irreversible and irretrievable commitments of resources would not meaningfully vary among alternative segments along the Caliente rail alignment, or by implementation of the Shared-Use Option.

8.1.3.1 Physical Setting

Construction of the rail line and construction and operations support facilities along the Caliente rail alignment could displace mineral deposits. Perlite is a locally important mineral that occurs in the area of the Caliente and Eccles alternative segments. Although no minerals would be removed, placement of the rail line could displace perlite and reduce its availability for mining, if there was perlite within the construction right-of-way. The Goldfield alternative segments would cross mining areas and could displace minerals or limit the boundaries for mining if mineral resources extend under the rail alignment. If these circumstances occurred and options for future use of minerals were limited, there would be an irreversible commitment of resources.

8.1.3.2 Land Use and Ownership

Construction and operation of the proposed railroad would require the commitment of land for placement of the rail line, construction and operations support facilities, and access roads. If at a future date DOE were to abandon the railroad, although much of the construction material might be removed, it is not likely that all of the natural landscape would be restored, and some of the land commitment would remain irreversible. Following abandonment of the rail line, lands along the Caliente rail alignment would be relinquished back to the BLM. If DOE had to acquire private lands for the Staging Yard at either of the Caliente options (Upland or Indian Cove), the Department would dispose of purchased land pursuant to DOE Order O 430.1B, *Real Property Asset Management*, or would return leased land to the lessee.

8.1.3.3 Aesthetic Resources

DOE determined that the visual impacts of operating trains would range from no visual contrast to strong visual contrast, and that the long-term visual impacts of marks on rock, soil, and vegetated landscape from cuts, fills, well pads, and access roads would range from weak to strong (with mitigation in Garden Valley) (see Section 4.2.3). The railroad would remain consistent with BLM visual resource management objectives where areas of high visual value are managed to minimize contrast levels, and areas of lower visual value are allowed higher contrast levels. Where land commitment was irreversible, aesthetic impacts would sometimes remain irreversible.

8.1.3.4 Air Quality

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment.

8.1.3.5 Surface-Water Resources

The Caliente alternative segment is adjacent to wetlands and some wetland fill would be unavoidable. This could result in an irretrievable commitment of resources along the Caliente rail alignment. Approximately 0.09 square kilometer (22 acres) of wetlands would be filled to construct the potential quarry siding. Construction of the Staging Yard in Indian Cove would require filling an area of wetlands and in the resultant loss of approximately 0.19 square kilometer (47 acres) of wetland habitat. The Eccles alternative segment Interchange Yard would require portions of Clover Creek to be filled to elevate the site out of the floodplain. The total area to be filled within the confines of Clover Creek would be approximately 0.033 square kilometer (8.2 acres).

8.1.3.6 Groundwater Resources

DOE estimated that a total of 7.52 billion cubic meters (6,100 ***acre-feet***) of water would be required for railroad construction (DIRS 180875-Nevada Rail Partners 2007, Section 4.4.2, pp. 4 to 10), most of which would be obtained through the construction of new water wells. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the railroad construction period, it is anticipated that this water would be replenished through the natural water cycle following the railroad construction phase. The use of groundwater could be considered as an irretrievable commitment of resources during the construction phase.

8.1.3.7 Biological Resources

The areas that would be occupied by the rail line, railroad construction and operations support facilities, and access roads would be irreversibly removed from natural habitat for the life of the proposed railroad. In addition, the disturbances of the desert soil surfaces in areas of temporary construction activity could result in changes that would be irreversible over the long term. The permanent conversion of vegetation resources and wildlife habitat along the rail line and at construction and operations support facilities could represent an irreversible commitment of biological resources for the life of the proposed railroad and beyond if, following abandonment, DOE did not restore these resources, or if former vegetation cover and composition did not recover. Losses of wildlife during railroad construction and operations would represent an irretrievable commitment of biological resources.

Impacts to wetlands and riparian habitats from construction of the Caliente alternative segment and either of the potential Staging Yard locations (Indian Cove and Upland), the Eccles alternative segment, and the Interchange Yard could represent an irreversible rather than irretrievable commitment of resources if, following abandonment, DOE did not restore these resources. However, during rail line final design, DOE would make adjustments to minimize such impacts.

8.1.3.8 Noise and Vibration

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment.

8.1.3.9 Socioeconomics

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment.

8.1.3.10 Occupational and Public Health and Safety

As discussed in Section 8.1.1.10, nonradiological industrial hazards (such as exposure to chemicals, dust, and pathogens) could cause injury or illness to workers during railroad construction and operations; however, DOE estimated the ***risk*** as approximately two fatalities. Radiological impacts to workers (0.34 latent cancer fatality) and the general public (1.4×10^{-4} latent cancer fatality) could occur from incident-free transportation, and DOE assessed the potential transportation safety impacts of movement on roadways, the rail line, at railroad operations support facilities, and at grade crossings associated with railroad construction and operation. DOE estimated there could be six vehicular-related fatalities during construction and approximately seven during operations. DOE estimated there could be approximately one rail-related fatality during construction and operations.

8.1.3.11 Utilities, Energy, and Materials

As described in Section 4.2.11, DOE estimated that annual consumption of diesel fuel during the construction phase would be 117 million liters (31 million gallons) (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5b). Over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed, and if the Shared-Use Option was implemented during the operations period, a total of 392 million liters (103.5 million gallons) would be consumed (DIRS 182825-Nevada Rail Partners 2007, Appendix D, Table D-5a). Fossil fuel consumed would be irreversible, and any portion of fuel consumed that was bio-fuel would be considered irretrievable. DOE has established an 8-megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray 2007, all). Fossil fuel or nuclear resources that generated that electricity would be irreversible.

As described in Section 4.2.11, construction of the railroad would require an estimated 82,000 metric tons (90,000 tons) of steel and 450,000 metric tons (496,000 tons) of concrete. Approximately 1,020,000 concrete railroad ties would be required for track construction. The estimated requirement for railroad ***ballast*** would be approximately 3.2 million metric tons (3.5 million tons), and approximately 2.7 million metric tons (3 million tons) for ***subballast*** (DIRS 180875-Nevada Rail Partners, Section 3.1.1, p. 3-1). Use of these materials would not be considered an irretrievable commitment of resources, because they could be recovered and recycled if DOE eventually abandoned the rail line.

8.1.3.12 Hazardous Materials and Waste

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment, other than the irreversible loss of land used for landfills.

8.1.3.13 Cultural Resources

Cultural resources (archeological, historical, and ethnographic) are nonrenewable resources and any loss would be irreversible. At this time DOE cannot fully characterize potential effects on cultural resources along the Caliente rail alignment or the magnitude of these effects.

8.1.3.14 Paleontological Resources

At this time DOE has not identified any impacts to paleontological resources along the Caliente rail alignment, but any impact that could occur would be irreversible.

8.1.3.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Caliente rail alignment would not cause high or adverse impacts to or fall disproportionately on minority or ***low-income populations***. Thus, DOE did not identify any associated irreversible and irretrievable commitments of resources along the Caliente rail alignment that would present an environmental justice concern.

8.2 Mina Rail Alignment

During the engineering and site evaluation and planning phase for the proposed railroad, DOE considered many factors to avoid or minimize potential environmental impacts (see Chapter 2), and would continue to consider these factors during the final design phase. DOE would meet all applicable regulatory requirements during proposed railroad construction and operations along the Mina rail alignment, and would implement an array of best management practices to ensure compliance with requirements (see Chapter 7, Best Management Practices and Mitigation). Also as described in Chapter 7, DOE could implement measures to mitigate any impacts remaining after final design and compliance with regulatory requirements and implementation of best management practices.

However, there could be unavoidable adverse impacts; impacts to short-term uses and long-term productivity resources; and/or irreversible and irretrievable commitment of resources, for example:

- DOE could mitigate most potential impacts described in Chapter 4, but there would be some unavoidable impacts, for example, on the use of grazing land.
- Railroad construction would involve ground-disturbing activities that would result in localized short-term impacts to soil, water use, and habitat. These resources would recover over time, and long-term productivity would not be affected.
- An irreversible commitment of resources such as consumption of fossil fuel, and an irretrievable commitment such as a loss of habitat.

This chapter summarizes and consolidates information from Chapter 4, Environmental Impacts, and Chapter 7, Best Management Practices and Mitigation.

8.2.1 UNAVOIDABLE ADVERSE IMPACTS

Engineering and site evaluation and planning are the first steps in undertaking a proposed action. Next follows compliance with all laws, regulatory requirements, and stipulations and conditions of associated permits to minimize environmental and health-related impacts. Best management practices are implemented to maintain compliance with these requirements. Where analyses identify potential environmental impacts, mitigation measures are implemented to avoid, minimize, rectify, reduce, or compensate for those impacts. Finally, unavoidable adverse impacts may arise where there are no reasonably practicable mitigation measures to entirely eliminate impacts, and there are no reasonably practicable alternatives to the proposed project that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar significant adverse impacts.

Unavoidable adverse impacts would not vary substantially among alternative segments along the Mina rail alignment, or by implementation of the Shared-Use Option. Sections 8.2.1.1 to 8.2.1.15 describe unavoidable adverse impacts, if any, for each environmental resource area evaluated in this Rail Alignment EIS.

8.2.1.1 Physical Setting

Construction of the proposed railroad along the Mina rail alignment would lead to permanent alterations in topography in the rail alignment construction right-of-way as a result of cuts and fills, and in the locations of potential quarry sites. Cuts and fills would also alter local drainage patterns, and would remain after a possible future abandonment of the rail line. Cuts and fills associated with construction of any of the alternative segments could result in the loss of topsoil, and an increased potential for erosion. No mineral deposits would be removed; nevertheless, a rail line could unavoidably restrict access to such deposits. Less than 1 percent of soils along the Mina alignment are classified as prime farmland. As required under the Farmland Protection Policy Act (7 U.S.C. 4201 *et seq.*), which directs federal agencies to identify and quantify adverse impacts of federal programs on farmlands, DOE has coordinated with the Natural Resources Conservation Service to minimize any potential conversion of land classified as prime farmland to nonagricultural uses. Less than 0.1 percent of soils along the Mina rail alignment are classified as prime farmlands, all of which occur on the Walker River Paiute Reservation. There are 0.011 square kilometer (2.7 acres) of prime farmland along Schurz alternative segment 1, 0.012 square kilometer (3 acres) along Schurz alternative segment 4, and 0.014 square kilometer (3.5 acres) along each of Schurz alternative segments 5 and 6; at present these soils are not farmed. The Walker River Paiute Reservation contains approximately 5.5 square kilometers (1,400 acres) of prime farmland soils, thus, construction of the Mina rail alignment would remove less than 0.1 percent of prime farmland soils on the Reservation from possible future productive use. Construction activities within the construction right-of-way would result in local soil compaction, which could impact the natural revegetation rate and vegetation types over time.

Any permanent alterations in topography that could not be mitigated could be viewed as unavoidable adverse impacts. As described in Section 4.3.1.2.1, topographic impacts due to major cut-and-fill and other earthwork processes would occur primarily along the Montezuma alternative segments, specifically along Montezuma alternative segment 1. In addition, impacts from major cut-and-fill and other earthwork processes also would occur around the Calico Hills and Terrill Mountains, the Goldfield Hills, Beatty, and Yucca Mountain. As described in Section 4.3.1.2.1.1, the total area that would be disturbed during construction of the proposed rail line and construction and operations support facilities would range from approximately 40 to 48 square kilometers (9,900 to 12,000 acres). Tables 4-145 to 4-150 in Section 4.3.1 list specific amounts of disturbed surface areas for the Mina rail alignment alternative segments, common segments, and construction and operations support facilities. Any impacts to physical setting, although unavoidable, would be small.

8.2.1.2 Land Use and Ownership

Use of land along the Mina rail alignment for construction and operation of the proposed railroad would involve some long-term changes in land use. The land DOE would use for this project would be managed as a right-of-way grant obtained from the BLM. This would not pose a land-use conflict because the rights-of-way would not be in right-of-way avoidance areas. The BLM could establish land management requirements that provide for multiple use, but land used for the proposed rail line and construction and operations support facilities could limit certain other land uses. The multiple-use mandate set forth in the Federal Land Policy and Management Act would continue to apply to the public lands within the right-of-way, but railroad construction and operations could limit certain future land uses that pose a conflict.

Construction and operation of the proposed railroad along the Mina rail alignment would directly impact grazing allotments by transecting parcels and potentially hindering access to forage and water resources. Other potential impacts include allotments being reduced in size and a reduced ability of livestock, wild horses, and burros to range freely across grazing areas. Even with mitigation, some adverse impacts to the use of grazing land would be unavoidable. Tables 4-161 to 4-166 in Section 4.3.2 summarize potential impacts to land use and ownership for each alternative segment, common segment, and railroad construction and operations support facility.

Construction and operation of the proposed railroad would not displace existing or planned land uses over a large area or conflict with land-use plans or goals. Therefore, any impacts to land use and ownership, although unavoidable, would be small.

8.2.1.3 Aesthetic Resources

The region of influence for aesthetic resources is the viewshed around all Mina rail alignment alternative segments, common segments, and railroad construction and operations support facilities, and any additional sidings that would be added under the Shared-Use Option. Operation of the proposed railroad along the Mina rail alignment would remain consistent with BLM visual resource management objectives, under which areas of high visual value (Classes I and II) are managed to minimize contrast levels, and areas of lower visual value (Classes III and IV) are allowed higher contrast levels. There would be unavoidable visual changes associated with the proposed railroad. Contrast levels that were rated by DOE as none, weak, or moderate would be such that BLM visual resource management objectives would be met for BLM-administered lands and impacts would be comparable on non-BLM-administered land.

8.2.1.4 Air Quality

Construction and operation of the proposed rail line and operations support facilities along the Mina rail alignment would cause unavoidable emissions of some criteria air pollutants. However, air pollutant concentrations would not exceed National Ambient Air Quality Standards for construction or operation of the railroad and associated facilities, with the exception of the 24-hour standards for both particulate matter with an aerodynamic diameter of 10 micrometers or less (PM_{10}) and an aerodynamic diameter of 2.5 micrometers or less (***$PM_{2.5}$***) that DOE modeled as exceeded near the construction right-of-way at Mina and Schurz during the short (less than 6 months) construction period, and at the Staging Yard at Hawthorne and the potential Garfield Hills quarry. However, DOE will be required to obtain a Surface Area Disturbance Permit Dust Control Plan, issued by the State of Nevada, Department of Environmental Protection, prior to development of the quarry and construction of the Staging Yard. DOE anticipates that compliance with the requirements of this plan to reduce fugitive dust emissions would decrease the possibility of ***ambient air*** quality standards exceedances—for example, the requirement for cessation of all operations when winds make control of fugitive dust difficult (this was a mitigating attribute not accounted for in the modeling that DOE undertook). DOE could further reduce the possibility of exceeding the 24-hour standard for PM_{10} at a public boundary by acquiring additional land and moving public access farther away.

The highest increase in air pollutant emissions would occur during the construction phase, and the highest increase in air emissions from railroad operations would occur in the vicinity of the operations support facilities. The highest increase in criteria air pollutant emissions would be for ***nitrogen oxides*** in Esmeralda County during the construction phase, where emissions could be 3,570 metric tons (3,940 tons) per year higher than the 2002 county-wide emissions of nitrogen oxides. However, these emissions would be distributed over the entire length of the rail alignment in the county and no air quality standard would be exceeded. Fugitive dust emissions from construction-vehicle traffic on unpaved roads, surface disturbance (such as grading, scraping, bulldozing, wind erosion, and quarry excavation activities), and operation of concrete batch plants could cause unavoidable temporary impacts to air quality that, although within permissible limits, could not be completely mitigated. Table 4-198 in Section 4.3.4 summarizes impacts to air quality, which are projected to be small during both construction and operation, except temporarily during construction near the construction right-of-way at Mina and Schurz, the Staging Yard at Hawthorne, and the Garfield Hills quarry.

Therefore, any impacts to air quality, although unavoidable, would be small.

8.2.1.5 Surface-Water Resources

Regrading, cut and fill activities, and structures such as box culverts would cause localized changes in drainage patterns throughout the rail line construction right-of-way. Construction of the proposed Staging

Yard and Interchange Yard would require channelization of natural drainage surface waters to keep water out of railroad operations support facility sites. Changes in drainage patterns could result in changes in erosion and sedimentation rates or locations. Construction in washes or other flood-prone areas could reduce the area through which floodwaters naturally flow, resulting in water buildup or ponding on the upstream side of crossings during floods that would slowly drain through the culverts or bridges.

Temporary unavoidable impacts could occur from disturbance of about 0.002 square kilometer (0.55 acre) of wetlands along Schurz alternative segments 1 and 4, and 0.003 square kilometer (0.73 acre) of wetlands along Schurz alternative segments 5 and 6 during construction of a bridge at the Walker River crossing. Permanent fill or loss of wetlands would total about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

DOE evaluated potential impacts to surface waters by identifying areas where there are drainage channels or other water resources. While some changes would be unavoidable, DOE would take steps to ensure the alterations to natural drainage, sedimentation, and erosion would not increase future flood damage, increase the impact of floods on human health and safety, or cause identifiable harm to the functions and values of floodplains. Because hydraulic structures and conveyance systems would be designed to safely convey 50-year or 100-year design storms and minimize concentration of flow, impacts associated with drainage conveyance would be small. The Department would minimize impacts to surface-water resources through the implementation of engineering design standards and best management practices that include erosion control measures.

Therefore, any impacts to surface-water resources, although unavoidable, would be small.

8.2.1.6 Groundwater Resources

Withdrawal of groundwater from multiple wells for construction of the proposed railroad could cause a short-term decrease in groundwater resources resulting from increased demand on the host aquifer at each new well location. Groundwater withdrawal could decrease the amount of water available to a nearby existing well or spring discharge, and/or, in theory, decrease the amount of water available for underflow to a downgradient basin. The impacts of groundwater withdrawals from the proposed water-supply wells at the range of production rates that would be required for the rail line would be localized in nature, small in magnitude compared to existing groundwater inventories, and primarily temporary. Impacts analysis results indicate that short-term withdrawal of water from new water wells at the proposed withdrawal rates could, in some instances, if unmitigated, have some unavoidable impact on existing wells or springs. In those instances, mitigation measures are proposed, such as use of a staggered pumping schedule for the new well, or pumping the new well at a reduced rate over a longer time period, in order to minimize or prevent such impacts on existing groundwater users and uses. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the construction phase, DOE anticipated that this water would be replenished through the natural water cycle following the construction phase. Some of the water used for compaction would return to groundwater aquifers. For these reasons, DOE expects that there would be no adverse long-term impacts to existing groundwater resources.

8.2.1.7 Biological Resources

There could be unavoidable, short-term, adverse impacts to wildlife, special status species, protected game species, and wild horses and burros. There would be the potential for unavoidable impacts to threatened or endangered species during the construction phase. Potential impacts to desert tortoise would be moderate because of fragmentation of habitat. There would be the potential for impacts to threatened or endangered species during construction. Unavoidable impacts to wildlife and wild horses and burros from railroad operations would consist of potential collisions of wildlife with trains and short-term disruption of activities (such as foraging, nesting, and resting). Other unavoidable impacts could include possible changes to predator/prey interactions due to the construction of towers and other structures that would provide new perch habitat for raptors and other predatory birds.

There could be some unavoidable impacts to special status wildlife or plant species. For example, project activities could result in small to moderate but unavoidable adverse impacts to:

- Lahontan cutthroat trout (*Oncorhynchus clarki henshawi*), as a result of construction of a bridge crossing the Walker River
- Non-critical habitat for the federally threatened Mojave population of the desert tortoise (*Gopherus agassizii*)
- Western snowy plover (*Charadrius alexandrinus nivosus)* along Mina common segment 1
- Northern goshawk (*Accipiter gentilis*) and Ferruginous hawk (*Buteo regalis*) along Montezuma 1, 2, and 3 and the potential North Clayton quarry

Nevertheless, DOE has concluded that there would be a small loss of habitats, and potential deaths of wildlife from trains and construction traffic would be low. Although such impacts would be unavoidable, long-term impacts would be small.

Construction of additional access roads would make ***herd management areas*** more accessible, which would then indirectly, but unavoidably, increase the loss of wild horses, burros, and desert tortoises from human interaction. However, DOE has determined that such impacts would be small and would have a small impact on management strategies within herd management areas. The overall ***indirect impact*** would be small.

8.2.1.8 Noise and Vibration

Railroad operations along the Mina rail alignment would lead to an unavoidable increase in ambient noise from passing trains in areas of Nevada that are mostly uninhabited. Noise from trains might be noticeable as new noise in residential areas near the rail line in Silver Springs, Silver Peak, Mina, and Goldfield. Because there is already some train activity in Silver Springs, additional train noise would be less noticeable there than in other areas where there is no train activity and no train noise at present. DOE estimated noise levels during the operations phase at all sensitive receptor locations along the Mina rail alignment, and found they would be below Surface Transportation Board noise impact criterion. Therefore, DOE has determined that no long-term adverse noise impacts would be expected during railroad operations along the Mina rail alignment. However, during the construction phase, DOE estimated that noise levels at certain receptor locations would be higher than Federal Transit Administration construction noise guidelines. This unavoidable impact would be temporary.

8.2.1.9 Socioeconomics

Construction and operation of the proposed railroad along the Mina rail alignment would unavoidably impact population, housing, employment, and public services in Lyon, Mineral, Esmeralda, Nye, and Clark Counties; traffic; and, to a small extent, local current agriculture, ranching, and mining activities.

Socioeconomic changes during the construction phase would include a brief elevation in project-related employment, temporary population increases, and immediate impact on existing levels of public services (health care, transportation, fire protection, and law enforcement) where construction activities were concentrated near communities. DOE determined that the greatest impacts would be economic, and although unavoidable, would be viewed as beneficial and not adverse. As outlined in Section 4.3.9, DOE demonstrated that construction-related impacts in Lyon, Mineral, Esmeralda, and Nye Counties would result in small increases in peak employment, increases in real disposable income, and increases in gross regional product. The project would generate vehicle trips during facilities construction, both from the movement of materials and from workers traveling to and from the work sites. DOE analyzed highway level of service by looking at traffic volume in terms of the peak hour flow during a 4- to 10- year construction period. DOE determined that there would be some unavoidable impacts from construction of the Rail Equipment Maintenance Yard and Cask Maintenance Facility at Yucca Mountain to traffic on U.S. Highway 95 near the entrances to the Yucca Mountain Site. This effect would degrade the level of service during peak traffic hours. However, this level would represent high density but stable traffic flow and constitute a small, but unavoidable, impact. This unavoidable impact would be temporary, lasting only as long as the construction phase (4 to 10 years, with the peak period limited to 2 years).

Impacts to traffic during railroad operations would be considerably lower than construction-related impacts. DOE determined that Rail Equipment Maintenance Yard operations would affect traffic on U.S. Highway 95 near the entrances to the Nevada Test Site; however, this level would represent high density but stable traffic flow, and constitute a small, but unavoidable, impact. Elsewhere, there would be no impacts or changes to highway levels of service during the operations phase.

Socioeconomic changes during the operations phase would include increases in project-related employment (particularly associated with railroad operations support facilities); slight long-term population increases; moderate pressure on available housing, and fire-protection and health services in southern Nye County; and continued small impacts on mining, ranching and agriculture. DOE determined that the greatest economic gains would arise in Mineral, Esmeralda, and Nye Counties.

8.2.1.10 Occupational and Public Health and Safety

The possibility of nonradiological industrial hazards (such as exposure to physical hazards, chemicals, dust, and pathogens) causing injury or illness to workers during construction and operations would not be completely unavoidable. However, the potential for such impacts would be very small. DOE has estimated that there could be approximately two fatalities associated with all such hazards during rail line and facility construction and 50 years of railroad operations.

There could be radiological impacts to workers and the public from incident-free transportation and facility operations. While the impact would be very small, radiological impacts would not be completely unavoidable. DOE estimated that approximately 0.35 latent cancer fatality could result to workers from incident-free transportation and facility operations, and that approximately 8.5×10^{-4} latent cancer fatality could result to the public from incident-free transportation and facility operations.

There could be radiological impacts from rail accidents involving casks. Radiological impacts from accidents are estimated to result in less than one latent cancer fatality.

There could be radiological impacts from sabotage events involving casks. If a sabotage event occurred in a suburban area, the collective radiation dose to the population is estimated to be 4,700 person-rem. The total latent cancer fatalities for people exposed during a sabotage event is estimated to be three.

By their nature, roadway accidents are considered unavoidable; however, the projected number of roadway accidents that could be attributed to construction and operation of the proposed rail line and facilities would be very small. DOE assessed the potential transportation safety impacts of vehicle traffic on roadways associated with constructing and operating the rail line and facilities. DOE determined that there could be six fatalities on roadways for the 315 million vehicle-kilometers (190 million vehicle-miles) traveled over the construction period, and seven fatalities on roadways for the 420 million vehicle-kilometers (263 million vehicle-miles) traveled during the 50-year operations phase.

Also by their nature, railway accidents are considered unavoidable; however, the projected number of rail accidents that could be attributed to construction and operation of the rail line and facilities would be very small. DOE determined that there could be approximately one fatality associated with the construction and operations phases. DOE also assessed the potential transportation safety impacts of rail traffic on the rail line and at at-grade crossings during the operations phase. The Department estimated that over the 50-year operations phase, 16 rail-related accidents could be expected to occur for the entire set of estimated train movements.

8.2.1.11 Utilities, Energy, and Materials

Some interfacing with existing utility rights-of-way, in particular electric utility lines, would be unavoidable. Temporary unavoidable impacts to utilities during the construction phase could include possible short-term service interruptions as service was switched from existing electric-power lines, telecommunication lines, and water pipelines to new lines crossing the rail line, or to lines that were relocated to avoid railroad construction activities.

The two principal electric providers in the project region, Nevada Power Company and Sierra Pacific Power Company, can currently meet peak load demands of 5,800 megawatts and 1,900 megawatts, respectively, through generating capacity or power-purchase capabilities. In 2005, their electricity sales were estimated to be 19 million megawatt-hours and 8.8 million megawatts, respectively. In addition, the smaller Valley Electric Association, Inc., is a local area power purchaser and reseller. Over the 4- to 10-year construction phase, the electrical power providers in the project region would have adequate generating capacity or power-purchase capabilities (see Section 3.3.11) to supply the project during peak demand without disrupting service to the providers' respective coverage areas. Therefore, although energy use would be unavoidable, anticipated electricity demand to meet construction and operations needs would be modest and would not adversely impact other regional needs for electric power.

As described in Section 4.3.11.2.1.3, DOE estimated that annual consumption of diesel fuel during the construction phase would be 109 million liters (28.8 million gallons), which would represent 6 percent of diesel fuel used annually in Nevada (DIRS 180874- Nevada Rail Partners 2007, Appendix D, Table D-5b). As described in Section 4.3.11.2.2.2, DOE estimated that over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed, and the annual consumption rate would peak at 4.3 million liters (1.1 million gallons), a rate which is less than 0.25 percent of the current annual vehicular diesel fuel usage in Nevada. Although the use of fuel would be unavoidable, its use during either construction or operations would not adversely affect the capacity of national and regional fuel producers and distributors.

The need for construction materials, primarily steel, concrete, and aggregate, would be unavoidable, but would represent a small fraction of available materials (see Table 4-284). The regional and national impacts of meeting such needs would be small. Materials needed during the operations phase would be much less than during the construction phase, remaining considerably below available capacity, and impacts would not be adverse.

8.2.1.12 Hazardous Materials and Waste

The generation of some general solid wastes, special wastes (construction debris, used tires, and other materials with specific management requirements), and hazardous materials would be unavoidable, primarily during railroad construction. DOE would handle all wastes in accordance with applicable regulations, and would implement best management practices and pollution prevention/waste minimization programs. As described in Section 4.3.12, DOE estimated that 2,300 metric tons (2,500 tons) per year of nonhazardous solid waste (such as general household waste) would be generated during the construction phase, for a daily rate of about 6.3 metric tons (6.9 tons). Nonrecyclable wastes would be disposed of, which would raise the total amount disposed of in the four-county area of Mineral, Nye, Esmeralda, and Clark Counties by approximately 0.077 percent. In addition, DOE estimated that construction activities would generate approximately 12,000 metric tons (13,100 tons) of industrial and special wastes per year, for an approximate daily rate of 33 metric tons (36 tons), which would result in an increase of approximately 0.41 percent in waste receipt to local landfills.

DOE estimated that 170 metric tons (190 tons) per year or 0.45 metric tons (0.5 tons) per day of nonhazardous solid waste would be generated at railroad operations support facilities, which would raise the total amount disposed of in the four-county area by less than 0.01 percent. There would be ample disposal capacities to accept the small amounts generated of low-level radioactive wastes from the Cask Maintenance Facility of 3,200 to 7,900 cubic meters (113,000 to 280,000 cubic feet) over the 30- to 50-year lifetime of this project (DIRS 181425-MTS 2007, Table 2).

Although the use of disposal facilities would be unavoidable, existing disposal facilities have ample capacity to handle all additional wastes.

8.2.1.13 Cultural Resources

Because of the length of the Mina rail alignment and the complexity associated with engineering a feasible alignment, DOE used a phased cultural resource identification and evaluation approach, as described in 36 CFR 800.4(b)2, to identify specific cultural resources as is fully described in Section 4.3.13. DOE has surveyed approximately 20 percent of the area for cultural resources. Based on cultural resources already identified, it is reasonable to conclude that there may be undiscovered cultural resources in the Mina region of influence. The number and extent of identified cultural resource sites throughout the Mina rail alignment region of influence will continue to increase as more surveys and inventories of potentially disturbed land are completed.

Nevertheless, construction activities could cause unavoidable disturbance or destruction of cultural resources. Disturbance or destruction could occur during ground-disturbing activities along the Mina rail alignment, at quarries, along temporary access roads, at borrow sites, at temporary construction camps, and at railroad operations support facilities. During construction, larger numbers of workers in the vicinity of the construction camps could increase the potential for impacts to nearby cultural resources. Excavation and other construction-related ground-disturbing activities could unearth additional cultural materials that were either thought, based on previous archaeological surveys, to occur only at ground surface, or were previously undetected because they were completely underground.

Railroad construction and operation could also lead to unavoidable changes in cultural landscapes, such as changes to ethnographic, rural historic, and historic viewscapes. Cultural landscapes include historic-period Northern Paiute use of the Walker River and Walker Lake areas; historic-period Western Shoshone villages and surrounding use areas in the Oasis Valley and Goldfield areas; and historic mining in the Luning, Mina, and Goldfield districts.

DOE would further modify the rail alignment, as necessary, to avoid discovered cultural resources. Based on preliminary information and sample surveys, any impacts would likely range from small to moderate because of an extensive effort to avoid or mitigate them.

8.2.1.14 Paleontological Resources

DOE has not identified paleontological resources at or close to the Mina rail alignment, nor do these areas have a strong potential to contain important paleontological resources. While there could be a potential to uncover previously unknown fossils during railroad construction, DOE would consult with the BLM to develop appropriate measures to minimize damage to paleontological resources during project-related construction if fossils were found. DOE has not identified any unavoidable adverse impacts.

8.2.1.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Mina rail alignment would not result in disproportionately high and adverse human health, environmental, ecological, or cultural impacts on minority populations, low-income communities, or American Indian tribes from construction and operation of a rail line along the Mina rail alignment. DOE has not identified impacts, unavoidable or otherwise, in the context of environmental justice.

8.2.2 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Council on Environmental Quality regulations that implement the procedural requirements of NEPA require consideration of “the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity” (40 CFR 1502.16). This includes using “ … all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generation of Americans” (NEPA, Section 101, 42 U.S.C. 4331).

This section discusses the short-term use of the environment and the maintenance of its long-term productivity. Chapter 4 provides more detailed discussions of the impacts and resource utilization associated with the Proposed Action and the Shared-Use Option. Construction and operation of the proposed railroad would require short-term uses of land and other resources. Any long-term loss of productivity in disturbed areas would be small. The land-cover types along the proposed rail alignment are widely distributed throughout the region of influence and any loss of vegetation in the disturbed area along the rail alignment would have little impact on the regional productivity of plants and animals. Future long-term land uses such as grazing or mining would not be precluded by the short-term use of the land for the proposed rail line. The relationships between short-term uses and long-term productivity would not be meaningfully altered if either the Proposed Action or Shared-Use Option were implemented, or by the selection of alternative segments within the Mina corridor.

DOE anticipates temporary short-term disturbances of about 0.002 square kilometer (0.55 acre) of wetlands along Schurz alternative segments 1 and 4, and 0.003 square kilometer (0.73 acre) of wetlands along Schurz alternative segments 5 and 6 during construction of a bridge at the Walker River crossing. Permanent fill or loss of wetlands would total about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

Productivity loss for soils should be limited to the disturbed areas impacted by land clearing, grading, and construction. Most disturbed areas not permanently maintained for railroad operations would recover over time, although recovery and a return to natural productivity could be slow for disturbed biological communities in an arid environment. DOE would revegetate disturbed areas with appropriate native species. DOE estimated a maximum of 14,000 square meters (3.5 acres) of potentially disturbed soils are characterized as prime farmland along the Schurz alternative segments and the minimal loss of these unfarmed soils would not impact long-term productivity.

The areas used for temporary construction camps would likely recover in the short-term because they would be unused after construction activities ceased. DOE would implement restoration activities to encourage natural vegetation to grow on these sites. The Department might eventually abandon the proposed rail line and its operations support facilities, although it is unlikely that the rail roadbed would ever be completely dismantled. The proposed rail line and these facilities could be turned over to commercial carriers, especially if the Shared-Use Option were selected, and could continue to aid economic productivity in the region. Under the Shared-Use Option, the proposed rail line could increase transportation opportunities and lower transportation costs in the region.

The short-term withdrawal of water from the temporary construction wells could have a small impact on groundwater availability. However, DOE has projected that drawdowns would be sufficiently small to preclude impacts on flow rates or discharge rates at existing productive water-supply wells or springs. There would be no long-term impacts to groundwater resource productivity because the construction wells would only be used for a short time.

8.2.3 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA Section 102 (42 U.S.C. 4332) and Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR 1502.16) require that environmental analyses include identification of "… any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible commitment of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity, whereas an irretrievable commitment of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the utilization opportunities foregone are irretrievable.

This section describes irreversible and irretrievable commitments of resources associated with implementation of the Proposed Action along the Mina rail alignment. Sections 8.2.3.1 to 8.2.3.15 discuss resource commitments that could be irreversible and irretrievable. Irreversible and irretrievable commitments of resources would not meaningfully vary among alternative segments along the Mina rail alignment, or by implementation of the Shared-Use Option.

8.2.3.1 Physical Setting

Construction of the rail line and railroad construction and operations support facilities along the Mina rail alignment could displace mineral deposits. Although no minerals would be removed, placement of the rail line could displace mineral deposits and reduce their availability for mining, if any were found within the construction right-of-way. If these circumstances occurred and options for future use of minerals were limited, there would be an irreversible commitment of resources.

8.2.3.2 Land Use and Ownership

Construction and operation of the proposed railroad would require the commitment of land for placement of the rail line, construction and operations support facilities, and access roads. If at a future date DOE were to abandon the railroad, although much of the construction material might be removed, it is not likely that all of the natural landscape would be restored, and some of the land commitment would remain irreversible. Following abandonment of the railroad, the appropriate lands along the Mina rail alignment would be relinquished back to the BLM, the Walker River Paiute Tribe, and Department of Defense at the Hawthorne Army Depot.

8.2.3.3 Aesthetic Resources

DOE determined that the visual impacts of operating trains would range from no visual contrast to strong visual contrast, and that the long-term visual impacts of marks on rock, soil, and vegetated landscape from cuts, fills, well pads, and access roads would range from weak to strong (see Section 4.3.3). The rail alignment would remain consistent with BLM visual resource management objectives where areas of high visual value are managed to minimize contrast levels, and areas of lower visual value are allowed higher contrast levels. Where land commitment was irreversible, aesthetic impacts would sometimes remain irreversible.

8.2.3.4 Air Quality

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment.

8.2.3.5 Surface-Water Resources

Permanent fill or loss of wetlands would total about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6. This could result in an irreversible commitment of resources.

8.2.3.6 Groundwater Resources

DOE estimated that a total of 7.3 billion cubic meters (5,900 acre-feet) of water would be required for railroad construction and operations, all of which DOE assumed would be obtained through the construction of new water wells. Although this water would be consumed, this would not be an irretrievable commitment. Over time, because the amount of groundwater withdrawn represents a fractionally small percentage of the available groundwater in storage, and the withdrawals would be limited primarily to the railroad construction period, it is anticipated that this water would be replenished through the natural water cycle following the railroad construction phase. Some of the water used for compaction would return to groundwater aquifers. For these reasons, it is expected that there would be no adverse long-term impacts to existing groundwater resources.

8.2.3.7 Biological Resources

The areas that would be occupied by the rail line, railroad construction and operations support facilities, and access roads would be irreversibly removed from natural habitat for the life of the proposed railroad. In addition, the disturbances of the desert soil surfaces in areas of temporary construction activity could result in changes that would be irreversible over the long term. The permanent conversion of vegetation resources and wildlife habitat along the rail line and at construction and operations support facilities could represent an irreversible commitment of biological resources for the life of the railroad and beyond if, following abandonment, DOE did not restore these resources, or if former vegetation cover and composition did not recover. Losses of wildlife during railroad construction and operations would represent an irretrievable commitment of biological resources.

8.2.3.8 Noise and Vibration

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment.

8.2.3.9 Socioeconomics

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment.

8.2.3.10 Occupational and Public Health and Safety

As discussed in Section 8.2.1.10, nonradiological industrial hazards (such as exposure to chemicals, dust, and pathogens) could cause injury or illness to workers during railroad construction and operations; however, DOE estimated the risk as approximately two fatalities. Radiological impacts to workers (0.35 latent cancer fatality) and the general public (8.5×10^{-4} latent cancer fatality) could occur from incident-free transportation, and DOE estimated the risk to be each less than one. DOE assessed the potential transportation safety impacts of movement on roadways, the rail line, at operations support facilities, and at grade crossings associated with railroad construction and operation. DOE estimated that there could be six vehicular-related fatalities during construction, seven vehicular-related fatalities during operations, and approximately one rail-related fatality during construction and operations.

8.2.3.11 Utilities, Energy, and Materials

As described in Section 4.3.11, DOE estimated that annual consumption of diesel fuel during the railroad construction phase would be 109 million liters (28.8 million gallons). Over an anticipated 50-year operations lifecycle, 119 million liters (31.5 million gallons) of diesel fuel would be consumed, and if the Shared-Use Option was implemented during the operations period, a total of 390 million liters (103.5 million gallons) would be consumed (DIRS 180874-Nevada Rail Partners 2007, Appendix D, Table D-5a). Fossil fuel consumed would be irreversible, and any portion of fuel consumed that was bio-fuel would be considered irretrievable. DOE has established an 8 megawatt power requirement (which includes a 30-percent reserve) for the Rail Equipment Maintenance Yard and Cask Maintenance Facility (DIRS 181033-Hamilton-Ray 2007, all). Fossil fuel or nuclear resources that generated that electricity would be irreversible.

As described in Section 4.3.11, railroad construction would require an estimated 63,000 metric tons (69,000 tons) of steel and 373,000 metric tons (411,000 tons) of concrete. Approximately 776,000 concrete railroad ties would be required for track construction. The estimated requirement for rail line ballast would be approximately 2.5 million metric tons (2.8 million tons), approximately 2.2 million metric tons (2.4 million tons) for subballast (DIRS 180874-Nevada Rail Partners 2007, Section 3.1.1, p. 3-1). Use of these materials would not be considered an irretrievable commitment of resources because they could be recovered and recycled if DOE eventually abandoned the rail line.

8.2.3.12 Hazardous Materials and Waste

DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment, other than the irreversible loss of land used for landfills.

8.2.3.13 Cultural Resources

Cultural resources (archeological, historical, and ethnographic) are nonrenewable resources and any loss would be irreversible. At this time, DOE cannot fully characterize potential effects on cultural resources along the Mina rail alignment or the magnitude of these effects.

8.2.3.14 Paleontological Resources

At this time DOE has not identified any impacts to paleontological resources along the Mina rail alignment, but any impact that could occur would be irreversible.

8.2.3.15 Environmental Justice

DOE determined that constructing and operating the proposed railroad along the Mina rail alignment would not cause high or adverse impacts to fall disproportionately on minority or low-income populations. Thus, DOE did not identify any associated irreversible and irretrievable commitments of resources along the Mina rail alignment that would present an environmental justice concern.

PREPARERS, CONTRIBUTORS, AND REVIEWERS

This chapter identifies the individuals who had key responsibilities in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, and summarizes their education and professional experience.

Preparers and Contributors

The U.S. Department of Energy (DOE or the Department) provided direction to the NEPA analysis team, which was responsible for developing the analytical methodology and alternatives, coordinating the work tasks, performing the impact analyses, and producing the documents. DOE is responsible for data quality, scope, content, issue resolution, and direction.

In addition, Bechtel SAIC Company, LLC, and its subcontractors prepared engineering-based documentation and information that was independently evaluated and incorporated into the Nevada Rail Corridor SEIS and the Rail Alignment EIS. DOE retained the responsibility for determining the appropriateness and adequacy of incorporating any data, analyses, and results of other work performed by these organizations into the SEIS and the EIS; the NEPA analysis team integrated this work in the documents.

The table below lists the names, education, experience summaries, and responsibilities of key personnel who managed, prepared, contributed to, and reviewed the Rail Corridor SEIS and the Rail Alignment EIS.

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 1 of 9).

Name	Education	Experience	Responsibilities
U.S. Department of Energy/Office of National Transportation			
M. Lee Bishop	B.S., Biology, 1987	16 years – NEPA; environmental permitting and protection; health physics; radioactive waste management	SEIS/EIS Document Manager
Robert Black	M.P.A., Public Administration, 1984 M.N.S., Biological Sciences, 1977 B.S., Zoology, 1969	32 years – NEPA compliance; environmental studies; resource management	Technical reviewer
Robert Clark	B.S., Marine Engineering, 1981	24 years – nuclear design; construction; quality assurance; radioactive waste management	Rail line conceptual design; mitigation; technical reviewer
Ned B. Larson	M.S., Geotechnical Engineering, 1982 B.S., Civil Engineering, 1978	25 years – engineering and design of numerous civil structures; soil and rock mechanics investigations; design of facilities to dispose of hazardous and nuclear wastes; project management	Nevada Rail Federal Project Director

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 2 of 9).

Name	Education	Experience	Responsibilities
U.S. Department of Energy/Office of National Transportation (continued)			
Narendra Mathur	M.S., Environmental Engineering, 1972	30 years – NEPA compliance and documentation; environmental, safety, and health compliance; environmental audits; environmental program management; environmental regulatory compliance	National transportation
Robin L. Sweeney	Ph.D., Environmental Science and Public Policy, 2006 M.S., Geosciences, 1987 B.S., Biological Sciences, 1980	22 years – hazardous and nuclear waste field, waste management, RCRA/ CERCLA facility assessments, sampling and monitoring, project and program management, laboratory research	Technical Advisor, Nevada Transportation Project Manager
Mark Vandeberg	B.S., Geology, 1984	22 years – geotechnical/ environmental projects; CERCLA site restoration; DOE FUSRAP program management; environmental compliance and permitting	Technical reviewer
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Management Team			
Michael West Potomac-Hudson Engineering, Inc.	M.S., Environmental Engineering, 2001 B.S., Environmental Engineering, 1993	14 years – NEPA analysis; environmental studies; regulatory analysis; program management	Project Manager Project Controls Officer Deputy Quality Assurance Manager
A. Brook Crossan, P.E. Potomac-Hudson Engineering, Inc.	Ph.D., Geophysical Fluid Dynamics, 1974 M.S., Mechanical Engineering, 1971 B.S., Mechanical Engineering, 1969	35 years – NEPA analysis and mitigation design; environmental permitting; project management	Project Manager Technical reviewer
Jeffrey McCann Potomac-Hudson Engineering, Inc.	B.G.S., Geology, 1980	26 years – geological analysis; NEPA specialist; program management	Deputy Project Manager Engineering interface and project integration
Elizabeth Kavanagh Potomac-Hudson Engineering, Inc.	B.S., Environmental Science, 2000	6 years – NEPA review and supporting studies; environmental management systems; regulatory compliance	Deputy Project Manager Project integration
Robert Peel URS Corporation	B.S., Geography, 1976	30 years – DOE and commercial nuclear projects; NEPA document management; environmental impact analysis; regulatory compliance	Deputy Project Manager

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 3 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Management Team (continued)			
Neil Sullivan ICF International	M.S., Integrated Environmental Management, 1999 B.S., Human and Physical Geography, 1994	11 years – NEPA documentation for rail and other nonlinear projects; environmental program management; technical and policy analysis	Deputy Project Manager Lead, Rail Alignment EIS Chapter 1
Judith Shipman Potomac-Hudson Engineering, Inc.	A.A., General Studies, 1991	31 years – NEPA documentation; document production coordination; editing; quality assurance	Document Manager Editorial lead
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team			
Jeff Ang-Olson ICF International	Master of City Planning, 1997 M.S., Transportation Engineering, 1997	11 years – passenger and freight transportation planning and analysis	Analyst, Shared-Use Option
Matthew Barkley ICF International	M.A., Organizational Management, 2006 Certificate of Environmental Management, 2002 B.S., Environmental Resource Management, 1997	8 years – NEPA and environmental consulting, including cumulative impact assessments, wetland delineations, and hazardous materials surveys	Analyst, mitigation, cumulative impacts
Stephanie Barrett ICF International	M.P.A., Environmental Policy, 1998 B.S., Geology, 1994	11 years – environmental policy analysis, including hazardous waste, land revitalization programs, and land use impact for NEPA projects; 2.5 years – RCRA and groundwater contamination sampling and reporting	Analyst, land-use impacts and Rail Alignment EIS Chapter 2
Anthony Becker Potomac-Hudson Engineering, Inc.	B.S., Biology, 2003	4 years – NEPA analysis	Lead analyst, waste and hazardous materials
Mark Bethoney ICF International		16 years – GIS and computer-aided mapping	GIS, CAD, map atlas creation/production, graphics
Fred Carey, P.E. Potomac-Hudson Engineering, Inc.	M.S., Environmental Engineering, 1997 B.S., Civil Engineering, 1992	15 years – NEPA management and impact analysis; civil engineering	Senior Technical Reviewer
Edward Carr ICF International	M.S., Atmospheric Science, 1983 B.S., Meteorology, 1979	19 years – air quality impact assessments; air quality modeling; emission inventory development; meteorological data collection and assessment	Lead analyst, air quality and climate

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 4 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Austina Casey Potomac-Hudson Engineering, Inc.	M.S., Environmental Sciences, 2001 B.S., Chemistry, 1990	16 years – environmental compliance; air permits and air quality impact assessments preparation; emissions inventory development; RCRA investigations	Analyst, air quality and climate
Nancy Clark Potomac-Hudson Engineering, Inc.	J.D., 2004 M.S.E.L., Environmental Law, 2004 B.S., Chemical Engineering, 2001	7 years – NEPA analysis; nuclear waste engineering; environmental law	Analyst, statutory requirements Engineering interface
David Coate ICF International	M.S., Energy Technology, 1980 B.A., Mathematics, 1978 B.A., Physics, 1978 B.A., Chemistry, 1978	28 years – acoustics and vibrations analysis	Lead analyst, noise and vibration
Brian Colson URS Corporation	B.S., Geography, 2004	2 years – NEPA projects; various FEMA projects; energy projects, and transportation projects for public and private sectors	Cartographer GIS analyst for biological, cultural, and groundwater resources
Anna Compton URS Corporation	M.S., Geography, pending (coursework, examinations, and research completed) B.S., Logistics & Transportation, 2003	5 years – GIS analysis; cartography	Analyst, water resources
Charina Contreras		10 years – administrative and records support	Administrative record and references support
Theodore Coogan ICF International	B.S., Environmental Earth Science, 1986	23 years – marine geochemistry and geospatial sciences	GIS and mapping
Mary Jo Crance URS Corporation	M.S., pending B.S., Environmental Science, 1991 B.A., Environmental Studies, 1991 A.A.S., Laboratory Technology, 1985	18 years – radiological, chemical, and biological characterizations and mitigations through habitat investigations; surface-water sampling; groundwater sampling; NEPA analysis	Analyst, water resources
Maria de la Paz Aviles Potomac-Hudson Engineering, Inc.	M.S., Environmental Management and Planning, 2004 B.S., Biological Resources Engineering, 2002	5 years – NEPA support; field studies	GIS, CAD, graphics creation and production

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 5 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
James Dendy URS Corporation	B.S., Geology, 1999 (emphasis in hydrogeology)	8 years – senior environmental consultant/hydrogeologist for DoD and DOE	Analyst, groundwater resources
Steve Diem URS Corporation	M.S., Biology, 1999 B.S., Engineering Geology, 1994	9 years – geological consulting and paleontology	Technical reviewer, paleontological resources
Michelle Moser ICF International	M.S., Biological Sciences, 2005 B.S., Environmental Sciences, 2002	4 years- environmental and biological studies; NEPA analysis; regulatory analysis	Quality assurance support; SEIS editorial support
Frank Gallivan ICF International	Master of City Planning, 2006 B.A., Economics / Classical Archaeology, 2001	3 years – transportation studies, master planning, and land use studies	Analyst, Shared-Use Option
Lynne Gilman Potomac-Hudson Engineering, Inc.		35 years – document management; quality control	Project and quality controls; reference traceability
Elizabeth Gormsen ICF International	M.P.P., Public Policy, 2002 B.A., Economics, 1998	6 years – policy analysis; economic and regulatory analysis; socioeconomic impact analysis	Analyst, socioeconomics
Joe Grieshaber Potomac-Hudson Engineering, Inc.	M.B.A., Finance, 1984 M.S., Biology, 1974 B.S., Biology, 1972	30 years – NEPA analysis; project management; environmental compliance	Technical reviewer; project controls
Mark Hale URS Corporation	M.A., pending (coursework, examinations, and research completed) B.A., Anthropology,1983	25 years – federal experience, including DOE and BLM; NEPA document preparation for variety of federal projects, including rail construction; NEPA review and evaluations; Section 106 Compliance	Analyst, cultural resources
Brian Harper URS Corporation	M.S., Nuclear Engineering, 2006 B.S., Chemical Engineering, 1997	3 years – radiological monitoring/analysis; investigation of nuclear fuel cycle impacts; groundwater and contaminant transport modeling	Analyst, water resources

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 6 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Seth Hartley ICF International	M.S., Atmospheric Sciences, 2000 B.S., Physics, 1996	7 years – air pollution and air quality, particularly as related to transportation, as well as general numerical modeling, engineering, and data handling and analysis issues	Analyst, air quality and climate
Jennifer Kelly URS Corporation	B.S., Earth Science, 2004 B.A., Anthropology, 1993	3 years – environmental investigation projects; environmental remediation; groundwater and soil investigations; sampling and analysis reports	Analyst, groundwater resources
Michael Kelly URS Corporation	M.A., Anthropology, 1986 B.A., Anthropology, 1978	26 years – cultural resources management; Great Basin archaeology	Lead Analyst, cultural resources and American Indian interests
Kavi Koleini URS Corporation	B.S., Environmental Science, 1999	7 years – natural resource inventory, analysis, and reporting; preparation of NEPA documents for long-term land-use plans	Biological surveys of potential quarry sites
Tanvi Lal ICF International	M.S.E.S., Environmental Conservation and Management, 2006 M.P.A., Environmental Economics and Policy, 2006 B.S., Life Sciences, 2001	1 year – NEPA analysis, environmental science, natural resource conservation, and environmental economics	Project controls; quality assurance
David Lawrence URS Corporation		12 years – visual simulation and analysis; experience with the BLM Visual Resource Management system and the U.S. Forest Service Visual Management System	Analyst, aesthetics
Robert Lanza ICF International	M. Eng., Chemical Engineering, 1982 B.S., Chemical Engineering, 1980	25 years – NEPA document preparation and review, including NEPA documentation for proposed radioactive and hazardous waste management units and radioactive and hazardous materials transportation projects	Lead analyst, occupational and public health and safety
Alistair Leslie ICF International	Ph.D., Chemistry, 1975 B.A., Physics and Chemistry, 1966	30 years – NEPA analysis, environmental regulation and compliance; electric-power generation and transmission; energy analysis; air pollution analysis; air quality legislation; atmospheric chemistry research	Lead analyst, utilities, energy, and materials; unavoidable impacts Lead, Summary and Rail Alignment EIS Chapter 6

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 7 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Jon Luellen URS Corporation	B.S., Geology, 1979 B.S., Physics, 1977	19 years – hydrogeologic investigations; site characterization; monitoring system design and implementation; site remediation; water resource assessments; nuclear disposal facility design and licensing	Lead analyst, groundwater resources
Jamie Martin-McNaughton Potomac-Hudson Engineering, Inc.	B.S., Geology-Biology, 2003	4 years – NEPA analysis, geology and soils science	Lead analyst, physical setting, geology, soils
Kristine Mayer URS Corporation	B.S., Geography, 2004	2 years – NEPA projects; various FEMA projects; energy projects	Cartographer GIS analyst
David McIntyre Potomac-Hudson Engineering, Inc.	M.S., Environmental Management, 1997 M.A., Geography, 2000 B.S., History 1990	16 years – NEPA analysis; environmental studies; program management	Lead, Nevada Rail Corridor SEIS
Aaron McKinnon Potomac-Hudson Engineering, Inc.		10 years – document production, graphics	Lead desktop publisher; graphics coordinator
Evelyn Mayfield		30 years – writing, editing, document production	Editorial support
Michelle Moser ICF International	M.S., Biological Sciences, 2005 B.S., Environmental Science, 2002	5 years – NEPA analysis, rulemaking support, and ecological risk assessments	Analyst, mitigation and best management practices
Elena Nilsson URS Corporation	M.A., Anthropology, 1985 B.A., English, 1978	28 years – cultural resources management; NEPA document preparation for variety of federal projects, including rail construction; NEPA review and evaluations; Section 106 Compliance	Analyst, cultural resources
Becky Oldham Potomac-Hudson Engineering, Inc.	B.S., English, 1991	15 years – NEPA analysis; document management	Lead analyst, environmental justice
Cynthia Ong Potomac-Hudson Engineering, Inc.	M.S., Environmental Science, 2003 B.S., Civil Engineering, 1994	5 years – land development; stormwater design; NEPA analysis	Analyst, transportation; surface water; utilities, energy, and materials
Marek Ostrowski URS Corporation	M.S., Water Resources and Hydraulics, 1999 B.S., Civil Engineering, 1989	17 years – hydrogeology, hydrology and hydraulics; groundwater flow and contaminant transport modeling; design of drainage and remediation systems; water supply evaluations	Analyst, water resources

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 8 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS and Rail Alignment EIS Preparation Team (continued)			
Dautis Pearson URS Corporation	B.S., Biology, 1994	22 years – land management planning; interdisciplinary and interagency team leading and facilitation; NEPA document preparation	Analyst, biological resources
Stephanie Pesek URS Corporation	B.S., Animal Science, 1997	7 years – threatened and endangered species surveys; NEPA document preparation; Section 404 permitting	Analyst, biological resources
Polly Quick ICF International	Ph.D., Anthropology, 1976 M.A., Anthropology, 1970 B.A., Anthropology, 1968	31 years – NEPA analysis; public participation	Lead analyst, aesthetics and socioeconomics
Jean Reynolds URS Corporation	M.S., Meteorology, 1967 B.S., Meteorology, 1965	18 years – meteorological research; 6 years – air quality permitting, NEPA analysis; program management, regulatory compliance and waste management	Lead analyst, paleontological resources
Danny Rakestraw URS Corporation	M.S., Wildlife Ecology, 1995 B.S., Wildlife Ecology, 1986	16 years – endangered species compliance; environmental impact monitoring; biological resource studies	Analyst, biological resources and water resources
Mike Rivera Potomac-Hudson Engineering, Inc.	B.S., Environmental Planning and Analysis, 1993 B.S., Earth Science, 1992	13 years – NEPA analysis; wetland specialist	Analyst, water resources
Rachel Spangenberg Potomac-Hudson Engineering, Inc.	B.S., Biology, 1987	19 years – NEPA analysis; hazardous wastes; solid wastes	Analyst, physical setting
Mike Stanwood ICF International	M.S., Mineral Economics, 1979 B.A., Psychology, 1975	23 years – NEPA project management and process management; socioeconomics; land use; cultural resources; environmental justice; visual resources	Lead analyst, cumulative impacts and mitigation
Michelle Stegner URS Corporation	M.A., Anthropology, 2007 (pending) B.A., Geography-Anthropology, 1999	11 years – cultural resources management, Great Basin archaeology, NEPA document preparation; Section 106 compliance	Analyst, cultural resources
Adam Teepe ICF International	M.S., Environmental Science and Management, 2004 B.S., Environmental Geology, 2001	3 years – environmental impact analysis	Lead, Rail Alignment EIS Chapter 2 Engineering interface

DOE and contractor personnel education, experience, and responsibilities in preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS (page 9 of 9).

Name	Education	Experience	Responsibilities
Nevada Rail Corridor SEIS Rail Alignment EIS Preparation Team (continued)			
Nathan Wagoner ICF International	M.S., Human Dimensions of Ecosystem Science and Management, 2006 B.S., Natural Resources Integrated Policy and Planning, 2003	4 years – parks and recreation and visitor use characteristics	Analyst, aesthetics and land use
Toni Washington Potomac-Hudson Engineering, Inc.		17 years – federal records management	Administrative record and technical reference coordination; records management
Jen Wennerlund URS Corporation	B.S., Geography, Cartography, Remote Sensing, Land Use Planning, 1987	18 years – geosciences, GIS analyst, manager; NEPA analysis for federal, state, and private projects	GIS Manager
Marcy Westover URS Corporation	B.S., Biology, 2000	6 years – natural resources; ecology; threatened and endangered species surveys; NEPA document preparation	Analyst, biological resources
Brian Whipple, P.E. Potomac-Hudson Engineering, Inc.	M.S., Information Science, 2003 B.S., Environmental Engineering, 1993	14 years – NEPA analysis; environmental remediation; engineering studies; regulatory compliance	Lead analyst, surface-water resources
Hovalin Woods ICF International	M.P.A., Environmental Policy and Management, 2001 B.S., Finance, 1999	7 years – NEPA analysis for rail projects and other linear projects, environmental management systems	Analyst, cumulative impacts
Audra Ziolkowski Potomac-Hudson Engineering, Inc.	B.A, Journalism/Mass Communications English, 1995	12 years – Editing, writing, proofreading, fact checking	Editor
Zintars Zadins URS Corporation	Ph.D., Geology, 1989 M.S., Geology, 1983 B.S., Geology, 1979	19 years – geologic and environmental remediation investigations in the academic, federal, and private sectors	Peer reviewer, groundwater resources

a. BLM = Bureau of Land Management; CAD = computer-aided design; CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act; DoD = U.S. Department of Defense; DOE = U.S. Department of Energy; FEMA = Federal Emergency Management Agency; FUSRAP = Formerly Utilized Sites Remedial Action Program; GIS = geographic information system; NEPA = National Environmental Policy Act; RCRA = Resource Conservation and Recovery Act.

Reviewers

The DOE Yucca Mountain Project Office incorporated input into the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS from a number of other DOE offices that reviewed the document while it was under development. These offices included:

- The Office of Naval Reactors, Nuclear Energy
- The Office of Repository Development
- National Nuclear Security Administration, Nevada Operations Office

Cooperating and Consulting Agencies

Cooperating and consulting agencies in the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, who provided appropriate input or participated in document review and comment resolution processes, are as follows:

- Cooperating agencies
  - U.S. Bureau of Land Management
  - Surface Transportation Board
  - U.S. Air Force
- Consulting agencies
  - U.S. Bureau of Indian Affairs
  - Walker River Paiute Tribe
  - U.S. Army

Disclosure Statements

As required by federal regulations (40 Code of Federal Regulations 1506.5c), Potomac-Hudson Engineering, Inc., and its subcontractors have signed National Environmental Policy Act of 1969 (42 United States Code 4321) disclosure statements in relation to the work they performed on the Nevada Rail Corridor SEIS and the Rail Alignment EIS. These statements appear on the following pages.

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certify as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a) X Has no past, present, or currently planned financial interest in the outcome of the project.

(b) Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Contractual Interest:

(a) X Has no past, present, or currently planned contractual interest in the outcome of the project.

(b) Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Organizational Interest:

(a) X Has no past, present, or currently planned organizational interest in the outcome of the project.

(b) Has the following organizational interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

(b) Has the following other interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to Potomac-Hudson Engineering, Inc.'s participation on the instant contract.

Certified by:

08/12/05

Signature Date

Fred Carey, Vice President

Name & Title (Printed)

Potomac-Hudson Engineering, Inc.

Company

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certifies as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a) X Has no past, present, or currently planned financial interest in the outcome of the project.

(b) Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Contractual Interest:

(a) X Has no past, present, or currently planned contractual interest in the outcome of the project.

(b) Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

2.

3.

Organizational Interest:

(a) X Has no past, present, or currently planned organizational interest in the outcome of the project.

(b) Has the following organizational interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

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3.

Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

(b) Has the following other interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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3.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to ICF Incorporated's participation on the instant contract.

Certified by:

Michael Berg 8/10/05

Signature Date

Michael Berg, Senior Vice President

Name & Title (Printed)

ICF Incorporated, LLC

Company

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certify as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a) X Has no past, present, or currently planned financial interest in the outcome of the project.

(b) Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

Contractual Interest:

(a) Has no past, present, or currently planned contractual interest in the outcome of the project.

(b) X Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

California Institute of Technology
200 E. California Blvd., Pasadena CA 91125-0600
Nathan Niemy, PhD, (626) 395-6166
URS is completing development of Environmental Assessments of potential impacts of new geodetic monitoring stations to be installed by CalTech in southern Nevada and southeastern California. The stations will be used to monitor minute movements in the tectonic plates in the region so that the Department of Energy can evaluate potential performance of the Yucca Mountain repository. CalTech is installing the stations as a subcontract to the University of Nevada System on a grant from the DOE. URS' interest in the project will be completed in by the end of September, if not earlier.
URS POC: Danny Rakestraw
Client Contract Number: 26698733
Wilbur Smith Associates
201 Mission Street, Suite 1450, San Francisco CA, 94105
Justin Fox, Chief of Rail Studies, 415-495-6201 (Fax) 415-495-5305
As a subcontractor to Wilbur Smith Associates, URS evaluated potential economic benefits to the counties of Nye, Lincoln and Esmeralda from a new freight rail line to serve the federal geologic waste repository at Yucca Mountain, Nevada. This preliminary assessment involved quantifying the freight traffic that would be generated by the new rail line, or diverted from shipment via truck, and translating transportation cost savings into local economic benefit. Shippers and potential shippers throughout the rail corridor were interviewed regarding their interest in rail shipment, and the savings it would represent. In addition, URS assessed the potential benefits the three counties might gain via involvement in the planning, construction, ownership and operation of the railroad.

URS POC: D. Sanford Stadtfeld
Client Contract Number: None Assigned
Bechtel SAIC
1180 Town Center Drive, Las Vegas, NV 889144
Richard Pernisi, (702) 821-7720
Development of preclosure seismic design and posclosure performance assessment ground motions for the repository and surface facilities. Activities include geotechnical and geological site characterization and numerical modeling of earthquake ground motions.
URS POC Ivan Wong
Subcontract #QA-HC4-00443

Organizational Interest:

(a) X Has no past, present, or currently planned organizational interest in the outcome of the project.

(b) Has the following organizational interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to URS Group Inc.'s participation on the instant contract.

Certified by:

[signature] August 11, 2005
Signature Date

Edward Jennrich, Vice President
Name & Title (Printed)

URS Group, Inc
Company

Disclosure Statement

Environmental Impact Statement
Rail Alignment for the Nevada Transportation Project
DE-RP28-05RW12351

DEAR 952.209-8 ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE requires an offeror to provide a statement of any past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the statement of work. The offeror is to provide a statement that no actual or potential conflict of interest or unfair competitive advantage exists with respect to the advisory and assistance services to be provided in connection with the instant contract or that any actual or potential conflict of interest or unfair competitive advantage that does or may exist with respect to the contract in question has been communicated as part of the statement.

"Financial interest or other interest in the outcome of the project" includes "any financial benefit such as a promise of future construction or design work in the project, as well as indirect benefits the contractor is aware of (e.g., if the project would aid proposals sponsored by the firm's other clients)". See 46 FR 18026-18031.

In accordance with these requirements, the entity signing below hereby certify as follows: (check either (a) or (b) and list items being disclosed if (b) is checked).

Financial Interest:

(a) X Has no past, present, or currently planned financial interest in the outcome of the project.

(b) Has the following financial interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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Contractual Interest:

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(b) Has the following contractual interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

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Organizational Interest:

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Other Interest:

(a) X Has no past, present, or currently planned other interest in the outcome of the project.

(b) Has the following other interest in the outcome of the project and hereby agree to mitigate to the extent necessary to preclude a conflict prior to award of this contract:

1.

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3.

Unfair Competitive Advantage:

To the best of my knowledge and belief, no unfair competitive advantage exists with regard to Image Associates, LLC participation on the instant contract.

Certified by:

Signature 8/11/05
Date

Diane L. Gunter, President

Name & Title (Printed)

Image Associates, LLC

Company

GLOSSARY

DOE prepared this glossary to help readers understand information in the Supplemental Yucca Mountain Nevada Rail Corridor EIS and Rail Alignment EIS. This glossary includes definitions of technical and regulatory terms common to DOE NEPA documents and explains these terms with their most likely meanings in the context of DOE NEPA documents, and in particular this document. To better aid the reader, a number of terms in this glossary emphasize their specific relationship to the proposed railroad project and to the Yucca Mountain Repository. DOE obtained each definition from an authoritative source (for example, a statute, regulation, DOE directive, dictionary, or technical reference book).

Words in ***bold italics*** refer to other words in the glossary.

100-year flood — A flood event of such magnitude that it occurs, on average, every 100 years; this equates to a 1-percent chance of its occurring in a given year. A base flood may also be referred to as a 100-year storm. The area inundated during the base flood is sometimes called the 100-year ***floodplain***.

136 RE rail — This term denotes rail with a nominal weight of 136 pounds per yard specified in English units, and is also specified as 132 metric tons per kilometer (234 tons per mile) for two-rail track.

500-year flood — A flood event of such magnitude that it occurs, on average, every 500 years; this equates to a 0.2-percent chance of its occurring in a given year.

50-year flood — A flood event of such magnitude that it occurs, on average, every 50 years; this equates to a 2-percent chance of its occurring in a given year.

accessible environment — For this ***environmental impact statement*** (EIS), all points on Earth outside the surface and subsurface area controlled over the long term for the ***repository***, including the atmosphere above the controlled area.

accident — An unplanned sequence of events that results in undesirable consequences. Examples in this Rail Alignment EIS include an inadvertent release of ***radiation*** from the ***casks*** or hazardous materials from their containers; train derailments; vehicular accidents; and construction-related accidents that could affect workers.

acre-foot — A unit commonly used to measure water volume. It is the quantity of water required to cover 4,047 square meters (1 acre) to a depth of 0.3048 meter (1 foot), and is equal to 1,233.5 cubic meters (325,851 gallons).

AERMOD (**A**MS/**E**PA **R**egulatory **Mod**el)	A short-range steady-state ***air quality*** dispersion model. The model incorporates air dispersion concepts based on the state-of-the-science understanding of planetary boundary layer turbulence structure and scaling concepts. On December 9, 2005, AERMOD became the U.S. Environmental Protection Agency (EPA) preferred air dispersion model in place of ISC3.
AERMET (**AER**MOD **Met**eorological Preprocessor)	The meteorological preprocessor component of ***AERMOD***. Surface meteorological observations, hourly cloud-cover observations, and twice-a-day upper air sounds are "preprocessed" by AERMET into data used by AERMOD.
AERMAP (**AER**MOD **Map**s terrain Preprocessor)	The terrain preprocessor that uses data from the Digital Elevation Model Database and creates a file suitable for use within ***AERMOD***. This file contains elevation and hill-height scaling factors for each receptor for use by AERMOD.
aerosol	A suspension of tine, ***colloid***-size particles or liquid droplets in air. Fog and smoke are common examples of aerosols.
affected environment	For an EIS, a description of the existing ***environment*** (site description) covering information that relates directly to the scope of the ***Proposed Action***, the ***No-Action Alternative***, and the ***implementing alternatives*** being analyzed; that is, the information necessary to assess or understand the ***impacts***. This description must contain enough detail to support the impact analysis. The information must highlight "environmentally sensitive resources," if present; these include ***floodplains*** and ***wetlands***, ***threatened*** and ***endangered species***, prime and unique agricultural lands, and property of historic, archaeological, or architectural significance.
Agreement State	A state that reaches an agreement with the U.S. Nuclear Regulatory Commission (NRC) to assume regulatory authority to license and regulate ***radioactive*** materials.
air quality	A measure of the concentrations of pollutants, measured individually, in the air.
alien species	With respect to a particular ***ecosystem***, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem.
alkalinity	Acid-neutralizing capacity of a substance. High alkalinity conditions can promote metal ***corrosion***.
alluvial fan	A low, outspread, relatively flat-to-gently sloping mass of loose rock material, shaped like an open fan or a segment of a cone, deposited by a stream where it issues from a narrow mountain valley on a plain or break valley.
alluvium	A general term for the sedimentary material deposited by flowing water.

alpha particle

A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium ***nucleus*** and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***

alternative

One of two or more actions, processes, or propositions, from which a decisionmaker will determine the course to be followed. The National Environmental Policy Act, as amended, states that in preparing an EIS, an agency "shall … (s)tudy, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" [42 U.S.C. 4321, Title I, Section 102(E)]. The regulations of the Council on Environmental Quality that implement the National Environmental Policy Act indicate that the alternatives section is "the heart of the ***environmental impact statement*** (40 CFR 1502.14), and include rules for presentation of the ***alternatives***, including no action, and their estimated impacts.

The Nevada Rail Corridor SEIS analyzes one alternative to the ***Proposed Action***, the ***No-Action Alternative***. Under the Nevada Rail Corridor SEIS No-Action Alternative, the U.S. Department of Energy (DOE or the Department) would not select a ***rail alignment*** within the Mina ***rail corridor*** for the construction and operation of a ***railroad***. As such, the No-Action Alternative provides a basis for comparison to the Proposed Action.

The Rail Alignment EIS analyzes one alternative to the Proposed Action – the No-Action Alternative – and two implementing alternatives under the Proposed Action – the Caliente Implementing Alternative and the Mina Implementing Alternative – for constructing, operating, and possibly abandoning a ***railroad*** for the shipment of ***spent nuclear fuel*** and ***high-level radioactive waste*** for long-term ***disposal*** in a ***geologic repository*** at Yucca Mountain. Under the No-Action Alternative, DOE would not construct the proposed railroad along the Caliente rail alignment or the Mina rail alignment.

alternative segments

Geographic region of the ***rail alignment*** for which multiple routes for the ***rail line*** have been identified. In this Rail Alignment EIS, there are different alignments identified within the Caliente ***rail corridor*** and the Mina ***rail corridor*** that could minimize or avoid environmental ***impacts*** and reduce construction complexities.

ambient

(1) Undisturbed, natural conditions such as ambient temperature caused by climate or natural subsurface thermal gradients. (2) Surrounding conditions.

ambient air

The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It is not the air in the immediate proximity to emission sources.

ambient air quality standards	Standards established on a federal or state level that define the limits for airborne concentrations of designated ***criteria pollutants*** [***nitrogen dioxide***, ***sulfur dioxide***, ***carbon monoxide***, ***particulate matter*** with aerodynamic diameters less than 10 microns (***PM_{10}***), particulate matter with aerodynamic diameters less than 2.5 microns (***$PM_{2.5}$***), ***ozone***, and lead] to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).
ambient noise	The sum of all sounds (noise is unwanted sound) at a specific location over a specific time.
animal unit month	(1) A standardized unit of measurement of the amount of forage necessary for the complete sustenance of one animal for 1 month. (2) A unit of measurement of grazing privileges that represents the privilege of grazing one animal for 1 month.
aquifer	A subsurface saturated rock unit (formation, group of formations, or part of a formation) of sufficient ***permeability*** to transmit ***groundwater*** and yield usable quantities of water to wells and springs.
aquitard	A rock unit or layer that stores water and allows it to move only at a very slow rate.
Areas of Critical Environmental Concern	Places within the public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, and other natural systems, or processes or to protect life and safety from natural hazards.
arid	(1) Areas in which mean annual evaporation exceeds mean annual precipitation; (2) having insufficient rainfall to support agriculture; (3) the hyper-arid zone (arid index 0.03) comprising dry land areas without vegetation with the exception of a few scattered shrubs. Annual rainfall is low, rarely exceeding 100 millimeters (4 inches). In the arid zone (arid index 0.03-0.20), the native vegetation is sparse, being comprised of annual and perennial grasses and other herbaceous vegetation, and shrubs and small trees. There is high rainfall variability, with annual amounts ranging between 100 and 300 millimeters (4 and 12 inches).
at-grade crossing	Occurs when a roadway and a ***rail line*** cross paths at the same elevation.
atomic mass	The mass of a neutral atom, based on a relative scale, usually expressed in atomic mass units. See ***atomic weight.***
atomic nucleus	See ***nucleus***.
atomic number	The number of ***protons*** in an atom's ***nucleus***.

atomic weight	The relative mass of an atom based on a scale in which a specific carbon atom (carbon-12) is assigned a mass value of 12. Also known as relative ***atomic mass***.
A-weighted decibel scale	See ***decibel, A-weighted***.
Back Country Byway	A vehicle route that traverses scenic corridors utilizing secondary or back country road systems
background radiation	***Radiation*** from cosmic sources, naturally occurring ***radioactive*** materials such as granite, and global fallout from nuclear testing.
ballast	The coarse rock that is placed under the ***railroad*** tracks to support the railroad ties and improve drainage along the ***rail line***.
barrier	Any material, structure, or condition (as a thermal barrier) that prevents or substantially delays the movement of water or ***radionuclides***.
basalt	A dark gray to black, dense to fine-grained, ***igneous*** rock.
baseline	The existing environmental conditions against which impacts of a ***proposed action*** and its alternatives can be compared.
berm	A mound or wall of earth.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a ***radioactive*** transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
bio-based products	Energy, industrial, and consumer products made from renewable biological resources such as wood, agricultural residues, and fiber crops.
BLM-designated sensitive species	Species not already conferred U.S. Bureau of Land Management (BLM) special status by virtue of being (1) a federally listed, proposed, or ***candidate species***, or (2) a State of Nevada listed species. BLM policy is to provide these species with the same level of protection that is provided for candidate species in BLM Manual 6840.06 C.
block-bounding fault	A high-angle, ***normal fault*** with relatively large displacement that bounds one or both sides of the fault-block mountains typical of the Basin and Range province.
blowing soil	A soil characteristic based on the soil survey classification of susceptibility of a given soil to wind erosion. The blowing soils characteristic identifies areas where fine-textured, sandy materials predominate and where uncontrolled soil disturbance could result in increased wind erosion.

boiling-water reactor (BWR)	A ***nuclear reactor*** that uses boiling water to produce steam to drive a turbine.
borehole	For this Rail Alignment EIS, a hole drilled for purposes of collecting geotechnical information.
borosilicate glass	***High-level radioactive waste matrix*** material in which boron takes the place of the lime used in ordinary glass mixtures. See ***vitrification***.
borrow sites	Areas outside the ***nominal*** width of the ***rail-line construction right-of-way*** where construction personnel could obtain materials to be used in the establishment of a stable platform (subgrade) for the rail track. Aggregate crushing operations could occur in these areas.
buffer car	A flatbed railcar that would be placed at the front of a ***cask*** train between the locomotive and the first ***cask car*** and at the back of the train between the last cask car and the ***escort car***. Federal regulations require the separation of a railcar carrying ***spent nuclear fuel*** and ***high-level radioactive waste*** from a locomotive, occupied caboose, carload of undeveloped film, or railcar carrying another class of hazardous material by at least one ***buffer car***. These could be DOE railcars or, in the case of general freight service, commercial railcars.
caldera	An enlarged volcanic crater formed by explosion or collapse of the original crater.
cancer	A malignant tumor of potentially unlimited growth, capable of invading surrounding tissue or spreading to other parts of the body.
candidate species	Species for which the U.S. Fish and Wildlife Service has enough substantive information on biological status and threats to support proposals to list them as threatened or endangered under the Endangered Species Act. Listing is anticipated but has been precluded temporarily by other listing activities. See ***threatened species***, ***endangered species***.
canister	An unshielded metal container used as: (1) a pour mold in which molten vitrified ***high-level radioactive waste*** can solidify and cool; (2) the container in which DOE and electric utilities place intact ***spent nuclear fuel***, loose rods, or nonfuel components for shipping or ***storage***; or (3) in general, a container used to provide ***radionuclide confinement***. ***Canisters*** are used in combination with specialized overpacks that provide structural support, ***shielding*** or confinement for storage, transportation, and ***emplacement***. Overpacks used for transportation are usually referred to as transportation ***casks***; those used for emplacement in a ***repository*** are referred to as ***waste packages***.
carbon monoxide (CO)	A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; one of the six pollutants for which there is a national ***ambient air quality standard***.
carcinogen	An agent capable of producing or inducing ***cancer***.

carcinogenic	Capable of producing or inducing ***cancer***.
case file, BLM	A file typically including the following information: a report identifying the present users of the lands and how they would be affected; a report specifying water use for the project and how water would be obtained; an Environmental Assessment or ***EIS***; and floodplain and wetland impact statements. 43 CFR 2310.3-2 describes the required contents of a case file.
cask	A heavily shielded container that meets applicable regulatory requirements used to ship ***spent nuclear fuel*** or ***high-level radioactive waste***.
cask car	A railcar that would be used to transport ***casks*** of ***spent nuclear fuel*** or ***high-level radioactive waste***.
Cask Maintenance Facility	Processing location for empty transportation casks used to transport canistered fuel, including testing, inspection, maintenance, and decontamination
casual use	Activities ordinarily resulting in no or negligible disturbance of the public lands, resources, or improvements, including surveying, marking routes, and collecting data to use to prepare grant applications.
Census County Division	A statistical subdivision of a county, established and delineated cooperatively by the U.S. Census Bureau and state, local, and tribal officials for data presentation purposes. Census County Divisions have been established in states that do not have minor civil divisions suitable for data presentation. In these cases, minor civil divisions have not been legally established, do not have governmental or administrative purposes, have boundaries that are ambiguous or change frequently, or generally are not well known to the public.
Class 1 Area (related to air quality)	A specifically designated area in which the degradation of ***air quality*** is stringently restricted (for example, many national parks, wilderness areas).
Class 1 commercial railroad	The Surface Transportation Board defines a Class 1 commercial railroad as one with an annual operating revenue exceeding $277.7 million.
Class 3 road	A light-duty, paved or improved road.
Class 4 road	An unimproved, unsurfaced road (includes track roads in back country).
Class I inventory (related to cultural resources)	A study of published and unpublished documents, records, files, registers, and other sources, resulting in analysis and synthesis of all reasonably available data.

Class II inventory (related to cultural resources)	A sample-oriented field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area to make possible an objective estimate of the nature and distribution of cultural resources in the entire defined area.
Class III inventory (cultural resources)	An intensive field survey designed to locate and record all cultural resource sites within a specified area. Upon completion of such an inventory, no further cultural resource inventory work is normally needed in the area.
clastic	Describing a rock or sediment composed mainly of broken fragments of preexisting minerals or rocks that have been transported from their places of origin.
cloudshine	***Irradiation*** of the human body by ***neutrons*** and ***gamma rays*** emitted by the passing plume of ***radioactive*** material.
collective dose	See ***population dose***.
colloid	Small particles in the size range of 10^{-9} to 10^{-6} meters that are suspended in a solvent. Naturally occurring colloids in ***groundwater*** arise from clay minerals.
colluvium	Loose earth material that has accumulated at the base of a hill through the action of gravity.
commercial spent nuclear fuel	Commercial nuclear fuel rods that have been removed from ***reactor*** use at civilian nuclear power plants that generate electricity. See ***spent nuclear fuel*** and ***DOE spent nuclear fuel***.
committed groundwater resource	Within a given hydrographic area, the total volume of permitted, certificated, and vested groundwater rights that are recognized by the State Engineer and have been approved for withdrawal in a ***hydrographic area*** in any given year.
common segment	Geographic region of the ***rail alignments*** for which a single route for the ***rail line*** has been identified.
community water system	A public water system that serves year-round residents of a community, subdivision, or mobile home park that has more than 15 service connections or an average of more than 25 residents for more than 60 days of the year.
Condition 1, 2, 3	BLM ranking of areas for their potential to contain paleontological resources: ***Condition 1 -*** Areas that are known to contain vertebrate ***fossils*** or noteworthy occurrences of invertebrate or plant fossils. ***Condition 2 -*** Areas with exposures of geological units or settings that have high potential to contain vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils. ***Condition 3*** - Areas that are very unlikely to produce vertebrate fossils or noteworthy occurrences of invertebrate or plant fossils.

cone of depression	The lowering of the ***water table*** in a cone-shaped depression around a pumped well.
confinement	As it pertains to ***radioactivity***, the retention of ***radioactive*** material within some specified bounds. Confinement differs from containment in that there is no absolute physical ***barrier*** in the former.
construction and operations support facilities	Construction support facilities are the temporary facilities that would be used during the ***railroad*** construction phase (***construction camps***, quarries, some access roads, and some water wells). Operations support facilities are the permanent structures that would be used during the railroad operations phase (***Staging Yard***, ***Interchange Yard***, ***Maintenance-of-Way Facilities***, ***Rail Equipment Maintenance Yard***, ***Cask Maintenance Facility***, some access roads, and some water wells).
construction camps	Areas along the ***rail alignment*** that could be used as temporary residences for construction crews, material and equipment storage areas, and concrete production areas. Such camps would be used during rail-line construction activities far from population centers.
construction right-of-way	Property obtained for construction of the proposed railroad. This right-of-way would have a ***nominal*** width of 150 meters (500 feet) on either side of the centerline of the ***rail line***, but would vary at specific locations to accommodate, for example, certain deep ***cuts*** and ***fills***, and construction of drainage controls. In addition, some facilities (such as quarries) would be outside the nominal width of the ***construction right-of-way***, but DOE would also obtain rights-of-way in these areas. See ***operations right-of-way***.
contaminant	A substance that contaminates (pollutes) air, soil, or water. It could also be a hazardous substance that does not occur naturally or that occurs at levels greater than those occurring naturally in the surrounding ***environment***.
contamination	The intrusion of undesirable elements (unwanted physical, chemical, biological, or radiological substances, or matter that has an adverse effect) to air, water, or land.
convection	(1) Thermally driven ***groundwater*** flow or a heat-transfer mechanism for a gas phase. The bulk motion of a flowing fluid (gas or liquid) in the presence of a gravitational field, caused by temperature differences that, in turn, cause different areas of the fluid to have different densities (for example, warmer is less dense). (2) One of the processes that moves solutes in groundwater.
corrosion	The process of dissolving or wearing away gradually, especially by chemical action.
cosmic radiation	A variety of high-energy particles including ***protons*** that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level, where the Earth's atmosphere is most dense and provides the greatest protection.

cosmogenic radionuclides	***Radioactive*** nuclides generated when the upper atmosphere interacts with many of the ***cosmic radiations***. Common cosmogenic ***radionuclides*** include carbon-14, tritium, and beryllium-7.
criteria air pollutants	Six common pollutants (***ozone***, ***carbon monoxide***, ***particulate matters***, ***sulfur dioxide***, lead, and ***nitrogen dioxide***) known to be hazardous to human health and the ***environment***, and for which the U.S. Environmental Protection Agency sets National ***Ambient Air Quality Standards*** under the Clean Air Act. See ***toxic air pollutants***.
crustal extension	Descriptive of the slow movement off ***tectonic plates*** stretching Earth's outer layer of rocks.
culvert	A conduit for conveying surface water through an embankment.
cumulative impact	The ***impact*** on the ***environment*** that results from the incremental impact(s) of an action when added to other past, present, or reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.
cut	Cutting away from the top of a slope to fill in at the bottom, thereby providing a suitable grade for the rail ***roadbed***. See ***fill***.
day-night average noise level	The energy average of ***A-weighted decibel*** sound levels over 24 hours, which includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the daytime.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called ***decay products***.
decay product	A ***nuclide*** resulting from the radioactive decay of a parent isotope or precursor nuclide.
decay series	The ***radioactive decay*** of different discrete radioactive decay products as a chained series of transformations. Most ***radioactive*** elements do not decay directly to a stable state, but rather undergo a series of ***decays*** until eventually a stable isotope is reached.
decibel (dB)	A standard unit for measuring sound pressure levels based on a reference sound pressure of 0.0002 dyne per square centimeter. This is the smallest sound a human can hear.

decibel, A-weighted (dBA)	A frequency-weighted ***noise*** unit that corresponds approximately to the frequency response of the human ear and thus correlates well with loudness. It is widely used for traffic and industrial noise measurements.
dedicated train	A train that handles only one commodity. For the proposed ***railroad***, this separate train with its own crew would limit switching between trains of the railcars carrying ***spent nuclear fuel*** and ***high-level radioactive waste***.
demand (related to groundwater)	The amount (volume) of water needed to complete a specified action.
desert	***Arid***, barren land incapable of supporting any considerable population without an artificial water supply.
designated groundwater basin	A ***hydrographic area*** identified by the State of Nevada when permitted water rights approach or exceed the estimated ***perennial yield*** and the water resources are being depleted or require additional administration.
dip-slip fault	A ***fault*** in which the relative displacement is along the direction of dip of the fault plane. If the block above the fault has moved downward, it is a ***normal fault***; upward movement indicates a ***reverse fault***.
direct impact	Effect that results solely from the construction or operation of a ***proposed action*** without intermediate steps or processes. Examples include ***habitat*** destruction, soil disturbance, air emissions, and water use.
disposal (of spent nuclear fuel and high-level radioactive waste)	The ***emplacement*** in a ***repository*** of ***spent nuclear fuel***, ***high-level radioactive waste***, or other highly ***radioactive*** material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the ***isolation*** of such waste from the ***accessible environment***.
disproportionately high and adverse environmental impacts	An environmental ***impact*** that is unacceptable or above generally accepted norms; these would include economic impacts of the ***Proposed Action***. A disproportionately high impact is one (or the ***risk*** of one) to a ***low-income population*** or ***minority population*** that significantly exceeds the impact to the general population. In assessing cultural and aesthetic impacts, agencies consider impacts that would have unique effects on geographically dislocated or dispersed low-income or minority populations.
distance zones	Landscape divisions based on their relative location to common viewpoints: foreground to middleground, background, and seldom seen. The foreground-middleground zone includes areas less than 5 to 8 kilometers (3 to 5 miles) away. The background zone includes areas visible beyond the foreground-middleground zone but usually less than 24 kilometers (15 miles) away. Areas not seen as foreground-middleground or background are in the seldom-seen zone.

DOE spent nuclear fuel	***Radioactive*** waste created by defense activities that consists of more than 250 different ***waste forms***. The major contributor to this waste form is the N-Reactor fuel currently stored at the Hanford Site. This waste form also includes 65 ***metric tons of heavy metal*** of ***naval spent nuclear fuel***.
dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
dose equivalent	(1) The number (corrected for background) zero and above that is recorded as representing an individual's ***dose*** from external ***radiation*** sources or internally deposited ***radioactive*** materials; (2) the product of the absorbed dose in ***rads*** and a quality factor; (3) the product of the absorbed dose, the quality factor, and any other modifying factor. The ***dose equivalent*** quantity is used for comparing the biological effectiveness of different kinds of radiation (based on the quality of radiation and its spatial distribution in the body) on a common scale; it is expressed in ***rem***.
dose rate	The ***dose*** per unit time.
dose risk	The product of a ***radiation dose*** and the ***probability*** of its occurrence.
duty (related to groundwater)	The amount of water either appropriated or under consideration for appropriation by the Nevada State Engineer to a water rights holder in the State of Nevada. Duty is typically specified in terms of a total annual duty or total duty granted over a specified seasonal period to a water rights holder. A ***pending annual duty*** value represents an annual duty for which an appropriation application has been submitted to the State Engineer for consideration and that the State Engineer has classified as a pending annual duty value within a specified ***groundwater*** basin (***hydrographic area***), in accordance with Nevada Revised Statutes contained in Chapter 533 and pursuant to the application review process contained in Nevada Revised Statutes 533.370.
earthquake	A series of elastic waves in the crust of the Earth caused by abrupt movement easing strains built up along ***geologic faults*** or by volcanic action and resulting in movement of the Earth's surface.
ecoregion	A relatively discrete set of ***ecosystems*** characterized by certain plant communities or assemblages.
ecosystem	A community of organisms and their physical environment interacting as an ecological unit.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
EIS	See ***environmental impact statement***.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.

emplacement	The placement and positioning of ***waste packages*** in the ***repository***.
endangered species	A species that is in danger of extinction throughout all or a significant part of its range; a formal listing of the U.S. Fish and Wildlife Service under the Endangered Species Act.
endemic	Being native to one location only.
environment	(1) Includes water, air, and land and all plants and humans and other animals living therein, and the interrelationship existing among these. (2) The sum of all external conditions affecting the life, development, and survival of an organism.
environmental impact statement (EIS)	A detailed written statement that describes: "...the environmental impact of the ***proposed action***; any adverse environmental effects which cannot be avoided should the proposal be implemented; ***alternatives*** to the proposed action; the relationship between local short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Preparation of an EIS requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments.
environmental justice	The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Executive Order 12898, *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to make achieving environmental justice part of their missions by identifying and addressing ***disproportionately high and adverse effects*** of agency programs, policies, and activities on ***minority populations*** and ***low-income populations***.
environmental resource areas	Areas examined for potential environmental impacts as part of the National Environmental Policy Act analysis process. Examples include ***air quality***, ***hydrology***, and biological resources.
ephemeral (creek, stream, wash, river, drainage)	A channel with a bed above the normal water table and only flows in direct response to precipitation or snowmelt within its drainage basin.

equivalent sound levels (L_{eq})	A single value of sound level for any desired duration (such as 1 hour), which includes all of the time-varying sound energy in the measurement period. L_{eq} correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant.
erionite	A natural fibrous zeolite in the rocks in and around Yucca Mountain that is listed as a known human ***carcinogen*** by recognized international agencies such as the International Agency for Research on Cancer.
erodes easily (soil characteristic)	A measure of the susceptibility of bare soil to be detached and moved by water. These soils, which tend to contain relatively high amounts of silts and ***loams***, have fair to poor erosion characteristics when disturbed.
escort cars	Railcars in which escort personnel would travel on trains carrying ***spent nuclear fuel*** or ***high-level radioactive waste***.
ethnographic	Describing the study and systematic recording of human cultures.
ethnographic landscape (ethnographic cultural landscape)	(1) A landscape containing a variety of natural or cultural resources that contemporary cultural groups define as meaningful because they are inextricably and traditionally linked to their own local or regional histories, cultural identities, beliefs, and behaviors. (2) A landscape that helps inform what it means to be a member of a particular culture, especially a culture (such as the American Indian culture) that is tied religiously to that landscape.
evapotranspiration	The combined processes of evaporation and plant ***transpiration*** that remove water from the soil and return it to the air.
exposure (to radiation)	The condition of being subject to the effects of or potentially acquiring a ***dose*** of ***radiation***. The incidence of radiation on living or inanimate material by ***accident*** or intent. Background exposure is the exposure to natural ionizing radiation. Occupational exposure is the exposure to ***ionizing radiation*** that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.
exposure pathway	The course a chemical or physical agent takes from the source to the exposed organism; describes a unique mechanism by which an individual or population can become exposed to chemical or physical agents at or originating from a release site. Each exposure pathway includes a source or a release from a source, an exposure point, and an exposure route.
fan piedmont	The area along the base of a mountain slope within a large ***alluvial fan***.
fan remnants	Parts of an older ***alluvial fan*** that remain after erosion has removed most of the fan.
fan skirt	The area along the base of the ***alluvial fan*** in a valley.

fault	A ***fracture*** or a fracture zone in crustal rocks along which there has been movement of the fracture's two sides relative to one another, separating one continuous rock stratum or vein into parts.
faulting	The movement of the Earth's crust that produces relative displacement of adjacent rock masses along a ***fracture***.
fill	The material used to fill the bottom of a slope with material cut away from the top of a slope, thereby providing a suitable grade for the rail ***roadbed***. (See ***cut***.)
Fiscal Year	A 12-month period to which a jurisdiction's annual budget applies and at the end of which its financial position and the results of its operations are determined. For example, the Fiscal Year for Clark and Nye Counties, the Cities of Las Vegas and North Las Vegas, the Towns of Tonopah and Pahrump, and the Clark County and Nye County School Districts is from July 1 through the following June 30; the federal fiscal year runs from October 1 through the following September 30.
fission	The splitting of a ***nucleus*** into at least two other nuclei, resulting in the release of two or three ***neutrons*** and a relatively large amount of energy.
fission products	***Radioactive*** or nonradioactive atoms produced by the ***fission*** of heavy atoms, such as uranium.
floodplain	The lowlands adjoining inland and coastal waters, and relatively flat areas and flood-prone areas of offshore islands, including, at a minimum, that area inundated by a 1-percent or greater chance flood in any given year. The base floodplain is defined as the 100-year (1.0-percent) floodplain. The critical action floodplain is defined as the 500-year (0.2-percent) floodplain. (See ***100-year flood***, ***50-year flood***, ***500-year flood***.)
fluvial	Of or pertaining to rivers or produced by the action of a stream or river.
footprint	The area that would be covered by the ***rail line*** or ***rail-line construction and operations support facilities***. For certain of these facilities (for example, quarry sites), this would be the area inside the site fence line.
fossil	Fossils include the body remains, traces, and imprints of plants or animals that have been preserved in the Earth's crust since some past geologic or prehistoric time. Generally, to be considered a fossil, the remains must be older than recent in age (older than 10,000 years). Fossils are found in ***sedimentary rock***.
fracture	A general term for any break in a rock, or the act of breaking, whether or not it causes displacement, caused by mechanical failure from stress. Fractures include cracks, ***joints***, and ***faults***. Fractures can act as pathways for rapid ***groundwater*** movement.
free-use permit	An authorization to extract mineral materials from public lands at no charge. The BLM issues free-use permits to a federal or state agency when the materials are for use in a public project.

fuel assembly	A number of fuel elements held together by structural materials, used in a ***nuclear reactor***; sometimes called a fuel bundle.
fugitive dust	***Particulate matter*** composed of soil; can include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is removed or redistributed.
fugitive emissions	(1) Emissions that do not pass through a stack, vent, chimney, or similar opening where they could be captured by a control device. (2) Any air pollutant emitted to the atmosphere other than from a stack. Sources of fugitive emissions include pumps; valves; flanges; seals; area sources such as ponds, lagoons, landfills, piles of stored material (such as coal); and road construction areas or other areas where earthwork occurs.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
geologic repository	A system for the ***disposal*** of ***radioactive*** waste in excavated geologic media, including surface and subsurface areas of operation, and the adjacent part of the geologic setting that provides ***isolation*** of the radioactive waste in a controlled area.
geotextiles	Fabrics manufactured from synthetic fiber that are used for soil reinforcement, to allow for drainage, and to control erosion.
graben	An elongated block of rock down-dropped along roughly parallel normal faults.
grade (related to a rail line)	The ratio of elevation change to the distance traveled by a train, expressed as a percent. For example, a 1-meter (3.28-foot)-change in elevation over 100 meters (328 feet) of track is a 1-percent grade.
grade-separated crossing	Occurs when a roadway and a ***rail line*** cross paths and one passes over the other via an overpass or under the other via an underpass.
grazing allotment	An area where one or more livestock operators graze their livestock. An allotment generally consists of federal land but may include parcels of private or state-owned land.
grant	Any authorization or instrument (for example, easement, lease, license, or permit) the BLM issues under Title V of the Federal Land Policy and Management Act (43 U.S.C. 1761 *et seq.*).
gray water	Non-industrial wastewater generated from domestic processes such as washing dishes, laundry, and bathing. Gray water gets its name from its cloudy appearance and from its status as being neither fresh nor heavily polluted.
groundshine	The ***radiation dose*** received from an area on the ground where ***radioactivity*** has been deposited by a ***radioactive*** plume or cloud.

gross regional product	The dollar value of all final goods and services produced in a given year in a specific region (such as the ***region of influence***).
ground vibration	The rapid linear motion of a compression wave in the ground caused by a single or repeated force or impact to the ground, as in the action of a pile driver, or a tire hitting a bump or pothole in a road.
groundwater	Water contained in pores or fractures in either the ***unsaturated*** zone or ***saturated zone*** below ground level.
habitat	Area in which a plant or animal lives and reproduces.
half-life	The time in which half the atoms of a ***radioactive*** substance ***decay*** to another nuclear form. Half-lives range from millionths of a second to billions of years depending on the stability of the nuclei.
hardpan	A layer of hard subsoil that prevents the ***infiltration*** of water or roots.
hazardous air pollutant	An air pollutant not covered by ***ambient air quality standards*** but which may present a threat of adverse human health effects or adverse environmental effects, and is specifically listed on the federal list of 189 hazardous air pollutants in 40 CFR 61.01.
hazardous chemical	As defined under the Occupational Safety and Health Act (Public Law 91-956) and the Emergency Planning and Community Right-to-Know Act (42 U.S.C. 116), a chemical that is a physical or health hazard.
hazardous pollutant	A ***hazardous chemical*** that can cause serious health and environmental hazards; listed on the federal list of hazardous air pollutants (Clean Air Act; 42 U.S.C. 7412). See ***toxic air pollutants***.
hazardous waste	Waste that appears on the list of hazardous materials prepared by the U.S. Environmental Protection Agency or a state or local regulatory agency, or if it has characteristics defined as hazardous by such agency. If the Environmental Protection Agency does not list a material as hazardous,, it can be considered a hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C: ignitability, corrosivity, reactivity, or toxicity.
herd management area (HMA)	Areas where wild horses and burros were found on public lands when the Wild and Free-Roaming Horses and Burros Act passed in 1971. The BLM evaluates each area to determine if there is adequate food, water, cover, and space to sustain healthy and diverse wild horse and burro populations over the long term. The areas that meet these criteria are then designated herd management areas in BLM land-use plans.
heritage tourism	Heritage tourism is "the business and practice of attracting and accommodating visitors to a place or area based especially on the unique or special aspects of that locale's history, landscape (including trail systems), and culture." (Section 7 of Executive Order 13287).

hertz	A unit of frequency equal to one cycle per second.
high-level radioactive waste	(1) The highly ***radioactive*** material that resulted from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains ***fission products*** in sufficient concentrations.
hi-rail truck	A vehicle that is capable of traveling on roads or on railroad tracks.
historic tourism	Traveling to experience the places, artifacts, and activities that authentically represent the stories and people of the past and present.
hydric soil	Soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. Hydric soils are used to characterize ***wetland*** conditions.
hydrogeology	A study that encompasses the interrelationships of geologic materials and processes involving water.
hydrographic area	In reference to Nevada ***groundwater***, divisions of the state into groundwater basins and sub-basins based primarily on topographic features such as mountains and valleys. The state uses the map of hydrographic areas as the basis for water planning, management, and administration. (Because they are based heavily on topographic features, hydrographic area boundaries sometimes differ from groundwater basin designations developed from studies of inferred or measured groundwater flow patterns.)
hydrology	(1) The study of water characteristics, especially the movement of water. (2) The study of water, involving aspects of geology, oceanography, and meteorology.
igneous	(1) A type of rock formed from a molten, or partially molten, material. (2) An activity related to the formation and movement of molten rock either in the subsurface (plutonic) or on the surface (***volcanic***).
impact	For an EIS, the positive or negative effect of an action (past, present, or future) on the natural ***environment*** (land use, ***air quality***, water resources, geological resources, ecological resources, aesthetic and scenic resources) and the human environment (***infrastructure***, economics, social, and cultural).
impact limiters	Devices attached to rail and truck ***shipping casks*** that would help absorb impact energy in the event of a collision.

implementing alternative
: An action or proposition by DOE necessary to implement the ***Proposed Action*** and to enable the estimation of the range of reasonably foreseeable ***impacts*** of that action or proposition. In this Rail Alignment EIS, there are two implementing alternatives under the Proposed Action:

1. The Caliente Implementing Alternative, under which DOE would construct and operate the proposed ***railroad*** from in or near the City of Caliente, Nevada, westward and then southward to ***Yucca Mountain***.

2. The Mina Implementing Alternative (the non-preferred alternative), under which DOE would construct and operate the proposed railroad from Hazen, Nevada, southeastward to Yucca Mountain. Under this implementing alternative, DOE would use the existing Union Pacific Railroad Hazen Branchline from Hazen to Wabuska, Nevada, and would not perform any construction activities along this portion of the rail alignment.

in attainment
: The U.S. Environmental Protection Agency designates an area as being in attainment for a particular pollutant if ***ambient*** concentrations of that pollutant are below the National ***Ambient Air Quality Standards***.

in situ
: In its natural position or place. The phrase distinguishes in-place experiments, conducted in the field or underground facility, from those conducted in the laboratory.

incident-free transportation
: Routine transportation in which cargo travels from origin to destination without being involved in an ***accident***.

indirect impact
: An effect that is related to but removed from a ***proposed action*** by an intermediate step or process. Examples include surface-water quality changes resulting from soil erosion at construction sites, and reductions in productivity resulting from changes in soil temperature.

industrial and special wastes
: Construction debris and other ***solid waste***, such as tires, that have specific management requirements for permitted landfill disposal.

industry track
: A ***siding*** used by a single shipper.

infiltration
: The process of water entering the soil at the ground surface and the ensuing movement downward. Infiltration becomes percolation when water has moved below the depth at which it can return to the atmosphere by evaporation or ***evapotranspiration***.

infrastructure
: Basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication systems.

Interchange Yard
: The ***sidings*** where railcars containing other materials (such as materials needed for construction and operation of the proposed ***railroad*** and the ***repository***) would be decoupled from Union Pacific Railroad trains.

intermittent stream/ intermittent
: A channel bed that fluctuates above or below the normal water table along its length, and may or may not have flow within it during any particular time or at

drainage	any particular location. The presence of flow within the channel is determined by its channel elevation relative to the water table, precipitation events, or snowmelt within its drainage basin.
invasive plant species	An alien species the introduction of which does or is likely to cause economic or environmental harm or harm to human health (Executive Order 13112).
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
Isolate (related to cultural resources)	An isolated artifact occurrence that does not meet the minimum threshold to be designated a "site." Isolates are generally considered ineligible for the *National Register of Historic Places*.
isolation	Inhibiting the transport of ***radioactive*** material so that the amounts and concentrations of this material entering the ***accessible environment*** stay within prescribed limits.
isotropic	Identical in all directions.
joint	A non-tectonic fracture in the surface or linear opening in a rock.
latent	Present and capable of becoming, though not now visible, obvious, or active.
latent cancer fatality	A death that results from ***cancer*** that exposure to ***ionizing radiation*** caused. There typically is a ***latent period*** between the time of the radiation exposure and the time the cancer cells become active.
latent period	(1) The incubation period of a disease. (2) The interval between stimulation and response. (3) The interval between ***radiation exposure*** and the time a cancer becomes active.
level of service (roadway)	A qualitative measure describing operational conditions within a traffic stream, generally described in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.
lithic scatters	Concentrations of waste flakes resulting from the manufacture of stone tools.
lithology	The study and description of the general, gross physical characteristics of a rock, especially sedimentary ***clastics***, including color, grain size, and composition.
loam	A soil composed of a mixture of clay, silt, sand, and organic matter.
locomotive sanding	Area where a locomotive's sand box is filled. Trains use sand for traction.

area

long-term impact	In the Rail Alignment ***EIS***, ***impacts*** that could occur throughout and beyond the life of the ***railroad*** operations phase (up to 50 years).
lost workday cases	Incidents that result in injuries that cause the loss of work time.
low-income population	Defined in terms of U.S. Census Bureau annual statistical poverty levels, may consist of groups or individuals who live in geographic proximity to one another or who are geographically dispersed or transient (such as migrant workers or American Indians), where either type of group experiences common conditions of environmental exposure or effect.
low-level radioactive waste	***Radioactive*** waste that is not classified as ***high-level radioactive waste***, ***transuranic waste***, or byproduct tailings containing uranium or thorium from processed ore. Usually generated by hospitals, research laboratories, and certain industries.
maintenance-of-way activities	Activities to maintain the track, bridges, culverts, grade crossings, signal equipment, and communications equipment along a ***rail line***.
matrix (geology)	The solid, but porous, portion of rock.
maximally exposed individual	A hypothetical individual whose location and habits result in the highest total radiological or chemical ***exposure*** (and thus ***dose***) from a particular source for all exposure routes pathways (for example, inhalation, ingestion, direct exposure).
maximum contaminant level	Under the Safe Drinking Water Act (Public Law 93-523), the maximum permissible concentrations of specific constituents in drinking water that is delivered to any user of a public water system that serves 15 or more connections and 25 or more people; the standards established as maximum contaminant levels consider the feasibility and cost of attaining the standard.
maximum reasonably foreseeable accident	An ***accident*** characterized by extremes of mechanical (impact) forces, heat (fire), and other conditions that would lead to the highest foreseeable consequences. In general, accidents with conditions that have a chance of occurring more often than 1 in 10 million in a year are considered to be reasonably foreseeable.
mesosphere	Belt of atmosphere, just above the stratosphere, from 50 to 80 kilometers (30 to 50 miles) above the Earth's surface.
metamorphic rocks	Rocks that have undergone chemical or structural changes produced by an increase in heat and temperature or by replacement of elements by hot, chemically active fluids.
metric tons of heavy metal	Quantities of ***spent nuclear fuel*** without the inclusion of other materials such as cladding (the tubes containing the fuel) and structural materials. A metric ton is 1,000 kilograms (1.1 tons or 2,200 pounds). Uranium and other metals in spent

	nuclear fuel (such as thorium and plutonium) are called heavy metals because they are extremely dense; that is, they have high weights per unit volume.
mining area	Places where prospecting or mining is known to have occurred, or where concentrations of specific types of minerals are known to exist, but which were never included within an organized mining district. Many of these areas, with continued use, have come to be called ***mining districts***.
mining claim	The description by boundaries of real property in which metal ore and/or minerals may be located. A claim on public land must be filed with the BLM or other federal agency, and the claim must be "worked" by being mined or prepared for mining within a specific period of time. All mining claims are initially ***unpatented claims***, which give the right only for those activities necessary to exploration and mining, and last only as long as the claim is worked every year. The original mining law gave miners the opportunity to obtain patents (deeds from the government), much as farmers could obtain title under the Homestead Act. The owner of a patented claim can put it to any legal use.
mining district	An area usually designated by name with described or understood boundaries where minerals are found and mined under rules prescribed by the miners, consistent with the General Mining Law of 1872.
minority population	A community in which the percent of the population of a racial or ethnic minority is 10 points higher than the percent found in the population as a whole.
mitigation	Actions and decisions that (1) avoid ***impacts*** altogether by not taking a certain action or parts of an action, (2) minimize impacts by limiting the degree or magnitude of an action, (3) rectify the impact by repairing, rehabilitating, or restoring the ***affected environment***, (4) reduce or eliminate the impact over time by preservation and maintenance operations during the life of the action, or (5) compensate for an impact by replacing or providing substitute resources or environments.
mixed low-level waste	***Low-level radioactive waste*** mixed with ***hazardous wastes***; it must satisfy treatment, storage, and disposal regulations both as low-level radioactive waste and as hazardous waste.
movement corridor	A patch of wildlife habitat, generally vegetated, that joins two or more larger areas of wildlife habitat.
native plant species	With respect to a particular ***ecosystem***, a species that, other than as a result of an introduction, historically occurred, or currently occurs in that ecosystem.
naval spent nuclear fuel	***Spent nuclear fuel*** discharged from reactors in surface ships, submarines, and training ***reactors*** operated by the U.S. Navy.
neutron	An atomic particle with no charge and an ***atomic mass*** of 1; a component of all atoms except hydrogen; frequently released as ***radiation***.

nitrogen dioxide	See ***nitrogen oxides***.
nitrogen oxides (oxides of nitrogen; NO_x)	Gases formed in great part from atmospheric nitrogen and oxygen when combustion occurs under conditions of high temperature and high pressure; a major air pollutant. Two primary nitrogen oxides, nitric oxide (NO) and ***nitrogen dioxide*** (NO_2), are noteworthy airborne ***contaminants***. Nitric oxide combines with atmospheric oxygen to produce nitrogen dioxide. Both nitric oxide and ***nitrogen dioxide*** can, in high concentration, cause lung ***cancer***. ***Nitrogen dioxide*** is a ***criteria pollutant***.
No-Action Alternative	Under the No-Action Alternative in the Nevada Rail Corridor SEIS, DOE would not construct and operate a railroad within the Mina ***rail corridor*** from Wabuska to ***Yucca Mountain***. Under the No-Action Alternative the Rail Alignment ***EIS***, DOE would not implement the ***Proposed Action*** in the Caliente or the Mina rail corridor.
nominal	(1) Of, being, or relating to a designated or theoretical size that may vary from the actual. (2) According to plan.
nonattainment area	An area that does not meet the ***ambient air quality standard*** for one or more ***criteria pollutants***. Further designations (for example, serious, moderate) describe the magnitude of the nonattainment.
non-transient, non-community public water system	A public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.
non-native plant species	A species found in an area where it has not historically been found.
nonpoint source pollution	Pollution does not come from a single source but from many unidentifiable sources. An example of nonpoint source pollution would be urban runoff of items like oil, fertilizers, and lawn chemicals. As rainfall or snowmelt moves over and through the ground, it picks up and carries away natural and human-made pollutants. These pollutants are eventually deposited into natural bodies of water, such as lakes, rivers, wetlands, coastal waters, and underground sources of drinking water.
normal fault	A ***fault*** in which the relative displacement is along the direction of dip of the fault plane (***dip-slip fault***) where the block above the fault has moved downward in relation to the block below the fault. See ***reverse fault***.
nuclear radiation	***Radiation*** that emanates from an unstable ***atomic nucleus***.
notable drainage channels	In the Rail Alignment ***EIS***, channels with a stream order of 2 or greater based on Strahler's ordering system, with the National Hydrography Dataset as a base map.

noxious weeds	Any species of plant that is, or is likely to be, detrimental or destructive and difficult to control or eradicate.
nuclear reactor	A device in which a nuclear fission chain reaction can be initiated, sustained, and controlled to generate heat or to produce useful ***radiation***.
nuclear waste	Unusable by-products of nuclear power generation, nuclear weapons production, and research, including ***spent nuclear fuel*** and ***high-level radioactive waste***.
Nuclear Waste Technical Review Board	An independent body established within the Federal Government executive branch, created by the Nuclear Waste Policy Amendments Act of 1987 to evaluate the technical and scientific validity of activities undertaken by DOE, including site characterization activities and activities relating to the packaging or transportation of ***spent nuclear fuel*** or ***high-level radioactive waste***. Members of this Board are appointed by the President from a list prepared by the National Academy of Sciences.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
operations right-of-way	Property that would be obtained for operation of the proposed ***railroad***. This right-of-way would be a ***nominal*** width of 61 meters (200 feet) on either side of the centerline of the ***rail line***, but could vary at specific locations to accommodate, for example, access and maintenance roads, and drainage structures. In addition, some facilities (such as the ***Staging Yard***) would be outside the nominal width of the operations right-of-way, but DOE would also obtain rights-of-way in these areas. See ***construction right-of-way***.
ordinary high water mark	That line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas (33 CFR 328.3e).
other material	In the Rail Alignment EIS, material related to the construction (for example, reinforcing steel and cement) and operation (for example, ***waste packages*** and fuel oil) of the ***repository***.
outcrop	The part of a rock formation that appears at the surface of the ground.
overburden	***Geologic*** material of any nature, consolidated or unconsolidated, that overlies a deposit of useful materials.
ozone (O_3)	The triatomic (three atoms in the molecule) form of oxygen; in the ***stratosphere***, ozone protects the Earth from the sun's ***ultraviolet radiation***, but in lower levels of the atmosphere, it is an air pollutant.

package plant	Modular ***wastewater treatment*** units that can be designed to be portable. Most package plants use some type of biological treatment, which can be based on aerobic, anaerobic, or anoxic conditions and use attached or suspended organisms. Other processes incorporated into package plants can include membrane filtration and disinfection by chlorine, ultraviolet light, or ***ozone***.
particulate matter	Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions. See PM_{10}.
peak particle velocity	The maximum instantaneous positive or negative peak of the vibration signal, measured as a distance per time (such as millimeters or inches per second). This measurement has been used historically to evaluate shock-wave type vibrations from actions like blasting, pile driving, and mining activities, and their relationship to building damage.
pending annual duty	See ***duty***.
perceived risk and stigma	DOE uses the term risk perception to mean how an individual perceives the amount of risk from a certain activity. Studies show that perceived risk varies with certain factors, such as whether the exposure to the activity is voluntary, the individual's degree of control over the activity, the severity of the exposure, and the timing of the consequences of the exposure. DOE uses stigma to mean an undesirable attribute that blemishes or taints an area or locale.
perennial stream	A stream that receives ***groundwater*** into its channel and its streambed is normally below the water table. During years with normal precipitation, a perennial stream will have constant flow.
perennial yield	The estimated quantity of ***groundwater*** that can be withdrawn annually from a ***hydrographic area*** without depleting the ***aquifer***. The Nevada State Engineer uses the perennial yield estimate as a guideline by which to limit groundwater allocations.
permeability	In general terms, the capacity of such mediums as rock, sediment, and soil to transmit liquid or gas. Permeability depends on the substance transmitted (oil, air, water, etc.) and on the size and shape of the pores, ***joints***, and ***fractures*** in the medium and the manner in which they interconnect. "Hydraulic conductivity" is equivalent to "permeability" in technical discussions relating to ***groundwater***.
permeable	Pervious; a permeable rock is a rock, either porous or cracked, that allows water to soak into and pass through it freely.
person-rem	A unit used to measure the ***radiation exposure*** to an entire group and to compare the effects of different amounts of radiation on groups of people; it is the product of the average ***dose equivalent*** (in ***rem***) to a given organ or tissue multiplied by the number of persons in the population of interest.
petroglyph	A carving or inscription on a rock; rock art.

pH	A measure of the relative acidity or ***alkalinity*** of a solution, expressed on scale from 0 to 14, with the neutral point at 7.0. Acid solutions have pH values lower than 7.0, and basic (that is, alkaline) solutions have pH values higher than 7.0.
plate girder bridge	A typical bridge constructed across short spans. It usually looks like a u-shape in cross section, with two steel plates supporting each side of the bridge.
playa	A nearly level area at the bottom of a ***desert*** basin that does not drain to a river and is temporarily covered with water from heavy rains or snowmelts. Normally a dry lakebed that may contain water in response to seasonally high runoff.
pluvial lakes	Lakes that increase in size and depth as a result of increased precipitation and decreased evaporation, characteristic of past environmental conditions that were cooler and wetter than today.
PM_{10}	All ***particulate matter*** with an aerodynamic diameter less than or equal to a nominal 10 micrometers. Particles less than this diameter are small enough to be breathable and could be deposited in lungs.
$PM_{2.5}$	All ***particulate matter*** with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.
population dose	A summation of the ***radiation doses*** received by individuals in an exposed population; equivalent to ***collective dose***; expressed in ***person-rem***.
pressurized-water reactor (PWR)	A ***nuclear*** power ***reactor*** that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.
prime farmland	Land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and that is available for these uses. It has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming methods. In general, prime farmland has an adequate and dependable water supply from precipitation or irrigation, a favorable temperature and growing season, an acceptable level of acidity or ***alkalinity***, an acceptable content of salt and sodium, and few or no rocks. Its soils are ***permeable*** to water and air. Prime farmland is not excessively eroded or saturated with water for long periods of time, and it either does not flood frequently during the growing season or is protected from flooding.
primordial radionuclides	***Radionuclides*** that originate mainly from the interiors of stars and are still present because their ***half-lives*** are so long that they have not yet completely ***decayed***.

probability	The relative frequency at which an event can occur in a defined period. Statistical probability is what happens in the real world and can be verified by observation or sampling. Knowing the exact probability of an event is usually limited by the inability to know, or compile the complete set of, all possible outcomes over time or space. Probability is measured on a scale of 0 (event will not occur) to 1 (event will occur).
Proposed Action	The activity proposed to accomplish a federal agency's purpose and need. An ***EIS*** analyzes the environmental ***impacts*** of a proposed action, which includes the project and its related support activities. The Proposed Action in the Nevada Rail Corridor SEIS is to construct and operate a railroad to connect the Yucca Mountain repository to an existing ***rail line*** near Wabuska, Nevada (the Mina ***rail corridor***). The Proposed Action in the Rail Alignment EIS, is to determine an alignment (within a corridor) and construct and operate a railroad in Nevada to transport ***spent nuclear fuel***, ***high-level radioactive waste***, and other ***Yucca Mountain*** project materials to a repository at Yucca Mountain.
proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all ***atomic*** nuclei.
public lands	As defined in Public Law 94-79, public lands are any land and interest in land outside of Alaska owned by the United States and administered by the Secretary of the Interior through the BLM. In common usage, public lands may refer to all federal land no matter what agency has responsibility for its management.
public land order	An order affecting, modifying, or canceling a withdrawal or reservation that has been issued by the Secretary of the Interior pursuant to powers of the President delegated to the Secretary by Executive Order 9146 of April 24, 1942, or 9337 of April 24, 1943.
public water system	A water system that provides water for human consumption for an average of at least 25 persons per day (or 15 or more service connections) and in use for at least 60 days each year.
pyroclastic	Of or relating to individual particles or fragments of ***clastic*** rock material of any size formed by volcanic explosion or ejected from a volcanic vent.
qualitative	With regard to a variable, a parameter, or data, an expression or description of an aspect in terms of non-numeric qualities or attributes. See ***quantitative***.
quantitative	A numeric expression of a variable. See ***qualitative***.
rad	A unit of absorbed radiation dose in terms of energy. One rad equals 100 ergs of energy absorbed per gram of tissue.

radiation	The emitted particles or ***photons*** from the nuclei of radioactive atoms. Some elements are naturally ***radioactive***; others are induced to become radioactive by ***irradiation*** in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.
radioactive	Emitting ***radioactivity***.
radioactivity	The property possessed by some elements (for example, uranium) of spontaneously emitting ***alpha, beta***, or ***gamma rays*** by the disintegration of ***atomic*** nuclei.
radionuclide	See ***nuclide***.
radiotoxicity	Of, relating to, or being a ***radioactive*** substance that is toxic to living cells or tissues.
radius of influence	The distance from the well where the drawdown becomes insignificant and can be neglected.
rail alignment	An engineered refinement of a ***rail corridor*** in which DOE would identify the location of a ***rail line***. A rail alignment is comprised of ***common segments*** and ***alternative segments***.
rail corridor	As used in this Rail Alignment EIS, a strip of land, 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at ***Yucca Mountain***.
Rail Equipment Maintenance Yard	The rail yard that would be near the ***geologic repository*** and would temporarily store, service, and maintain railcars and locomotives in preparation for the return trip to the ***Staging Yard***.
rail line	An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.
rail route	Route from point of origin to the ***repository***.
railroad	A transportation system incorporating the ***rail line***, operations support facilities, railcars, locomotives, and other related property and infrastructure.
Nevada Railroad Control Center	A facility that would control all train movements, rail operations, and emergency response operations along the proposed ***railroad*** in Nevada to ***Yucca Mountain***.
rain shadow	Effect that occurs when moist air is blown toward a mountain and the air rises, cools, and releases its moisture as rain or snow. When the air passes to the other side of the mountain, it is dry and does not release moisture. If the wind always blows the same way, the area on the dry side of the mountain is said to be in a rain shadow.

reactor	See ***nuclear reactor***.
real disposable income	The value of total income received after taxes; it is the income available for spending or saving; also referred to as ***real disposable personal income***.
real disposable personal income	See ***real disposable income***.
recharge	The movement of water from an ***unsaturated zone*** to a ***saturated zone***.
Record of Decision	A document that provides a concise public record of a decision made by a government agency.
recordable cases	Occupational injuries or occupation-related illnesses that result in (1) a fatality, regardless of the time between the injury or the onset of the illness and death, (2) ***lost workday cases*** (nonfatal), and (3) the transfer of a worker to another job, termination of employment, medical treatment, loss of consciousness, or restriction of motion during work activities.
region of influence	The physical area that bounds the environmental, sociologic, economic, or cultural features of interest for the purpose of analysis.
rem	A unit of ***dose equivalent***. The dose equivalent in rems equals the absorbed dose in ***rads*** in tissue multiplied by the appropriate quality factor and possibly other modifying factors. Derived from roentgen equivalent man, referring to the dosage of ionizing ***radiation*** that will cause the same biological effect as one roentgen of ***X-ray*** or ***gamma ray*** exposure. One rem equals 0.01 sievert.
remediation	Action taken to permanently remedy a release or threatened release of a hazardous substance to the ***environment***, instead of or in addition to removal.
repository	See ***geologic repository***.
resource management plan	A land-use plan for public lands as described by the Federal Land Management and Policy Act. Among other things, it establishes land areas for limited, restricted, or exclusive use; allowable resource uses; resource condition goals and objectives; general management practices to achieve the goals; the need for more specific management plans for certain areas; general implementation sequences; and monitoring intervals and standards.
reverse fault	A ***fault*** in which the relative displacement is along the direction of the dip of the fault plane (***dip-slip fault***), and in which the block above the fault has moved upward in relation to the block below the fault.
right-of-way grant	Authorization from the BLM to use a specific portion of public land for construction and operation of the proposed ***railroad***. The land covered by the right-of-way grant would include the area of construction, known as the ***construction right-of-way*** and the area of operations known as the ***operations right-of-way***.

riparian	Of, on, or pertaining to, the bank of a river or stream, or of a pond or small lake.
riprap	Broken rocks or chunks of concrete used as foundation material or to protect embankments and gullies to control water flow or prevent erosion.
risk	The product of the ***probability*** that an undesirable event will occur multiplied by the consequences of the undesirable event.
roadbed	The earthwork foundation upon which the track, ties, ***ballast***, and ***subballast*** of a ***rail line*** are lain.
root mean-square velocity	An average or smoothed vibration amplitude, commonly measured over 1-second intervals. It is expressed on a log scale in ***decibels (VdB)*** referenced to 0.000001 (10^{-6}) inch per second and is not to be confused with noise ***decibels***.
sand sheets	Large, irregularly shaped, commonly thin, surficial mantles of windblown sand that lack the discernible slip faces that are common on dunes.
sanitary and industrial solid waste	***Solid waste*** that is neither ***hazardous*** nor ***radioactive.*** Sanitary waste streams include paper, glass, and discarded office material. State of Nevada waste regulations identify this waste stream as household waste.
sanitary waste	Domestic wastewater from toilets, sinks, showers, kitchens, and floor drains from restrooms, change rooms, and food preparation and storage areas.
saturated zone	The area below the ***water table*** where all spaces (***fractures*** and rock pores) are completely filled with water.
scenic quality	A measure of the visual appeal of a tract of land. Areas are rated from A to C based on key factors including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. An A rating is assigned to areas that combine the most outstanding characteristics of each category, whereas a C rating is assigned to areas common to the region.
screened (related to water wells)	The portion of a well that is screened is the interval in the well where the casing contains slots to let in the water from the primary (most productive) water-bearing zone or zones.
sedimentary rocks	Rock formed by the accumulation of sediment in water or land. Sandstone, chert, limestone, dolomite, shale, siltstone, and mudstone are types of sedimentary rocks that are found in the Great Basin. They are differentiated by chemistry, deposition, and texture.
seismic	Pertaining to, characteristic of, or produced by, earthquakes or earth vibrations.
seismicity	A ***seismic*** event or activity such as an ***earthquake*** or earth tremor; seismic action.
semi-desert	An ***arid*** area that has some of the characteristics of a ***desert*** but has greater annual precipitation.

sensitive receptors	As used in this Rail Alignment EIS, any specific resource (population or facility) that would be more susceptible to the effects of the ***impact*** of implementing the ***Proposed Action*** than would otherwise be.
sensitive structures	Buildings or structures, usually old and of cultural value, or facilities that house vibration-sensitive equipment, that could be susceptible to ***ground vibrations,*** activities, or conditions causing ***ground vibrations***.
sensitivity levels	A measure of public concern for ***scenic quality***. Areas are ranked high, medium, or low based on types of users, amount of use, public interest, adjacent land uses, and whether they are special areas.
Shared-Use Option	An option under the ***Proposed Action***. DOE would allow commercial and other shippers to use the ***rail line*** for general freight shipments. General freight would include stone and other nonmetallic minerals, petrochemicals, waste materials (nonradioactive), or other commodities that private companies would ship or receive.
short-term impact	In the Rail Alignment EIS, impacts limited to the construction phase (4 to 10 years).
shielding	Any material that provides ***radiation*** protection.
shipment	The movement of a properly prepared (loaded, unloaded, or empty) ***cask*** from one site to another and associated activities to ensure compliance with applicable regulations.
shipping cask	A heavily shielded, massive container that meets regulatory requirements for shipping ***spent nuclear fuel*** and ***high-level radioactive waste***. See ***cask***.
siding	A track that runs parallel to the main line for a short distance and is used for passing and overtaking trains to prevent backups and keep traffic flowing.
signal blocks	A ***rail line*** bounded on one end by an entry signal and on the other end by an exit signal. The proposed ***railroad*** would be divided into a number of signal blocks, which would allow for easier control of trains along the railroad.
site characterization	Activities associated with the determination of the suitability of the ***Yucca Mountain Site*** for a ***geologic repository***.
soft soils	Soils with saline conditions that limit the chemical and physical potentials of the soil and that could have negative effects on the vegetation-bearing capacity of the soil. These soils would have a higher potential for erosion until revegetation was complete.
soil recovery	The return of disturbed land to a relatively stable condition with a form and productivity similar to that which existed before any disturbance.
solid waste	For purposes of this analysis, defined as nonhazardous general household waste.

source term
Types and amounts of ***radionuclides*** that are the source of a potential release of ***radioactivity***.

Special Areas
Defined in BLM Visual Resource Inventory Manual 8410 as lands where measures must be taken to protect visual values. Special Areas often include designated natural areas, ***Wilderness Study Areas***, scenic rivers, and scenic roads. Special Areas are not necessarily unique or picturesque, but the management objective for a Special Area is to preserve its natural characteristics.

spent nuclear fuel

1. ***Nuclear reactor*** fuel that has been used to the extent that it can no longer effectively sustain a chain reaction.

2. Fuel that has been withdrawn from a nuclear reactor after ***irradiation***, the component elements of which have not been separated by reprocessing. For this project, this refers to:

    a. Intact, nondefective ***fuel assemblies***
    b. Failed fuel assemblies in ***canisters***
    c. Fuel assemblies in canisters
    d. Consolidated fuel rods in canisters
    e. Nonfuel assembly hardware inserted in ***pressurized-water reactor*** fuel assemblies
    f. Fuel channels attached to ***boiling-water reactor*** fuel assemblies
    g. Nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters

splay faults
Minor faults that branch off of a primary fault, or interconnect to form a fault zone.

spoils areas
Areas outside the ***rail corridor*** for the deposition of excavated materials from ***rail line*** development.

Staging Yard
The rail yard that would temporarily store, service, and maintain railcars and locomotives in preparation for a trip to the ***Rail Equipment Maintenance Yard*** inside the ***Yucca Mountain Site boundary*** near the ***repository*** operations area, or in preparation for return to the Union Pacific Railroad. Railcars containing ***casks*** would be decoupled from Union Pacific Railroad trains in preparation for the trip to the repository.

stakeholder
A person or organization with an interest in, or affected by, DOE actions (for example, representatives from federal, state, tribal, or local agencies; members of Congress or state legislatures; unions, educational groups, environmental groups, industrial groups; and members of the general public).

State protected species	Animals classified under Nevada Administrative Code, Section 503.103, as meeting the Endangered Species Act definition or the State population being in danger of extinction. Under Nevada Administrative Code 527.020, a plant species is classified as being in danger of extinction if its survival requires assistance because of overexploitation, disease, or other factors or because its habitat is threatened with destruction, drastic modification, or severe curtailment.
stigma	See ***perceived risk and stigma***.
storage	The collection and containment of waste or ***spent nuclear fuel*** in a way that does not constitute ***disposal*** of the waste or spent nuclear fuel for the purposes of awaiting treatment or disposal capacity.
stratigraphy	The branch of geology that deals with the definition and interpretation of rock strata, the conditions of their formation, character, arrangement, sequence, age, distribution, and especially their correlation, by the use of ***fossils*** and other means of identification.
stratosphere	The atmospheric shell above the ***troposphere*** and below the ***mesosphere***. It extends from 10 to 20 kilometers (6 to 12 miles) to about 53 kilometers (33 miles) above the Earth's surface.
stratum	A sheet like mass of ***sedimentary rock*** or earth of one kind lying between beds of other kinds.
subballast	A layer of crushed gravel that is used to separate the ***ballast*** and ***roadbed*** for the purpose of load distribution and drainage.
subgrade elevation	The elevation of the top of the ***subballast*** in the ***rail line***.
substrate	Basic surface on which a material adheres.
sulfur dioxide (SO_2)	A pungent, colorless gas produced during the burning of sulfur-containing fossil fuels. It is the main pollutant involved in the formation of acid rain. Coal- and oil-burning electric utilities are the major source of sulfur dioxide in the United States. Inhaled sulfur dioxide can damage the human respiratory tract and can severely damage vegetation. See ***criteria pollutants***, ***ambient air quality standards***.
sulfur oxides	A mixture of ***sulfur dioxide***, sulfur trioxide, and inorganic sulfites and sulfates. Sulfur dioxide combines with oxygen in the air to form sulfur trioxide and microscopic aerosol sulfite and sulfate particles, all of which are lung irritants. See ***criteria pollutants***, ***ambient air quality standards***.

surface entry	The appropriation of any non-federal interests or claims (other than mining claims), land sales, BLM land exchanges, state selections, Desert Land Entries, Indian Allotments, Carey Act selections, or any other like public land disposal actions. Surface entry does not include ***rights-of-way***, granted pursuant to Title V of the Federal Land Policy and Management Act, and other easements, leases, licenses, and/or use permits.
sustained yield	The amount of water that may be pumped from a ***hydrographic area*** during a specific period of time without affecting future yields. Equal to ***recharge***, and independent of economic feasibility and management objectives.
team track	A track on which rail cars would be placed for public use to load or unload freight.
tectonic plate	A piece of Earth's outer shell that moves across the mantle.
thermal desorption	The use of heat to remove an absorbed substance from a liquid or gas environment, including soil.
threatened species	A species that is likely to become an ***endangered species*** within the foreseeable future throughout all or a significant part of its range.
thrust fault	A ***fault*** that occurs when squeezing forces push the block above an inclined fault up in relation to the other block.
total employment	The sum of direct and indirect employment resulting from initiation of an activity. Direct employment consists of jobs performing the activity. Indirect employment consists of jobs in other activities supporting the direct employees. Also defined as composite employment.
total population	The sum of all people associated with direct and indirect employees and their families resulting from initiation of an activity.
toxic air pollutant	A ***hazardous chemical*** that can cause serious health and environmental hazards; listed on the federal list of ***hazardous air pollutants*** (Clean Air Act; 42 U.S.C. 7412).
traditional cultural property	A property that is eligible for inclusion in the *National Register of Historic Places* because of its association with cultural practices or beliefs of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community. Culture includes the traditions, beliefs, practices, lifeways, arts, crafts, and social institutions of any community, whether an American Indian tribe, a local ethnic group, or the people of the Nation as a whole. Properties can include buildings, structures, and sites; groups of buildings, structures, or sites forming historic districts; and individual objects.
transpiration	The process by which water enters a plant through its root system, passes through its vascular system, and is released into the atmosphere through openings in its outer covering. It is an important process for removal of water

	that has infiltrated below the zone where it could be removed by evaporation.
transuranic waste	Waste materials (excluding ***high-level radioactive waste*** and certain other waste types) contaminated with alpha-emitting ***radionuclides*** that are heavier than uranium with half-lives greater than 20 years and that occur in concentrations greater than 100 nanocuries per gram. Transuranic waste results primarily from treating and fabricating plutonium, and research activities at DOE defense installations.
troposphere	The lowest layer of the atmosphere; it contains about 95 percent of the mass of air in the Earth's atmosphere. The troposphere extends from the Earth's surface up to about 10 to 15 kilometers (7 to 9 miles).
tuff	***Igneous*** rock formed from compacted volcanic fragments from ***pyroclastic*** (explosively ejected) flows with particles generally smaller than 4 millimeters (about 0.16 inch) in diameter. Nonwelded tuff results when volcanic ash cools in the air sufficiently that it does not melt together, yet later becomes rock through compression.
ultraviolet radiation	Electromagnetic ***radiation*** with wavelengths from 4 to 400 nanometers. This range begins at the short wavelength limit of visible light and overlaps the wavelengths of long ***X-rays*** (some scientists place the lower limit at higher values, up to 40 nanometers). Also known as ultraviolet light.
uncertainty	A measure of how much a calculated or estimated value that is used as a reasonable guess or prediction might vary from the unknown true value.
unique farmland	Land other than ***prime farmland*** that is used for the production of specific high-value food and fiber crops such as citrus, tree nuts, olives, cranberries, fruits, and vegetables.
unpatented mining claim	See ***mining claim***.
unsaturated zone	The zone of soil or rock below the ground surface and above the ***water table***.
viewshed	A total field of vision or a vista. In particular, an area with visual boundaries seen from various points within the area.
vitrification	A waste treatment process that uses glass (for example, ***borosilicate glass***) to encapsulate or immobilize ***radioactive*** wastes.
volatile organic compound (VOC)	Organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.
volcanic rock	Rocks that have been ejected at or near the Earth's surface. ***Tuffs***, lava flows, volcanic breccias, basalt, andesite, and rhyolite are types of volcanic rocks that are found in the Great Basin. They are differentiated by chemistry and texture.

wash	The dry streambed of an ***intermittent*** or ***ephemeral stream***. In the Nevada Rail Corridor SEIS and the Rail Alignment EIS, wash is used interchangeably with intermittent and ***ephemeral streams***.
waste form	A generic term that refers to the different types of ***radioactive*** wastes.
waste package	A container that consists of the barrier materials and internal components into which DOE would place the ***canisters*** that contained ***spent nuclear fuel*** and ***high-level radioactive waste*** at the ***repository***.
waste packages	Two thick metal cylinders, one nested within the other. The inner cylinder would be made of stainless steel to provide structural strength. The outer cylinder would be made of a nickel alloy that is highly resistant to corrosion.
wastewater treatment	A process that typically involves three stages (called primary, secondary, and tertiary treatment). First, the solids are separated from the wastewater. Next, dissolved biological matter is progressively converted into a solid mass using indigenous water-borne bacteria. Finally, the biological solids are neutralized and then disposed of or re-used, and the treated water can be disinfected chemically or physically (such as by lagooning and micro-filtration). The final effluent can be discharged into a natural surface-water body or other environment.
water table	(1) The upper limit of the ***saturated zone*** (the portion of the ground wholly saturated with water). (2) The upper surface of a zone of saturation above which most pore spaces and ***fractures*** are less than 100-percent saturated with water most of the time (***unsaturated zone***) and below which the opposite is true (saturated zone).
waters of the United States	Streams, drainages, or washes under the jurisdiction of the U.S. Army Corps of Engineers under the Clean Water Act as defined at 33 CFR 328.3a. The U.S. Army Corps of Engineers and U.S. Environmental Protection Agency regulate the placement of dredged or fill material into these waters. The definition incorporates channels with ***ephemeral*** and intermittent flow that exhibit specific physical features, including channel shape and surrounding vegetation that would provide indications of an ***ordinary high water mark***.
wayside signal	Any signal of fixed location outside the train alongside the track.
welded tuff	A ***tuff*** deposited under conditions in which the particles making up the rock were heated sufficiently to cohere. In contrast to nonwelded tuff, welded tuff is denser, less porous, and more likely to be ***fractured*** (which increases ***permeability***).
wetland	Areas inundated or saturated by surface- or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

Wilderness Study Area	Areas of public lands the BLM has formally identified as having wilderness characteristics. These areas are protected by Congress, until Congress either designates them as an official Wilderness Area or removes them from any wilderness designation.
wildlife guzzler	A water development for wildlife that relies on rainfall or snowmelt to recharge it, rather than springs or streams. Usually used where there are no other sources of water for wildlife.
withdrawal	Related to land use: Withholding an area of federal land from settlement, sale, location, or surface entry, under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program. Related to water resources: Water diverted from the ground or diverted from a surface-water source for use.
worker year	Two-thousand hours of paid labor; a project requiring 1.5 worker years would take 3,000 hours to complete.
wye track	A triangular shaped arrangement of tracks with a switch at each corner. With a sufficiently long track leading away from each corner, a train of any length can be turned.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.
Yucca Mountain Site	The area inside the site boundary over which DOE has control.
Yucca Mountain Site boundary	The outer limit of the 600-square-kilometer (150,000-acre) area shown on figures in this Rail Alignment EIS, assumed, for purposes of analysis, to be the area of federal property set aside for the exclusive use of DOE for the repository project.

DOE used the Document Input Reference System (DIRS) to manage references for the document. The unique number assigned by this system has been used in text and in this Reference List to aid the reader in identifying source documents.

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176978	MO0604GISBLCAM.000	MO0604GISBLCAM.000. BLM, Lincoln County Conservation, Recreation, and Development Act Map. Submittal date: 04/05/2006.
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176979	MO0605GISGNISN.000	MO0605GISGNISN.000. GNIS - Nevada Springs. Submittal date: 05/03/2006.
176976	MO0605GISNWIDQ.000	MO0605GISNWIDQ.000. NWI - National Wetlands Inventory Data by Quadrangle. Submittal date: 05/03/2006.
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177709	MO0607NEI2002D.000	MO0607NEI2002D.000. National Emissions Inventory 2002 All-Sector Summary Data for Criteria Air Pollutants. Submittal date: 07/18/2006.
177714	MO0607NHDFLM06.000	MO0607NHDFLM06.000. National Hydrological Data - FLOWLINE_MERGE(3-22-06). Submittal date: 07/18/2006.
177712	MO0607NHDPOINT.000	MO0607NHDPOINT.000. National Hydrological Dataset Point Information for the State of Nevada. Submittal date: 07/18/2006.
177710	MO0607NHDWBDYD.000	MO0607NHDWBDYD.000. National Hydrological Dataset Waterbody Information for the State of Nevada. Submittal date: 07/18/2006.
177291	MO0607NPWINFSN.000	MO0607NPWINFSN.000. Non Permitted Well Information for the State of Nevada. Submittal date: 07/18/2006.
177293	MO0607PWMAR06D.000	MO0607PWMAR06D.000. Two New Existing Wells Within Dry Lake Valley. Submittal date: 07/18/2006.
177294	MO0607USGSWNVD.000	MO0607USGSWNVD.000. USGS Existing Wells Location Information for the State of Nevada. Submittal date: 07/18/2006.
174399	MO9901COV97208.000	MO9901COV97208.000. Coverage: NVLNDCVU. Submittal date: 01/21/1999.

APPENDIX A

FEDERAL REGISTER NOTICES

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APPENDIX A

FEDERAL REGISTER NOTICES

This appendix contains copies of *Federal Register* (*FR*) notices applicable to *Draft Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada – Nevada Rail Transportation Corridor* (DOE/EIS-0250F-S2D) and *Environmental Impact Statement for a Rail Alignment for the Construction and Operation of a Railroad in Nevada to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (DOE/EIS-0369D).

A.1 68 *FR* 74951, December 29, 2003

Federal Register / Vol. 68, No. 248 / Monday, December 29, 2003 / Notices 74951

DEPARTMENT OF ENERGY

Notice of Preferred Nevada Rail Corridor

AGENCY: Office of Civilian Radioactive Waste Management, U.S. Department of Energy.

ACTION: Notice of the Preferred Nevada Rail Corridor.

SUMMARY: On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. The Department of Energy (DOE or Department) is now responsible for planning and implementing a transportation program for the shipment of spent nuclear fuel and high-level radioactive waste, in the event the Nuclear Regulatory Commission authorizes receipt and possession of spent nuclear fuel and high-level radioactive waste at Yucca Mountain.

In the Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (DOE/EIS–0250F) (Final EIS), the Department evaluated various modes of transportation including mostly rail, mostly legal-weight truck and mostly heavy-haul truck. The Department identified the mostly rail alternative as its preferred mode of transportation in the Final EIS.

In the event that DOE selects the mostly rail alternative, a rail line would need to be constructed to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. Accordingly, the Final EIS evaluated five rail corridors[1]—Caliente, Carlin, Caliente-Chalk Mountain, Jean, and Valley Modified. The Department, however, did not identify a preferred rail corridor in the Final EIS, but indicated it would do so at least 30 days before making any decisions on the selection of a corridor.

The Department is now announcing the Caliente rail corridor as its preferred corridor in which to construct a rail line in Nevada, and Carlin as a secondary preference. If the Department adopts the mostly rail mode in Nevada, DOE will issue a Record of Decision selecting a rail corridor no sooner than 30 days after publication of this preference announcement. If the Department selects a rail corridor, DOE will issue a Notice of Intent in the **Federal Register** to initiate the preparation of a rail alignment EIS under the National Environmental Policy Act (NEPA) to consider alternative alignments within the selected corridor for construction of a rail line. Under this scenario, the Department would anticipate holding public scoping meetings in early-to-mid February, 2004. The exact date, time and locations of the meetings would be announced in the Notice of Intent.

FOR FURTHER INFORMATION CONTACT:

To obtain a copy of the Final EIS or for further information contact: Ms. Robin Sweeney, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477. The Final EIS is available on the Internet at *ocrwm.doe.gov*.

For further information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone (202) 586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Background

In the Final EIS, DOE analyzed a Proposed Action to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain. As part of the Proposed Action, DOE analyzed the potential impacts of transporting spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites to the Yucca Mountain site.[2] Transportation

[1] A corridor is a strip of land, approximately 400 meters (0.25 mile) wide, that encompasses one of several possible routes through which DOE could build a branch rail line. An alignment is the specific location of a rail line in a corridor.

[2] Additional sites (primarily research reactors) will ship spent nuclear fuel to DOE for disposal at the repository. Shipment from these sites to DOE is covered under a separate Environmental Impact Statement, *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environment Restoration and Waste Management Programs Environmental Impact Statement* (DOE/EIS–0203; April 1995), and associated Record of Decision (June 1, 1995; 60 FR 28680)). Two of these research reactors were recently closed and the spent fuel removed. Adding

Continued

could be accomplished using a variety of modes, including legal-weight truck, rail, heavy-haul truck, and possibly barge.

The Final EIS examined various national transportation scenarios and Nevada transportation implementing alternatives to estimate the range of potential environmental impacts that could occur. Two national transportation scenarios, referred to as the mostly legal-weight truck [3] scenario and the mostly rail [4] scenario, and three Nevada implementing alternatives, referred to as the legal-weight truck alternative, the rail alternative, and the heavy-haul truck [5] alternative are evaluated. In the Final EIS, the Department identified the mostly rail scenario as its preferred mode of transportation, both nationally and in the State of Nevada.

Implementation of the mostly rail scenario would require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada. Accordingly, the Final EIS evaluated five rail corridors—Caliente, Carlin, Caliente-Chalk Mountain [6], Jean and Valley Modified. The Department, however, did not identify a preferred rail corridor in the Final EIS.

Preferred Nevada Rail Corridor

After consideration of public comments, the analyses of the Final EIS and other information, the Department has identified the Caliente corridor as its preferred rail corridor with the Carlin Corridor as the secondary preference. The Department's preference for Caliente takes into consideration many factors, including its more remote location, the diminished likelihood of land use conflicts, concerns raised by Nevadans, and national security issues raised by the U.S. Air Force on the Caliente-Chalk Mountain corridor. Approximately one-third of the Caliente and Carlin corridors overlap. Since the Carlin corridor has similar attributes overall, DOE has identified the Carlin corridor as the secondary preference in the event the Caliente corridor is not selected.

If the Department adopts the mostly rail mode, DOE will issue a Record of Decision selecting a rail corridor no sooner than 30 days after publication of this preference announcement. If the Department selects a rail corridor, DOE will issue a Notice of Intent in the **Federal Register** to initiate the preparation of a rail alignment EIS under NEPA to consider alternative alignments within the selected corridor for construction of a rail line.

Issued in Washington, DC, December 23, 2003.

Margaret S.Y. Chu,

Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 03–32029 Filed 12–24–03; 8:45 am]

BILLING CODE 6450–01–P

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these sites to the 77 sites listed above results in a total of 129 sites with spent nuclear fuel or high-level waste destined for repository disposal.

[3] A truck with a gross vehicle weight (truck and cargo) of less than 80,000 pounds having dimensions, axle spacing, and if applicable, axle loads within Federal and state limits.

[4] Rail is defined to include vehicles, such as locomotives and specialized freight cars, with steel wheels running on steel rails using standard gauge that is compatible with the U.S. freight rail network.

[5] A heavy-haul truck is an overweight, overdimension vehicle that must have permits from state highway authorities to use public highways. An intermodal transfer station is a facility at the junction of rail and road transportation used to transfer shipping casks containing radioactive materials from rail to truck, and empty casks from truck to rail.

[6] As stated in the Final EIS, DOE considers the Caliente-Chalk Mountain rail corridor to be non-preferred, because of adverse effects on the security and operations of the Nevada Test and Training Range.

A.2 68 FR 74965, December 29, 2003

Federal Register / Vol. 68, No. 248 / Monday, December 29, 2003 / Notices 74965

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NV–930–1430–ET; NVN–77880; 4–08807]

Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice.

SUMMARY: The Bureau of Land Management has received a request from the Department of Energy to withdraw 308,600 acres of public land from surface entry and mining for a period of 20 years to evaluate the land for the potential construction, operation, and maintenance of a branch rail line for the transportation of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes a geologic repository at Yucca Mountain as provided for under the Nuclear Waste Policy Act of 1982, as amended. This notice segregates the land from surface entry and mining for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.

DATES: Comments and requests for a meeting should be received on or before March 29, 2004.

ADDRESSES: Comments and meeting requests should be sent to the Nevada State Director, BLM, 1340 Financial Blvd., PO Box 12000, Reno, Nevada 89520–0006.

FOR FURTHER INFORMATION CONTACT: Dennis J. Samuelson, BLM Nevada State Office, 775–861–6532.

SUPPLEMENTARY INFORMATION: The Department of Energy has filed an application (NVN 77880) to withdraw the following described public land from settlement, sale, location, or entry under the general land laws, including the mining laws and the mineral leasing laws, subject to valid existing rights:

Mount Diablo Meridian

A corridor one mile in width that contains a portion of, or are wholly encompassed within, the following sections:

10S 46E 01	1N 55E 24	2N 58E 03	3N 48E 35	4N 49.2E 35
10S 46E 02	1N 55E 25	2N 58E 04	3N 48E 36	4N 49.2E 36
10S 46E 12	1N 55E 26	2N 58E 05	3N 49E 02	4N 49E 24
10S 46E 13	1N 55E 27	2N 58E 07	3N 49E 03	4N 49E 25
10S 47E 06	1N 55E 28	2N 58E 08	3N 49E 04	4N 49E 26
10S 47E 07	1N 55E 29	2N 58E 09	3N 49E 05	4N 49E 33
10S 47E 08	1N 55E 30	2N 58E 13	3N 49E 07	4N 49E 34
10S 47E 09	1N 55E 31	2N 58E 17	3N 49E 08	4N 49E 35
10S 47E 15	1N 55E 32	2N 58E 18	3N 49E 09	4N 49E 36
10S 47E 16	1N 55E 33	2N 58E 19	3N 49E 10	4N 50E 30
10S 47E 17	1N 56E 01	2N 58E 20	3N 49E 17	4N 50E 31
10S 47E 18	1N 56E 02	2N 58E 21	3N 49E 18	4N 50E 32

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10S 47E 21	1N 56E 09	2N 58E 22	3N 49E 19	4N 60E 20
10S 47E 22	1N 56E 10	2N 58E 23	3N 50E 02	4N 60E 21
10S 47E 23	1N 56E 11	2N 58E 24	3N 50E 03	4N 60E 22
10S 47E 26	1N 56E 12	2N 58E 25	3N 50E 04	4N 60E 23
10S 47E 27	1N 56E 13	2N 58E 26	3N 50E 10	4N 60E 24
10S 47E 28	1N 56E 14	2N 58E 27	3N 50E 11	4N 60E 25
10S 47E 34	1N 56E 15	2N 58E 28	3N 50E 14	4N 60E 26
10S 47E 35	1N 56E 16	2N 58E 29	3N 50E 15	4N 60E 27
11S 47E 01	1N 56E 17	2N 58E 30	3N 50E 22	4N 60E 28
11S 47E 02	1N 56E 18	2N 58E 31	3N 50E 23	4N 60E 29
11S 47E 03	1N 56E 19	2N 58E 32	3N 50E 24	4N 60E 31
11S 47E 11	1N 56E 20	2N 59E 02	3N 50E 25	4N 60E 32
11S 47E 12	1N 56E 21	2N 59E 03	3N 50E 26	4N 60E 33
11S 47E 13	1N 57E 03	2N 59E 04	3N 50E 35	4N 61E 19
11S 47E 14	1N 57E 04	2N 59E 08	3N 50E 36	4N 61E 20
11S 47E 24	1N 57E 05	2N 59E 09	3N 58E 24	4N 61E 28
11S 47E 25	1N 57E 06	2N 59E 10	3N 58E 25	4N 61E 29
11S 48E 07	1N 62E 01	2N 59E 16	3N 58E 26	4N 61E 30
11S 48E 08	1N 62E 12	2N 59E 17	3N 58E 33	4N 61E 32
11S 48E 09	1N 63E 06	2N 59E 18	3N 58E 34	4N 61E 33
11S 48E 10	1N 63E 07	2N 59E 19	3N 58E 35	4N 61E 34
11S 48E 11	1N 63E 08	2N 59E 20	3N 58E 36	4S 43E 01
11S 48E 14	1N 63E 17	2N 60E 01	3N 59E 12	4S 43E 02
11S 48E 15	1N 63E 18	2N 61E 06	3N 59E 13	4S 43E 03
11S 48E 16	1N 63E 19	2N 62E 01	3N 59E 14	4S 43E 10
11S 48E 17	1N 63E 20	2N 62E 02	3N 59E 19	4S 43E 11
11S 48E 18	1N 63E 21	2N 62E 03	3N 59E 20	4S 43E 12
11S 48E 19	1N 63E 26	2N 62E 04	3N 59E 21	4S 43E 14
11S 48E 20	1N 63E 27	2N 62E 05	3N 59E 22	4S 43E 15
11S 48E 21	1N 63E 28	2N 62E 10	3N 59E 23	4S 43E 22
11S 48E 22	1N 63E 29	2N 62E 11	3N 59E 24	4S 43E 23
11S 48E 27	1N 63E 30	2N 62E 12	3N 59E 25	4S 43E 26
11S 48E 28	1N 63E 32	2N 62E 13	3N 59E 26	4S 43E 27
11S 48E 29	1N 63E 33	2N 62E 14	3N 59E 27	4S 43E 28
11S 48E 30	1N 63E 34	2N 62E 15	3N 59E 28	4S 43E 33
11S 48E 31	1N 63E 35	2N 62E 24	3N 59E 29	4S 43E 34
11S 48E 32	1S 43E 01	2N 62E 25	3N 59E 30	4S 67E 01
11S 48E 33	1S 43E 02	2N 62E 36	3N 59E 33	4S 67E 02
11S 48E 34	1S 43E 03	2N 63E 07	3N 59E 34	4S 67E 04
12S 48E 02	1S 43E 04	2N 63E 18	3N 59E 35	4S 67E 05
12S 48E 03	1S 43E 09	2N 63E 19	3N 59E 36	4S 67E 06
12S 48E 04	1S 43E 10	2N 63E 30	3N 60E 05	4S 67E 07
12S 48E 05	1S 43E 11	2N 63E 31	3N 60E 06	4S 67E 08
12S 48E 06	1S 43E 12	2S 43E 03	3N 60E 07	4S 67E 09
12S 48E 09	1S 43E 13	2S 43E 04	3N 60E 08	4S 67E 12
12S 48E 10	1S 43E 14	2S 43E 09	3N 60E 18	4S 68E 06
12S 48E 11	1S 43E 15	2S 43E 10	3N 60E 19	4S 68E 07
12S 48E 13	1S 43E 16	2S 43E 15	3N 60E 20	4S 68E 08
12S 48E 14	1S 43E 21	2S 43E 16	3N 60E 21	4S 68E 17
12S 48E 15	1S 43E 22	2S 43E 20	3N 60E 22	4S 68E 18
12S 48E 23	1S 43E 23	2S 43E 21	3N 60E 25	5S 43E 03
12S 48E 24	1S 43E 24	2S 43E 22	3N 60E 26	5S 43E 04
12S 48E 25	1S 43E 25	2S 43E 27	3N 60E 27	5S 43E 05
12S 48E 26	1S 43E 27	2S 43E 28	3N 60E 28	5S 43E 08
12S 48E 35	1S 43E 28	2S 43E 29	3N 60E 29	5S 43E 09
12S 48E 36	1S 43E 33	2S 43E 32	3N 60E 30	5S 43E 15
12S 49E 31	1S 43E 34	2S 43E 33	3N 60E 31	5S 43E 16
13S 48E 09	1S 44E 18	2S 43E 34	3N 60E 34	5S 43E 17
13S 48E 10	1S 44E 19	2S 43E 35	3N 60E 35	5S 43E 21
13S 48E 14	1S 44E 29	2S 43E 36	3N 60E 36	5S 43E 22
13S 48E 15	1S 44E 30	2S 44E 04	3N 61E 02	5S 43E 27
13S 48E 16	1S 44E 31	2S 44E 05	3N 61E 03	5S 43E 28
13S 48E 22	1S 44E 32	2S 44E 06	3N 61E 04	5S 43E 33
13S 48E 23	1S 51.2E 06	2S 44E 08	3N 61E 09	5S 43E 34
13S 48E 24	1S 51.2E 07	2S 44E 09	3N 61E 10	5S 43E 35
13S 48E 25	1S 51.2E 08	2S 44E 16	3N 61E 11	6S 43E 01
13S 48E 26	1S 51.2E 17	2S 44E 17	3N 61E 12	6S 43E 02
13S 48E 36	1S 51.2E 18	2S 44E 20	3N 61E 13	6S 43E 03
13S 49E 13	1S 51.2E 19	2S 44E 21	3N 61E 14	6S 43E 10
13S 49E 14	1S 51.2E 20	2S 44E 22	3N 61E 22	6S 43E 11
13S 49E 19	1S 51.2E 28	2S 44E 27	3N 61E 23	6S 43E 12
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13S 49E 26	1S 51.2E 33	2S 51.2E 04	3N 61E 28	6S 43E 24

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The area described contains 308,600 acres in Clark, Esmeralda, Lincoln, and Nye Counties.

This withdrawal approximates the land encompassed by the Caliente rail corridor as described in the Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, February 2002. The purpose of the withdrawal is to evaluate the land for the potential construction and operation of a branch rail line for the transportation of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes a geologic repository at Yucca Mountain as provided for under the Nuclear Waste Policy Act of 1982, as amended.

For a period of 90 days from the date of publication of this notice, all persons who wish to submit comments, suggestions, or objections in connection with the proposed withdrawal may present their views in writing to the Nevada State Director of the Bureau of Land Management.

Notice is hereby given that there will be at least one public meeting in connection with the proposed withdrawal to be announced at a later date. A notice of the time, place, and date will be published in the **Federal Register** and a local newspaper at least 30 days before the scheduled date of a meeting.

Comments, including names and street addresses of commenters, will be available for public review at the Nevada State Office, 1340 Financial Boulevard, Reno, Nevada, during regular business hours 7:30 a.m. to 4:30 p.m., Monday through Friday, except holidays. Individual respondents may request confidentiality. If you wish to hold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by law. All submissions from organizations or businesses will be made available for public inspection in their entirety.

The application will be processed in accordance with the regulations set forth in 43 CFR Part 2300.

For a period of 2 years from December 29, 2003, in accordance with 43 CFR 2310.2(a), the lands described in this notice will be segregated from surface entry and mining, unless the application is denied or canceled, or the withdrawal is approved prior to that date. Other uses which may be permitted during this segregative period are rights-of-way, leases, and permits as long as they do not conflict with the proposed withdrawal.

Dated: December 19, 2003.

Margaret L. Jensen,

Deputy State Director, Natural Resources, Lands, and Planning.

[FR Doc. 03–31901 Filed 12–24–03; 8:45 am]

BILLING CODE 4310–HC–P

A.3 69 FR 18557, April 8, 2004

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DEPARTMENT OF ENERGY

Record of Decision on Mode of Transportation and Nevada Rail Corridor for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV

AGENCY: Office of Civilian Radioactive Waste Management, U.S. Department of Energy.

ACTION: Record of decision.

SUMMARY: On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. In the event the Nuclear Regulatory Commission (NRC) authorizes construction of the repository and receipt and possession of spent nuclear fuel and high-level radioactive waste at Yucca Mountain, the Department of Energy (Department or DOE) would be responsible for transporting these materials to the Yucca Mountain Repository as part of its obligations under the Nuclear Waste Policy Act (NWPA). Pursuant to the NWPA and the National Environmental Policy Act (NEPA), DOE issued the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, February 2002) (Final EIS). That document analyzed the environmental impacts of the proposed action of constructing, operating and monitoring, and eventually closing a geologic repository for the disposal of 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste at Yucca Mountain, as well as of transporting spent nuclear fuel and high-level radioactive waste from commercial and DOE sites to the Yucca Mountain site.

In preparing the Final EIS, DOE initiated public scoping in 1995, and subsequently issued for public comment a Draft EIS in 1999 and a Supplement to the Draft EIS in 2000. During the 199–day public comment period on the Draft EIS, DOE held public hearings in 21

locations across the country, 10 of which were held throughout the State of Nevada. An additional hearing was convened in Las Vegas for members of Native American Tribes in the region. During the 56–day public comment period on the Supplement to the Draft EIS, DOE held three public hearings in Nevada. The Department received more than 13,000 comments on the Draft EIS and the Supplement to the Draft EIS; about 3,600 of these comments addressed transportation related matters.

DOE is now in the process of preparing an application to the Nuclear Regulatory Commission (NRC) seeking authorization to construct the repository. In addition, in order to be in a position to transport waste to the repository should the NRC approve construction and waste receipt, DOE must proceed with certain decisions relating to the transportation of this material. In particular, the Department has decided to select the mostly rail scenario analyzed in the Final EIS as the transportation mode both on a national basis and in the State of Nevada. Under the mostly rail scenario, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository site at Yucca Mountain up to 70,000 MTHM of spent nuclear fuel and high-level radioactive waste, with most of the spent nuclear fuel and high-level radioactive waste being transported by rail. This will ultimately require construction of a rail line in Nevada to the repository. In addition, the Department has decided to select the Caliente rail corridor [1] in which to examine potential alignments within which to construct that rail line. Should the Department select an alignment within that corridor, it will obtain all necessary regulatory approvals before beginning construction.

ADDRESSES: Copies of the Final EIS and this Record of Decision may be obtained by calling or mailing a request to: Ms. Robin Sweeney, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477. The Final EIS, including the Readers Guide and Summary, is available via the Internet at *http://www.ocrwm.doe.gov/ documents/ feis_a/index.htm*. This Record of Decision is available at *http:// www.ocrwm.doe.gov* under "What's New''. Questions regarding the Final EIS or this Record of Decision can be submitted by calling or mailing them to Ms. Robin Sweeney at the above phone number or address.

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE National Environmental Policy Act (NEPA) process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Transportation-Related Decisions

The analyses in the Final EIS provide the bases for the following three decisions under NEPA related to the establishment of a transportation program under which the Department would transport spent nuclear fuel and high-level radioactive waste to a repository at Yucca Mountain:

1. Outside Nevada, the selection of a national mode of transportation scenario (mostly rail or mostly legal-weight truck),
2. In Nevada, the selection among transportation mode scenarios (mostly rail, mostly legal-weight truck, or mostly heavy-haul truck with an associated intermodal transfer station), and
3. In Nevada, if the mostly rail scenario or mostly heavy-haul truck scenario were selected, the selection among rail corridor implementing alternatives, or heavy-haul truck route implementing alternatives with use of an associated intermodal transfer station.

See Figure 2–5 on page 2–7 of the Final EIS for a graphical depiction of the different transportation scenarios and implementing alternatives.

Part I. Record of Decision for Mode of Transportation

Proposed Action and Transportation Mode Scenarios Considered in the Final EIS

The Final EIS examines a Proposed Action under which DOE would ship spent nuclear fuel and high-level radioactive waste from 72 commercial and 5 DOE sites [2] to the Yucca Mountain Repository. The Final EIS considers the potential environmental impacts of transporting spent nuclear fuel and high-level radioactive waste to the repository under a variety of modes, including legal-weight truck, rail, heavy-haul truck, and possibly barge. The Final EIS also considers the environmental impacts of two No-Action Alternatives, one under which spent nuclear fuel and high-level radioactive waste would remain at the 72 commercial and five DOE sites under institutional control for at least 10,000 years, and one under which these materials would remain at the 77 sites in perpetuity, but under institutional control for only 100 years.

At the outset, we note that over the past 30 years, more than 2,700 shipments of spent nuclear fuel have been completed, none of which has resulted in an identified injury caused by the release of radioactive material. That basic fact provides important context for our decisionmaking today.

The Final EIS examines various national transportation scenarios and Nevada transportation implementing alternatives to reflect the range of potential environmental impacts that could occur. Two national transportation scenarios, referred to as the "mostly legal-weight truck'' scenario and the "mostly rail'' scenario, and three Nevada scenarios, referred to as the legal-weight truck scenario, the rail scenario, and the heavy-haul truck scenario, were evaluated. The three broad scenarios discussed below represent the combinations of the scenarios and implementing alternatives as analyzed in the Final EIS.

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[1] A corridor is a strip of land, approximately 0.25 miles (400 meters) wide, that encompasses one of several possible routes through which DOE could build a rail line. An alignment is the specific location of a rail line in a corridor.

[2] Fifty-four additional sites (primarily domestic research reactors) were expected to ship spent nuclear fuel to two DOE sites prior to disposal at the repository. DOE plans to consolidate these materials at the two DOE sites are independent of the decisions relating to a repository at Yucca Mountain. Shipments from these sites to DOE sites were analyzed in the "Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Environmental Impact Statement'' (PEIS) (DOE/EIS–0202–F; April 1995), and associated Records of Decision (June 1, 1995; 60 FR 28680 and March 8, 1996; 61 FR 9441). The direct impacts of this consolidation are not included in the analysis of the alternatives analyzed in the Final EIS for the repository, because they would occur whether or not DOE proceeds with the repository at Yucca Mountain. Since the PEIS was published, three research reactors have closed. As provided for in the Record of Decision (ROD) for the PEIS, spent nuclear fuel from one reactor was sent to the Savannah River Site and fuel from another reactor was sent to the Idaho National Engineering and Environmental Laboratory (INEEL). Fuel from the third reactor, which the ROD for the PEIS anticipated would be consolidated at INEEL, was sent on an interim basis to the United States Geological Survey (USGS) site in Lakewood, Colorado (which also was one of the fifty-four sites analyzed in the PEIS). It is still ultimately expected to be consolidated at INEEL as provided in the ROD for the PEIS, whence it will be shipped to the repository. The fuel that went to USGS is within the amounts analyzed by the PEIS as going from USGS to INEEL. Moreover, since the change in interim storage plans does not affect the shipment of fuel to Yucca Mountain, it does not affect the transportation analysis in the Final EIS for the repository.

Mostly Rail to the Yucca Mountain Repository—Preferred Mode of Transportation

Under the preferred mode of transportation as analyzed in the Final EIS (the mostly rail scenario), DOE would ship most of the spent nuclear fuel and high-level radioactive waste from the 77 sites to the Yucca Mountain Repository by rail. DOE would construct a rail line in one of five rail corridors considered in the Final EIS to connect the repository at Yucca Mountain to an existing main rail line in Nevada.

Under the mostly rail scenario analyzed in the Final EIS, radioactive materials from certain commercial nuclear sites that do not have the capability to load rail-shipping casks would be shipped by legal-weight truck to the repository. For other commercial sites that have the capability to load rail shipping casks, but do not have rail access, materials would be shipped either by heavy-haul truck or possibly barge to a nearby railhead outside Nevada for shipment by rail to the repository at Yucca Mountain.

Under the mostly rail alternative, about 9,000 to 10,000 train shipments (assuming one cask per train [3]) of spent nuclear fuel and high-level radioactive waste would travel on the nation's rail network over the anticipated 24–year period (DOE's current plan calls for three casks per train shipment, about 3,000 to 3,300 total shipments). In addition, there would be about 1,000 legal-weight truck shipments from commercial sites that do not have the capability to load rail-shipping casks to the repository at Yucca Mountain.

Mostly Rail to Nevada With Transfer to Heavy-Haul Truck for Shipment to the Repository

Under this scenario as analyzed in the Final EIS, DOE would ship most spent nuclear fuel and high-level radioactive waste from the 77 sites to Nevada by rail. Rail shipments would terminate in Nevada at an intermodal transfer station where shipping casks would be transferred from rail cars to heavy-haul trucks for shipment to the Yucca Mountain Repository. DOE would construct an intermodal transfer station at one of three locations analyzed in the Final EIS. One of the five heavy-haul routes analyzed in the Final EIS would be upgraded to improve transportation operations, reduce traffic congestion, and enable year-round shipments to the repository.

Under this scenario, radioactive materials from certain commercial nuclear sites that do not have the capability to load rail-shipping casks would be shipped by legal-weight truck directly to the repository.

Under this alternative, about 9,000 to 10,000 train shipments (assuming one cask per train) of spent nuclear fuel and high-level radioactive waste would travel on the nation's rail network to Nevada over the 24-year period. There also would be about 9,000 to 10,000 heavy-haul truck shipments in Nevada from the intermodal transfer station to the repository. In addition, there would be about 1,000 legal-weight truck shipments from commercial sites that do not have the capability to load rail-shipping casks to the repository at Yucca Mountain.

Mostly Legal-Weight Truck to the Yucca Mountain Repository

Under the mostly legal-weight truck scenario, as analyzed in the Final EIS, DOE would ship most spent nuclear fuel and high-level radioactive waste from the 77 sites to the repository by legal-weight truck. About 53,000 legal-weight trucks carrying these materials would travel primarily on the nation's interstate highway system during the 24-year period. About 300 shipments of naval spent nuclear fuel would travel from the Idaho National Engineering and Environmental Laboratory to Nevada by rail, where the rail casks would be transferred to heavy-haul trucks for shipment to the repository.

Environmentally Preferable Transportation Mode Alternative

In making this determination, DOE considered human health and environmental impacts that could occur from shipping spent nuclear fuel and high-level radioactive waste from the 77 sites to the repository at Yucca Mountain. DOE also considered the human health and environmental impacts that could occur from the construction of a rail line and from any upgrades to existing highways (the heavy-haul truck routes) in Nevada.

The Final EIS indicates that some potential non-radiological fatalities could occur as a result of traffic accidents during the transportation of spent nuclear fuel and high-level radioactive waste to the repository at Yucca Mountain. The Final EIS indicates that the highest number of potential traffic fatalities (about five) could occur under the mostly legal-weight truck scenario, whereas the mostly rail scenario could result in about three potential traffic fatalities during the 24-year period of shipping spent nuclear fuel and high-level radioactive waste to the repository at Yucca Mountain.

The Final EIS also considers the potential health effects that could result from radiation exposure to workers during shipping and from cask loading and unloading, and to the general population along the transportation routes to the repository. Under the mostly legal-weight truck scenario, the Final EIS indicates that about 12 worker and three general public latent cancer fatalities could occur from routine (incident-free) exposures during the 24-year period of shipping spent nuclear fuel and high-level radioactive waste to the repository. Under the mostly rail scenario, about three worker and one general public latent cancer fatalities could occur during the 24-year period. The radiation dose to any one individual would be extremely small.

DOE also estimated the potential health effects to the general public that could result from a severe transportation accident during shipments to the repository (referred to in the Final EIS as a maximum reasonably foreseeable accident). The probability that this accident could occur is extremely unlikely—about three chances in 10 million per year. If such an accident were to occur in an urban population setting, less than one latent cancer fatality could be expected under the mostly legal-weight truck scenario, whereas about five latent cancer fatalities could be expected under the mostly rail scenario, primarily because of the greater amounts of radioactive materials that could be released from a rail cask in such an accident.

In Nevada, construction of a rail line, regardless of the rail corridor selected, would involve the disturbance of land (and associated impacts, although low, to natural resources such as biological and cultural resources) in amounts greater than those associated with any heavy-haul truck alternative. For example, construction of a rail line in the shortest rail corridor (Valley Modified) would result in the disturbance of about 1,240 acres; rail line construction in the longest corridor (Carlin) would disturb about 4,900 acres. Construction of an intermodal transfer station and the upgrade of the longest heavy-haul route would result in the disturbance of about 1,000 acres. Furthermore, the construction of any rail line would involve various land use conflicts that, for the most part, would not occur with the limited construction required to improve any of the heavy-haul truck routes. No land disturbances

[3] The final EIS stated that DOE anticipated as many as 5 casks per train. However, DOE conservatively estimated 1 cask per train for analytical purposes to ensure that it considered routine and accident transportation risks that could result from a larger number of train shipments (9,000 to 10,000).

would occur under the legal-weight truck alternative.

The Department also evaluated the risk of sabotage, including terrorism. For reasons the NRC has carefully explained, this analysis is most likely not required by NEPA.[4] It is not possible to predict whether such acts would occur and, if they did, the nature of such acts. Moreover, such analysis does not advance the public participation purpose of NEPA, since there are serious limits on what information can responsibly be disseminated on these issues without risking disclosure of information that might be used in planning or carrying out such an act.[5] Nevertheless, the Final EIS includes the consequences of a potentially successful attempt on a cask during shipment via rail or legal-weight truck. In both instances, a successful attack would result in the release of contaminants into the environment. The consequences estimated for a rail shipment would be less than those estimated for a legal-weight truck shipment, mostly because the thicker shield wall of the heavier rail cask would tend to mitigate the effects of the sabotage event when compared to the lighter, legal-weight truck transportation cask.

None of the three transportation scenarios analyzed in the Final EIS is clearly environmentally preferable. Each would result in some impact to the environment, and public health and safety, although all impacts would be small. For example, transporting by either rail or heavy-haul truck in Nevada would result in some land disturbance, although the impacts would be greater for rail because more land would be disturbed during the construction of a rail line than during the upgrading of existing highways to accommodate heavy-haul trucks. Radiation exposure to workers and the public from either routine rail or truck shipments to the repository at Yucca Mountain would be very small, and the differences among the different modes of transportation also would be very small. Similarly, accident risks under each alternative would be very small, and associated differences among alternatives also very small. The Department does not consider the differences among modes to be sufficiently distinct to make any of them clearly environmentally preferable.

Although the potential impacts of any of the transportation alternatives would be small, they would be greater than the transportation-related impacts of the No-Action Alternatives. Overall however, as analyzed in the Final EIS, the impacts of proceeding with construction and operation of a repository at Yucca Mountain, including transportation, would cause relatively small public health impacts through the period 10,000 years after repository closure and would cause fewer public health impacts than the No-Action Alternative. For the No-Action Alternative with institutional controls for 10,000 years, the potential long-term environmental impacts also would be small, but significantly greater than the proposed action because the potential for nonradiological fatalities to workers under this alternative is significantly greater. Additional information may be found on pages S–82 through S–88 and Chapters 2 and 7 of the Final EIS. The cost of this No-Action Alternative is also significantly greater than that of the proposed action ($42.7 billion to $57.3 billion (in 2001 dollars) for the proposed action versus $167 billion to $184 billion for the first 300 years of institutional control and $519 million to $572 million per year thereafter). Additionally, the public health and safety impacts of the No-Action Alternative without effective institutional control are significantly greater than the proposed action. Likewise, in the long run, securing these materials by consolidating them and disposing of them in a secure, remote location, better protects against terrorist attack than leaving them at 72 commercial and 5 DOE sites in 35 states within 75 miles of more than 161 million Americans.[6] Moreover, for the reasons expressed by the Secretary and the President in their site recommendations and by the Congress in passing the joint resolution, it is in the national interest to move forward with this project.

In any event, in the Yucca Mountain Development Act, Pub. L. 107–200, Congress directed DOE to proceed with the development of a license application for a repository for the disposal of spent nuclear fuel and high-level radioactive waste. DOE believes that this statute and the NWPA make it incumbent on DOE to proceed with appropriate transportation planning so the Department will be in a position to fulfill its responsibility under the NWPA to begin disposal of this material promptly, should the NRC grant the necessary authorizations for it to do so.

Transportation-Related Comments on the Final EIS

DOE distributed about 6,200 copies of the Final EIS and has received written comments on the Final EIS from the White Pine County Nuclear Waste Project Office, White Pine County Board of County Commissioners, Board of County Commissioners Lincoln County, Board of Mineral County Commissioners, and a member of the public. Although comments were received on a variety of issues, the following summation addresses only those few comments related to the transportation of spent nuclear fuel and high-level radioactive waste to a Yucca Mountain repository.

Commenters stated that DOE should develop specific transportation-related mitigation measures, and encouraged DOE to do so in a cooperative manner. Commenters also stated that additional, more detailed and community-specific transportation analyses are needed for purposes of mitigation planning, as well as to support DOE in its transportation decisionmaking, such as the decision on the mode of transportation. Commenters also encouraged DOE to develop plans for transportation, such as route selection for shipments of spent nuclear fuel and high-level radioactive waste, and emergency planning and response. Commenters also requested clarification of the roles of the NRC and DOE's transportation services contractors, and whether counties are eligible for technical assistance and funding under Section 180(c) of the Nuclear Waste Policy Act (NWPA).

As discussed below in Use of All Practicable Means to Avoid or Minimize Harm (Parts I and II), DOE has already adopted measures to avoid or minimize environmental harm that could result from the transportation of spent nuclear fuel and high-level radioactive waste. Additional potential mitigation measures associated with the construction of a rail line will be identified during preparation of an environmental impact statement that considers alternative alignments within the Caliente corridor for construction of the rail line (see PART II of this ROD). DOE also will consult with states, Native American tribes, local governments, utilities, the transportation industry and other interested parties in a cooperative

[4] *See Duke Cogema Stone & Webster*, 56 N.R.C. 335 (2002); *Private Fuel Storage, L.L.C.*, 56 N.R.C. 340 (2002); *Duke Energy Corp.*, 56 N.R.C. 358 (2002); *Dominion Nuclear Connecticut, Inc.*, 56 N.R.C. 367 (2002); *Pacific Gas & Electric Company*, 57 N.R.C. 1 (2003); and *Pacific Gas & Electric Company*, 58 N.R.C. 185 (2003), appeal docketed, No. 03–74628 (9th Cir. Dec. 12, 2003).

[5] *See* materials cited in footnote 4

[6] As explained in footnote 2, some additional materials are currently stored at 50 additional sites (54 at the time of site recommendation), consisting primarily of research reactors, in four additional states, but DOE plans to consolidate these materials at two DOE sites for reasons unrelated to its repository plans.

manner to refine the transportation system as it is developed. Furthermore, DOE must comply with the transportation-related provisions of the NWPA. Spent nuclear fuel and high-level radioactive waste will be shipped to Yucca Mountain in casks that have been certified by the NRC (Section 180(a)). Prior to these shipments, DOE will comply with the regulations of the NRC regarding advanced notification of state and local governments (Section 180(b)).

Transportation Mode Decision

Under the NWPA, the Department is responsible for planning that will allow for the transportation of spent nuclear fuel and high-level radioactive waste in the event the NRC authorizes receipt and possession of these materials at Yucca Mountain. Accordingly, as the next step in fulfilling that responsibility, the Department is issuing this Record of Decision to select a transportation mode. The Department has decided to select the preferred mode of transportation analyzed in the Final EIS, the mostly rail scenario, both on a national basis and in the State of Nevada. Under this decision, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository up to 70,000 MTHM of spent nuclear fuel and high-level radioactive waste. Most of the spent nuclear fuel and high-level radioactive waste would be transported by rail. The Department would use truck transport where necessary, depending on certain factors such as the timing of the completion of the rail line proposed to be constructed in Nevada. This could include building an intermodal capability at a rail line in Nevada to take legal-weight truck casks from rail cars and transport them the rest of the way to the repository via highway, should the rail system be unavailable at the time of the opening of the repository [7]. In addition, since some commercial utilities are not able to accommodate rail casks, they would ship by legal-weight truck to the repository. Additionally, the Department would use heavy-haul truck and possibly barge as needed to ship spent nuclear fuel from commercial nuclear sites to nearby railheads outside Nevada for shipment to the repository.

[7] In March 2004, DOE issued a Supplement Analysis and determined, in accordance with 10 CFR 1021.314, that this rail/legal-weight truck scenario would not constitute a substantial change to the proposal previously analyzed in the Final EIS or significant new circumstances or information relevant to environmental concerns, as discussed in 40 CFR 1502.9(c)(1).

Basis for Transportation Mode Decision

As we explain below, the Department has concluded that it should use mostly rail nationwide and in Nevada based, in large part, on the analyses of the Final EIS. The Department also considered the preferences for rail transportation expressed by the State of Nevada and other factors described below.

The analyses in the Final EIS demonstrate that the potential radiation doses to workers and the general public from rail, truck or barge transportation would be very small, and that the differences in resulting potential impacts from such exposures among the different modes of transportation also would be very small. Nevertheless, using mostly rail tends to minimize the potential environmental impacts that could occur. The decision to rely primarily on the nation's rail system to ship these materials would result in fewer shipments than would occur if legal-weight trucks were the primary mode of transportation. This in turn would result in fewer trucks on public highways. The lower number of rail shipments as compared to truck shipments is estimated to result in fewer potential traffic fatalities and, under routine conditions, slightly fewer latent cancer fatalities to workers and the general public relative to mostly legal-weight truck shipments.

In reaching its decision, DOE also considered the number of commercial nuclear sites having, or expected to have, the capability to handle rail casks, the distances to suitable railheads near the commercial nuclear sites, and historical experience using rail to ship spent nuclear fuel and other large reactor-related components. The Department found that the preponderance of commercial sites have the capability and experience to ship to nearby railheads.

The Department also considered preferences expressed by the State of Nevada in its comments on the Draft EIS. In these comments, the state indicated that DOE should plan its transportation system to maximize the use of rail.

The Department also considered irreversible and irretrievable commitments of resources and cumulative impacts in making its decision. There would be an irreversible and irretrievable commitment of resources, such as land, electric power, fossil fuels and construction materials, associated with the construction of a rail line in Nevada, although this commitment of resources would not significantly diminish these resources, either nationwide or in Nevada. DOE also recognizes that for all alternatives involving transportation of spent nuclear fuel and high-level radioactive waste, there could be cumulative impacts from past, present and reasonably foreseeable future activities involving transportation of other radioactive materials. Based on the analyses in the Final EIS, DOE does not expect that any cumulative impacts would be significant over the duration of shipping spent nuclear fuel and high-level radioactive waste to the repository.

Based on these various considerations, DOE concludes that shipping by mostly rail, both nationally and in the State of Nevada, would be preferable to shipping by mostly truck or using heavy-haul trucks in Nevada.

Use of All Practicable Means To Avoid or Minimize Harm—Transportation Mode

The shipment of spent nuclear fuel and radioactive waste is highly regulated and subject to the utmost scrutiny. DOE carefully follows the Department of Transportation (DOT) and NRC transportation rules now and will follow or exceed any others that may be established in the future whether by the Congress or by DOT or NRC. DOE also will consult with states, Native American tribes, local governments, utilities, the transportation industry and other interested parties in a cooperative manner to refine the transportation system as it is developed.

Measures DOE will implement to avoid or minimize harm include the following [8]: prior to the shipment of spent nuclear fuel, the shipper or carrier must select routes and prepare a written plan listing origin and destination of the shipment, scheduled route, all planned stops, estimated time of departure and arrival, and emergency telephone numbers; advance notice must be provided to State and local governments prior to shipping irradiated reactor fuel through their states; anyone involved in the preparation or transport of radioactive materials will be required to have proper training; carriers must be provided with shipping papers containing emergency information, including contacts and telephone numbers, readily available during transport for inspection by appropriate officials; clearly identifiable markings, labels, and placards of hazardous contents must be provided; and all spent nuclear fuel and high-level

[8] Application of these measures to national security activities may, in some respects, be subject to section 7 of the Nuclear Waste Policy Act, 42 U.S.C. section 10106.

radioactive waste shipments would be in the most rugged casks (Type B, which range from small containers of sealed radioactive sources to heavily shielded steel casks that sometimes weigh as much as 150 tons).

The NRC has promulgated rules (10 CFR 73.37) and interim compensatory measures (March 4, 2002; 67 FR 9792) specifically aimed at protecting the public from harm that could result from sabotage of spent nuclear fuel casks. These security rules are designed to minimize the possibility of sabotage and facilitate recovery of spent nuclear fuel shipments that could come under the control of unauthorized persons. The use of armed escorts for all shipments; safeguarding the detailed shipping schedule information, monitoring of shipments through satellite tracking and a communication center with 24-hour staffing; and coordinating logistics with state and local law enforcement agencies all contribute to shipment security. Additionally, the cask safety features that provide containment, shielding, and thermal protection provide protection against sabotage. The Department and other agencies continue to examine the protections built into their physical security and safeguards systems for transportation shipments.

DOE is now developing its transportation security plan and its design basis threat for transportation. The transportation security plan will be developed in cooperation with other Federal agencies, including the NRC, DOT, and the Department of Homeland Security. The Office of Civilian Radioactive Waste Management is exploring the use of armed Federal agents as escorts for all shipments and other operational techniques employed by the National Nuclear Security Administration's Office of Secure Transportation as well as the design of special security cars for rail transport, to further mitigate the potential threat of a terrorist act. In addition to its domestic efforts, the Department is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of a potential act of sabotage and is exploring opportunities to enhance the physical protection of casks. As a result of the above efforts, DOE will modify its methods and systems as appropriate between now and the time shipments start.

In compliance with section 180(c) of the NWPA, DOE will provide technical assistance and funds to states for training public safety officials of appropriate units of local government and Native American tribes through whose jurisdictions the Department plans to ship spent nuclear fuel and high-level radioactive waste. The training of public safety officials will cover procedures required for safe routine transportation of these materials and for dealing with emergency response situations.

Pursuant to the NWPA, spent nuclear fuel and high-level radioactive waste will be transported in casks certified by the NRC. The NRC regulates and certifies the design, manufacture, testing and use of these casks. Additionally, the NWPA requires that DOE comply with NRC regulations regarding advance notification of State and local governments prior to transportation of spent nuclear fuel or high-level radioactive waste.

At this stage in the decision-making, the Department believes it has incorporated all practicable mitigation measures. The Department will continue to identify and evaluate potential mitigation measures as the transportation system develops and as a result of the lessons learned from the shipping of spent nuclear fuel and high-level radioactive waste.

Part II. Record of Decision for Nevada Rail Corridor

Background

As noted above, the mostly rail scenario assumes that DOE will ultimately construct a rail line in Nevada to ship spent nuclear fuel and high-level radioactive waste to the repository. To implement that scenario, DOE therefore needs to select among alternative rail corridors within which to study possible alignments in which it will pursue construction of a rail line that would connect the repository at Yucca Mountain to an existing main rail line in Nevada in the event the NRC authorizes construction of a repository at Yucca Mountain. In the Final EIS, DOE analyzed five potential rail corridors—Caliente, Carlin, Caliente-Chalk Mountain, Jean and Valley Modified—for this potential rail line. Additional descriptive information, including variations associated with each corridor, may be found in section 2.1.3.3 and Appendix J, section J.3.1.2, of the Final EIS. The Final EIS did not specify a corridor preference, but in December 2003, DOE announced its preference for the Caliente corridor (*Notice of Preferred Nevada Rail Corridor*; 68 FR 74951; December 29, 2003.

Proposed Action and Nevada Rail Corridors Considered in the Final EIS

A. Caliente Rail Corridor—Preferred Alternative

The Caliente corridor originates at an existing siding to the mainline railroad near Caliente, Nevada. The corridor extends in a westerly direction to the northwest corner of the Nevada Test and Training Range (previously known as Nellis Air Force Range), before turning south-southeast to the repository at Yucca Mountain. The corridor ranges between 318 miles (512 kilometers) and 344 miles (553 kilometers), depending on the variations to the corridor considered in the Final EIS. Construction of a rail line within the Caliente corridor would take about 46 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $880 million (2001 dollars).

B. Carlin Rail Corridor

The Carlin corridor originates at the mainline railroad near Beowawe in north central Nevada. The Carlin and Caliente corridors converge near the northwest boundary of the Nevada Test and Training Range. Past this point, they are identical. The Carlin corridor ranges between 319 miles (513 kilometers) and 338 miles (544 kilometers) long, depending on the variations to the corridor. Construction of a rail line within the Carlin corridor would take about 46 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $821 million (2001 dollars).

C. Caliente-Chalk Mountain Rail Corridor

The Caliente-Chalk Mountain corridor is identical to the Caliente corridor until it approaches the northern boundary of the Nevada Test and Training Range. At that point the Caliente-Chalk Mountain corridor turns south through the Nevada Test and Training Range and the Nevada Test Site to the Yucca Mountain site. Depending on the variations, the corridor is between 214 miles (344 kilometers) and 242 miles (382 kilometers) long from the tie-in at the mainline near Caliente to the Yucca Mountain site. Construction of a rail line within the Caliente-Chalk Mountain corridor would take about 43 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $622 million (2001 dollars). The Department designated the Caliente-Chalk Mountain alternative as non-preferred in the Final EIS due to national security concerns raised by the U.S. Air Force.

D. Jean Rail Corridor

The Jean corridor originates at the existing mainline railroad near Jean, Nevada. The corridor ranges between 112 miles (181 kilometers) and 127 miles (204 kilometers) long from the tie-in with the mainline to the Yucca Mountain site. Construction of a rail line within the Jean corridor would take about 43 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $462 million (2001 dollars).

E. Valley Modified Rail Corridor

The Valley Modified corridor originates at an existing rail siding off the mainline railroad northeast of Las Vegas. Depending on the variations, the corridor is between 98 miles (157 kilometers) and 101 miles (163 kilometers) long from the tie-in with the mainline to the Yucca Mountain site. Construction of a rail line within the Valley Modified corridor would take about 40 months. The total life-cycle cost for construction and operation of the rail line is estimated to be $283 million (2001 dollars).

Environmentally Preferable Rail Corridor Alternative

DOE considered human health and environmental impacts that could occur from the construction of a rail line, as well as from shipping spent nuclear fuel and high-level radioactive waste in Nevada.

Construction of a rail line, regardless of the rail corridor selected, would involve the disturbance of land and associated impacts, although low, to natural resources such as biological and cultural resources. For example, construction of a rail line in the Valley Modified corridor (shortest) would result in the disturbance of about 1,240 acres; rail line construction in the Carlin corridor (longest) would disturb about 4,900 acres.

Construction of any rail line in Nevada also would conflict with existing land uses. Depending on the variations considered, privately-owned lands occur on less than one percent of the lands analyzed under the Caliente (ranges from 222 to 618 acres), Caliente-Chalk Mountain (ranges from 198 to 272 acres) and Valley Modified (ranges from 0 to 44 acres) corridors, but up to about five and seven percent of the lands analyzed under the Jean (ranges from 32 to 865 acres) and Carlin (ranges from 1,804 to 3,756 acres) corridors, respectively. The Caliente and Carlin corridors cross Timbisha-Shoshone trust lands, and a relatively short distance on the Nevada Test and Training Range, although variations are available that would avoid these lands. The Caliente corridor crosses two wilderness study areas, and the Valley Modified corridor passes through the Desert National Wildlife Range, although variations may be available to avoid these lands. The Caliente-Chalk Mountain corridor crosses land dedicated to testing and training activities of the U.S. Air Force and Department of Defense on the Nevada Test and Training Range; no variations are available that would avoid the Range under this corridor alternative.

Under any rail corridor alternative, water would be used for compaction of the rail bed and dust suppression, and by workers during construction. Water consumption would vary, primarily because of the length of the corridor, ranging from 320 acre-feet for the Valley Modified corridor to 710 acre-feet for the Caliente corridor.

During the 24-year shipping period, assuming standard nationwide rail routing practices, the incident-free (routine) collective dose to members of the public from the transportation of spent nuclear fuel and high-level radioactive waste by rail would result in less than one latent cancer fatality regardless of which corridor is selected. The difference in impacts among the corridors is minimal. Similarly, less than one latent cancer fatality would occur in the exposed worker population, and that is not affected by the Nevada corridor selection.

DOE also estimated the potential health effects to the general public that could result from a severe transportation accident during shipments to the repository (referred to in the Final EIS as a maximum reasonably foreseeable accident). If such an accident were to occur in a rural population setting, the collective radiological dose to members of the public would result in less than one latent cancer fatality. The probability that this accident could occur is extremely unlikely—about 2 chances in 1 million per year.

The environmental impacts identified in the Final EIS do not provide a clear basis for discriminating among alternative rail corridors in Nevada. Each of these alternatives would result in some impact to the environment and public health and safety. Construction of a rail line within any rail corridor would involve certain land use conflicts, and land disturbance with attendant impacts (although small, the impacts tend to increase with increasing corridor length). Radiation exposure to workers and the public in Nevada would be small, and the differences among the rail corridor alternatives also would be very small.

For these reasons, DOE does not consider the differences among the corridor alternatives to be sufficient to make any of them clearly environmentally preferable.

Finally, although the potential impacts of any of the five potential rail corridors would be small, they would be greater than the potential transportation-related impacts of the No-Action Alternatives. Nevertheless, as explained above, the impacts of proceeding with construction and operation of a repository at Yucca Mountain, including transportation, are relatively small and less than either of the No-Action Alternative scenarios. Part I (of this ROD) provides further comparison of the proposed action and the No-Action Alternative scenarios. In any event, given DOE's responsibilities under the Yucca Mountain Development Act and the NWPA, DOE believes it is obligated to proceed with appropriate transportation planning, including, given its selection of the mostly rail scenario in Nevada, the selection of a corridor in which to study possible alignments for the Nevada rail line, in preference to either No-Action Alternative scenario.

Comments on Preferred Rail Corridor

DOE noticed its preference for the Caliente corridor in the **Federal Register** (December 29, 2003; 68 FR 74951). The Carlin corridor was identified as a secondary preference. The Department has received comments on the preference announcement. Concerns expressed in these comments included the need for a comprehensive programmatic EIS covering all aspects of nuclear waste transportation to Yucca Mountain, avoidance of all major population centers with transportation routes, and provision of documentation supporting the preference decision. Other comments addressed the need for adequate opportunities for public participation and comment on the corridor preference announcement, including a request for cooperating agency status for any future rail alignment EIS. Selection of a corridor preference prior to having a mode of transportation decision was raised as a concern. In addition, there was confusion regarding the designation of the Carlin corridor as a secondary preference and its relationship to the upcoming rail alignment EIS process. Furthermore, commenters indicated that a rail line in the Caliente corridor would have significant negative impacts on cultural, socioeconomic, and wildlife resources, as well as a massive modern

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sculpture project. Others raised the potential for impacts to ranchers living in proximity to the proposed Caliente corridor, including questions regarding the design and operation of a rail line and the nature of measures that could mitigate resulting adverse impacts. Finally, several commenters thanked DOE for announcing its corridor preference, recognizing the challenges and opportunities and associated need to coordinate closely as DOE proceeds with transportation planning.

Comments calling for DOE to prepare a programmatic transportation EIS and the need to avoid all major Nevada population centers with transportation routes were addressed in the response to comments in the Final EIS. DOE believes a programmatic EIS to be unnecessary as its Final EIS provides the environmental impact information necessary to make certain broad transportation-related decisions (as described above in Transportation-Related Decisions).

With regard to avoiding population centers, the analyses of the Final EIS illustrate that potential public health and safety impacts would be so low for individuals who lived and worked along any route that individual impacts would not be discernible, even if the corresponding doses could be measured.

Although some commenters stated that DOE's intent in identifying the Carlin corridor as a secondary preference was unclear, the decision to select the Caliente corridor also represents DOE's intent to no longer consider the Carlin corridor for development of a rail line. This decision and the basis for not selecting the Carlin corridor are discussed below in Rail Corridor Decision and Basis for Rail Corridor Decision.

The remaining concerns and issues regarding potential environmental impacts associated with the development of a rail line, potential mitigation measures, and opportunities for public involvement and project participation will be addressed during the future preparation of a rail alignment EIS. As part of developing this documentation, DOE will identify and adopt measures to avoid or minimize environmental harm that could result from the construction and operation of a rail line within the Caliente corridor.

Rail Corridor Decision

In Part I of this Record of Decision, the Department selected, both on a national basis and in the State of Nevada, the mostly rail scenario. That decision is premised on the assumption that DOE will ultimately construct a rail line to connect the repository site to an existing rail line in the State of Nevada. To that end, the Department has decided to select the preferred rail corridor alternative, the Caliente corridor, in which to evaluate alignments for a rail line.

Basis for Rail Corridor Decision

The Department decided to evaluate alignments within the Caliente corridor for possible construction of a rail line based, in large part, on the analyses of the Final EIS. The Department, however, also considered other factors discussed below, such as potential for construction delay, direct and indirect costs of each alternative, and comments received from the public.

The Department considered irreversible and irretrievable commitments of resources and cumulative impacts in making its decision. There would be an irreversible and irretrievable commitment of resources, such as electric power, fossil fuels, construction materials, and water associated with the construction of a rail line in Nevada, although this commitment of resources would not significantly diminish the resources in question in Nevada. DOE recognizes that for all rail corridors there could be cumulative impacts from past, present and reasonably foreseeable future activities.

The Department considered potential land use conflicts and their potential to affect adversely construction of a rail line, as analyzed in the Final EIS in making this decision. If the Department were to select the Valley Modified rail corridor there may be conflicts with the Desert National Wildlife Range and local community plans for development in the greater Las Vegas metropolitan area. If the Department were to select the Caliente-Chalk Mountain corridor there would be conflicts with U.S. Air Force and Department of Defense testing and training activities directly related to national security interests on the Nevada Test and Training Range. If the Department were to select the Jean corridor it may require crossing relatively greater amounts of private land, and would pose greater potential land use conflicts because of its proximity to the greater Las Vegas metropolitan area. If the Department were to select the Carlin corridor it would also require crossing relatively greater amounts of private land. Moreover, little infrastructure, such as roads and electric power, is available over long segments, which would tend to make logistics during construction as well as emergency response capabilities more challenging. Overall, the Caliente rail corridor appears to have the fewest land use or other conflicts that could lead to substantial delays in acquiring the necessary land and rights-of-way, or in beginning construction.

DOE also considered concerns expressed by the public in Nevada. In these comments, the public stated that DOE should avoid rail corridors in the Las Vegas Valley.

The Department also considered the direct costs of constructing and operating a rail line, and the indirect costs resulting from potential delays in the availability of the rail line. The Jean and Valley Modified corridors are the shortest and have the lowest estimated construction costs. The Carlin and Caliente corridors are the longest and on the basis of construction cost alone would be more expensive to develop. However, delays in the construction of the rail line because of land use or other conflicts and the resulting inability to accept large amounts of spent nuclear fuel and high-level radioactive waste transported by a railroad to the repository in a timely manner could add to both the liability costs for delayed acceptance of commercial spent nuclear fuel and the costs of continued storage of DOE wastes.

Based on all of the above, DOE concludes that the Caliente corridor is preferable to the other corridors it evaluated as a potential corridor in which to construct a rail line. Therefore, DOE has decided to select the Caliente corridor as the one within which to evaluate possible alignments for the rail line connecting the repository to an existing main rail line in Nevada.

Use of All Practicable Means To Avoid or Minimize Harm—Rail Corridor

In the Final EIS, DOE identified transportation-related measures that would be implemented, and other measures that would require further consideration and refinement before adoption to avoid or minimize environmental harm. As described in Part I, this decision adopts all practicable measures to avoid or minimize adverse environmental impact that could result from the transportation of spent nuclear fuel and high-level radioactive wastes to a repository at Yucca Mountain appropriate at this stage of decision-making. Construction of a rail line will be consistent with applicable Federal, state and Native American tribal requirements. In addition to these measures, other potential mitigation measures associated with the construction of a rail line will be identified and evaluated during preparation of future NEPA documentation.

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DEPARTMENT OF ENERGY

Notice of Intent to Prepare an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV

AGENCY: U.S. Department of Energy.

ACTION: Notice of intent.

SUMMARY: The U.S. Department of Energy (DOE or the Department) announces its intent to prepare an environmental impact statement (EIS) under the National Environmental Policy Act (NEPA) for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. On April 2, 2004, the Department signed a Record of Decision announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, February 2002) (Repository Final EIS). This decision will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste, in the event that the Nuclear Regulatory Commission authorizes construction of the repository and receipt and possession of these materials at Yucca Mountain. To that end, the Department also decided to select the Caliente rail corridor [1] in which to examine possible alignments for construction of a rail line that would connect the repository at Yucca Mountain to an existing main rail line in Nevada. DOE is now announcing its intent to prepare this Rail Alignment EIS to assist in selecting this alignment. The EIS also would consider the potential construction and operation of a rail-to-truck intermodal transfer facility, proposed to be located at the confluence of an existing mainline railroad and a highway, to support legal-weight truck transportation until the rail system is fully operational.

[1] A corridor is a strip of land 0.25 miles (400 meters) wide that encompasses one of several possible routes through which DOE could build a rail line. An alignment is the specific location of a rail line in a corridor.

DATES: The Department invites and encourages comments on the scope of the EIS (hereafter referred to as the Rail Alignment EIS) to ensure that all relevant environmental issues and reasonable alternatives are addressed. Public scoping meetings are discussed below in the **SUPPLEMENTARY INFORMATION** section. DOE will consider all comments received during the 45-day public scoping period, which starts with the publication of this Notice of Intent and ends May 24, 2004. Comments received after the close of the public scoping period will be considered to the extent practicable.

ADDRESSES: Written comments on the scope of this Rail Alignment EIS, questions concerning the proposed action and alternatives, requests for maps that illustrate the Caliente corridor and alternatives, or requests for additional information on the Rail Alignment EIS or transportation planning in general should be directed to: Ms. Robin Sweeney, EIS Document Manager, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477, or via the Internet at *http://www.ocrwm.doe.gov* under "What's New."

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance (EH–42), U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Background

On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. Subsequently, the Department issued a Record of Decision (April 2, 2004) to announce its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Repository Final EIS as the mode of transportation of spent nuclear fuel and high-level radioactive waste to the repository. Under the mostly rail scenario, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository site at Yucca Mountain up to 70,000 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste. Most of the spent nuclear fuel and high-level radioactive waste, however, would be transported by rail.

The Department's decision to select the mostly rail scenario in Nevada will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste in the event that the Nuclear Regulatory Commission authorizes construction of the repository and receipt and possession of these materials at Yucca Mountain. To that end, in the same Record of Decision, the Department also decided to select the Caliente rail corridor to study possible alignments for this rail line.

In the Repository Final EIS, DOE defined a rail corridor as a 0.25 miles (400-meter) wide strip of land that encompasses one of several possible alignments or specific locations within which DOE could build a rail line. The Caliente rail corridor was described as originating at an existing siding to the mainline railroad near Caliente, Nevada, and extending in a westerly direction to the northwest corner of the Nevada Test and Training Range, before turning south-southeast to the repository at Yucca Mountain.

In the Repository Final EIS, DOE also identified eight variations along the Caliente corridor that may minimize or avoid environmental impacts and/or mitigate construction complexities. Variations were defined as a strip of land 0.25 miles (400-meters) wide that describes a different route, from one point along the corridor to another point on the corridor. Thus, the Caliente corridor ranges between 318 miles (512 kilometers) and 344 miles (553 kilometers) in length, depending on the variations considered. In the Repository Final EIS, DOE did not identify variations for about 55 percent of the length of the corridor (hereafter these areas are referred to as "common segments").

DOE proposes to consider the common segments and the eight variations as preliminary alternatives to be evaluated in the Rail Alignment EIS. These alternatives are described in the *Preliminary Alternatives* section. In addition, DOE will consider other potential variations outside of the 0.25

mile wide corridor that might minimize, avoid or mitigate adverse environmental impacts.

For purposes of analysis in the Rail Alignment EIS, a rail line alignment is defined as a strip of land 100 feet (30 meters) on either side of the centerline of the track within the Caliente corridor, passing through the common segments and variations. DOE will define regions of influence for each environmental resource (for example, biological or cultural resources) that will extend beyond the dimensions of the alignment and allow DOE to estimate environmental impacts over the geographic area in which the impact is likely to be realized. Within these regions of influence, DOE will estimate environmental impacts of the common segments and alternatives, both separately and in aggregate. In this way, the analyses of the Rail Alignment EIS will offer DOE flexibility to minimize, avoid or otherwise mitigate potential environmental impacts of the final alignment chosen for construction.

Proposed Action

In the Rail Alignment EIS, the Proposed Action is to determine a rail alignment, and to construct and operate a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials [2] from a site near Caliente, Lincoln County, Nevada to a geologic repository at Yucca Mountain, Nye County, Nevada. Under the Proposed Action, the Caliente rail line would be designed and built consistent with Federal Railroad Administration safety standards. Construction would take between three and four years.

Construction activities would include the development of construction support areas; construction of access roads to the rail line construction initiation points [3] and to major structures to be built, such as bridges and culverts; and movement of materials and equipment to the construction initiation points. The number and location of construction initiation points would be based on such variables as the length of the rail line, the construction schedule, the number of contractors used for construction, the number of structures to be built, the supply of materials, and the locations of existing access roads adjacent to the rail line.

The construction of the rail line would require the clearing and excavation of previously undisturbed lands, and the establishment of borrow and spoils [4] areas. To establish a stable base for the rail track, construction crews would excavate some areas and fill (add more soil to) others, as determined by terrain features. To the extent possible, material excavated from one area would be used in areas that required fill material. However, if the distance to an area requiring fill material were excessive, the excavated material would be disposed of in spoils areas, and a borrow area would be established adjacent to the area requiring fill material. Access roads to spoils and borrow areas would be built during the track base construction work.

Under the Proposed Action, DOE would construct a secure railyard and facilities at the operational interface with the mainline railroad near Caliente, Nevada. The facilities would include sidings connected to the mainline, and buildings and associated equipment for track and equipment maintenance, locomotive refueling, and train crew quarters.

DOE also will consider the potential construction and operation of a rail-to-truck intermodal transfer facility to support limited legal-weight truck transportation until the rail system is fully operational. This intermodal transfer facility could be constructed at the confluence of an existing mainline railroad and a highway.

Typical construction equipment (front-end loaders, power shovels, and other diesel-powered support equipment) would be used for clearing and excavation work. Trucks would spray water along graded areas for dust control and soil compaction. The fill material used along the rail line to establish a stable base for the track would be compacted to meet design requirements. Water could be shipped from other locations or obtained from wells drilled along the rail line.

Railroad track construction would consist of the placement of railbed material (sub-ballast), ballast (support and stabilizing materials for the rail ties), ties and rail over the completed railbed base. Other activities would include: installation of at-grade crossings, fencing as needed, train monitoring and signals and communication equipment, and final grading of slopes, rock-fall protection devices, and restoration of disturbed areas.

Operation of the Caliente rail line would be consistent with Federal Railroad Administration standards for maintenance, operations, and safety. A typical spent nuclear fuel and high-level radioactive waste train would consist of two diesel-electric locomotives; three or more rail cars containing spent nuclear fuel or high-level radioactive waste; buffer cars; and an escort car. A typical train carrying construction materials would not have buffer cars or an escort car.

At the Yucca Mountain repository, rail cars containing casks of spent nuclear fuel and high-level radioactive waste would move through a security check into the radiologically controlled area. The casks would be inspected and protective barriers removed, in preparation for waste handling at the repository. Rail cars carrying construction materials would be offloaded and the materials stockpiled on site.

Preliminary Alternatives

As required by the Council on Environmental Quality and Department regulations that implement NEPA, the Rail Alignment EIS will analyze and present the environmental impacts associated with the range of reasonable alternatives to meet DOE's purpose and need for a rail line, and a no action alternative. The preliminary alternatives for the alignment comprise a series of common segments and alternatives (maps may be obtained as described above in **ADDRESSES**). The Department is particularly interested in identifying and subsequently evaluating any additional reasonable alternatives that would reduce or avoid known or potential adverse environmental impacts, national security activities, features having aesthetic values, and land-use conflicts, or alternatives that should be eliminated from detailed consideration. This could include identifying alternatives that could avoid wilderness study areas or other land use conflicts. The preliminary alternatives include:

Interface With Mainline Railroad

Three alternatives are available to connect to the existing mainline railroad, each of which would intersect the common segment of the rail alignment about 4 miles (6.5 kilometers) southwest of Panaca, Nevada, along U.S. 93 in the Meadow Valley area. The Caliente Alternative would begin at the town of Caliente, enter Meadow Valley at Indian Cove and extend north

[2] Other materials refer to materials related to the construction (*e.g.*, reinforcing steel, cement) and operation (*e.g.*, waste packages, fuel oil) of the repository.

[3] DOE anticipates that construction of the rail line may occur at several locations simultaneously along the alignment.

[4] Borrow areas are areas outside of the rail alignment where construction personnel could obtain earthen materials such as aggregate for construction of the rail line. Spoil areas are areas outside of the alignment for the deposition of excess earthern materials excavated during construction of the rail line.

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through Meadow Valley to converge with the common segment. This alternative is about 10.5 miles (17 kilometers) in length.

The Eccles Alternative would begin at the Eccles siding along Clover Creek about 5 miles (8 kilometers) east of Caliente, trend generally north entering Meadow Valley on the southeast, and would then trend northward to converge with the common segment. This alternative is about 11 miles (18 kilometers) in length.

The Crestline Alternative would begin north of the Crestline siding in Sheep Spring Draw, extend west after crossing Lincoln County Road 75, and pass north of the Cedar Range. It would then veer northwesterly just north of Miller Spring Wash and converge with the common segment just south of the Big Hogback. This alternative is about 23 miles (38 kilometers) in length.

White River

The two White River Alternatives would depart from the common segment about 1.5 miles (2.5 kilometers) west of its crossing of the White River immediately west of State Route 318. The northern White River Alternative (WR1) would follow the White River, curve around the northern end of the Seaman Range, and then turn southwest entering Coal Valley. This alternative is about 25 miles (40 kilometers) in length.

The southern White River Alternative (WR2) would depart the same common segment but would extend westerly along the flanks of Timber Mountain, proceed through Timber Mountain Pass, and then enter Coal Valley. This alternative is about 18.5 miles (30 kilometers) in length.

Once in Coal Valley, both alternatives would merge with the Garden Valley Alternatives. Several options are available to merge the White River Alternatives with the Garden Valley Alternatives.

Garden Valley

The southern Garden Valley Alternative (GV2) would start about 2 miles (3 kilometers) east of the water gap located along Seaman Wash Road, proceed westward through the Golden Gate Mountains, and turn southwesterly through Garden Valley to reconnect to a common segment about 2.5 miles (4 kilometers) northeast of the pass between the Worthington Mountains and the Quinn Canyon Range. This alternative is about 17 miles (27.5 kilometers) in length.

The northern Garden Valley Alternative (GV1) would diverge from the same common segment as Alternative GV2, but would pass through the Golden Gate Mountains about 4 miles (6.5 kilometers) further north of the Alternative GV2 location. Alternative GV1 would then continue southwesterly through Garden Valley to reconnect with the common segment described for Alternative GV2. This alternative is about 19 miles (31 kilometers) in length.

Mud Lake

The Mud Lake Alternatives would depart a common segment located near the northwest corner of the Nevada Test and Training Range (previously known as Nellis Air Force Range) immediately north of Mud Lake. The western Mud Lake Alternative (ML1) would pass about 1.5 miles (2.5 kilometers) northwest of Mud Lake avoiding its western shoreline, and would extend southward to reconnect with a common segment. This alternative is about 3 miles (5 kilometers) in length.

The eastern Mud Lake Alternative (ML2) also would skirt Mud Lake to avoid its western shoreline and would reconnect with the same common segment as the western Mud Lake Alternative. This alternative is about 4 miles (6.5 kilometers) in length.

Goldfield

There are two alternatives associated with Goldfield. The western Goldfield Alternative (GF1), from its connection to Alternative ML1, would extend southward into the Goldfield Hills area passing about 1 mile (1.5 kilometers) east of Black Butte. This alternative would then turn east to pass about 1 mile (1.5 kilometers) northeast of Espina Hill and then would bear south to pass about 1 mile (1.5 kilometers) east of Blackcap Mountain. Alternative GF1 would then continue in a southerly direction following an abandoned rail line to reconnect to a common segment located about 2.5 miles (4 kilometers) north-northeast of Ralston, Nevada. This alternative is about 25 miles (41 kilometers) in length.

From its connection with Alternative ML2, the eastern Goldfield Alternative (GF2) would extend south-southeast into the Nevada Test and Training Range, and then would emerge from the Range turning southwest to converge with the western Goldfield Alternative (GF1) as it enters Stonewall Flat. This alternative is about 22 miles (35.5 kilometers) in length.

DOE is aware of concerns raised by the Department of Defense and the U.S. Air Force regarding the alternatives that intersect the Nevada Test and Training Range lands, and will consult with the Department of Defense and the U.S. Air Force during the Rail Alignment EIS process to ensure the transportation alignment selected does not compromise public safety, national security interests, or training and testing at the Nevada Test and Training Range.

Bonnie Claire

Bonnie Claire comprises two alternatives that would depart a common segment located about 3.3 miles (5.5 kilometers) southeast of Lida Junction, Nevada. The western Bonnie Claire Alternative (BC1) would follow an abandoned rail line to cross U.S. 95 about 1 mile (1.5 kilometers) south of Stonewall Pass, and would then trend southeast paralleling U.S. 95 on the west across Sarcobatus Flat. This alternative would then cross State Route 267 about 1.5 miles (2.5 kilometers) southwest of Scotty's Junction, continuing southeasterly until crossing U.S. 95 again on the eastern edge of Sarcobatus Flat about 14 miles (22.5 kilometers) northwest of Springdale, Nevada. This alternative is about 22 miles (35.5 kilometers) in length.

The eastern Bonnie Claire Alternative (BC2) would parallel the contours of Stonewall Mountain to the southeast and would then extend south, adjacent to the western edge of Pahute Mesa. This alternative would then parallel the northern side of U.S. 95 about 1 mile (1.5 kilometers) until it converges with the western Bonnie Claire Alternative (BC1) on the eastern edge of Sarcobatus Flat. This alternative is about 25.5 miles (41 kilometers) in length.

DOE is aware of concerns raised by the Department of Defense and the U.S. Air Force regarding the alternatives that intersect the Nevada Test and Training Range lands, and will consult with the Department of Defense and the U.S. Air Force during the Rail Alignment EIS process to ensure the transportation alignment selected does not compromise public safety, national security interests, or training and testing at the Nevada Test and Training Range.

Oasis Valley

Oasis Valley includes two alternatives that would avoid naturally-occurring springs. Both alternatives would depart a common segment about 2 miles (3 kilometers) east-northeast of Oasis Mountain. Alternative OV1 is about 3 miles (5 kilometers) in length. Alternative OV2, which is about 3.5 miles (5.5 kilometers) in length, would cross Oasis Valley further to the east of Alternative OV1, thereby increasing the distance to the springs.

Beatty Wash

The Beatty Wash alternatives would depart from a common segment about 3

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miles (5 kilometers) east-northeast of the hot springs north of Beatty and about 2 miles (3 kilometers) north-northeast of Beatty Wash. The eastern Beatty Wash Alternative (BW2) would extend east for about 5 miles (8 kilometers), then turn southward crossing a pass about 1 mile (1.5 kilometers) east of the Silicon and Thompson Mines. Alternative BW2 would then turn south to converge with Alternative BW1 about 4 miles (6.5 kilometers) east-northeast of Merklejoho Peak. This alternative is about 14 miles (22 kilometers) in length.

The western Beatty Wash Alternative (BW1) would extend south from the common segment described for Alternative BW2, crossing Beatty Wash and proceeding to the west of the Silicon and Thompson Mines before reconnecting with a common segment. This alternative is about 8 miles (13 kilometers) in length.

No Action Alternative

The No Action Alternative would evaluate the consequences of not constructing a rail line in Nevada for the transportation of spent nuclear fuel, high-level radioactive waste and other materials. Under the No Action Alternative, these materials would be shipped by legal-weight and heavy-haul truck within the State of Nevada to a repository at Yucca Mountain. About 53,000 legal-weight truck and 300 heavy-haul truck shipments of spent nuclear fuel and high-level radioactive waste would be required.

Environmental Issues and Resources To Be Examined

To facilitate the scoping process, DOE has identified a preliminary list of issues and environmental resources that it may consider in the Rail Alignment EIS. The list is not intended to be all-inclusive or to predetermine the scope or alternatives of the Rail Alignment EIS, but should be used as a starting point from which the public can help DOE define the scope of the EIS. DOE anticipates incorporating by reference the relevant analyses of the Repository Final EIS, supplemented as appropriate.

- Potential impacts to the concept of multiple use as it applies to public land use planning and management specified by the Federal Land Policy and Management Act of 1976.
- Potential impacts to land use and ownership.
- Potential impacts to plants, animals and their habitats, including impacts to wetlands, and threatened and endangered and other sensitive species.
- Potential impacts to cultural and Native American resources.
- Potential impacts to paleontological resources.
- Potential impacts to the public from noise and vibration.
- Potential impacts to the general public and workers from radiological exposures during incident-free operations of the rail line in Nevada.
- Potential impacts to the general public and workers from radiological exposures from potential accidents during operations of the rail line in Nevada.
- Potential impacts to water resources and floodplains.
- Potential impacts to aesthetic values.
- Potential disproportionately high and adverse impacts to low-income and minority populations (environmental justice).
- Irretrievable and irreversible commitment of resources.
- Compliance with applicable Federal, state and local requirements.

The Department specifically invites comments on the following:

1. Should additional alternatives be considered that might minimize, avoid or mitigate adverse environmental impacts (for example, looking beyond the 0.25 mile wide corridor, avoiding wilderness study areas, Native American Trust Lands, or encroachment on the Nevada Test and Training Range)?
2. Should any of the preliminary alternatives be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. Should DOE allow private entities to ship commercial commodities on its rail line?
5. What mitigation measures should be considered?
6. Are there national security issues that should be addressed?

Schedule

The DOE intends to issue the Draft Rail Alignment EIS early in 2005 at which time its availability will be announced in the **Federal Register** and local media. A public comment period will start upon publication of the Environmental Protection Agency's Notice of Availability in the **Federal Register**. The Department will consider and respond to comments received on the Draft Rail Alignment EIS in preparing the Final Rail Alignment EIS.

Other Agency Involvement

The Department expects to invite the following agencies to be cooperating agencies in the preparation of the Rail Alignment EIS: U.S. Bureau of Land Management, the U.S. Air Force, and the U.S. Surface Transportation Board. These agencies were selected because they have management and regulatory authority over lands traversed by an alternative rail alignment within the Caliente rail corridor, or special expertise germane to the construction and operation of a rail line. DOE will consult with the U.S. Bureau of Indian Affairs, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. Nuclear Regulatory Commission, Native American Tribal organizations, the State of Nevada, and Nye, Lincoln and Esmeralda Counties regarding the environmental and regulatory issues germane to the Proposed Action. DOE invites comments on its identification of cooperating and consulting agencies and organizations.

Public Scoping Meetings

DOE will hold public scoping meetings on the Rail Alignment EIS. The meetings will be held at the following locations and times:

- Amargosa Valley, Nevada. Longstreet Inn and Casino, Highway 373, May 3, 2004 from 4–8 p.m.
- Goldfield, Nevada. Goldfield Community Center, 301 Crook Street, May 4, 2004 from 4–8 p.m.
- Caliente, Nevada. Caliente Youth Center, U.S. Highway 93, Caliente, Nevada, May 5, 2004 from 4–8 p.m.

The public scoping meetings will be an open meeting format without a formal presentation by DOE. Members of the public are invited to attend the meetings at their convenience any time during meeting hours and submit their comments in writing at the meeting, or in person to a court reporter who will be available throughout the meeting. This open meeting format increases the opportunity for public comment and provides for one-on-one discussions with DOE representatives involved with the Rail Alignment EIS and Nevada transportation project.

The public scoping meetings will be held during the public scoping comment period. The comment period begins with publication of this NOI in the **Federal Register** and closes May 24, 2004. Comments received after this date will be considered to the extent practicable. Written comments may be provided in writing, facsimile, or by email to Ms. Robin Sweeney, EIS Document Manager (see **ADDRESSES** above).

Public Reading Rooms

Documents referenced in this Notice of Intent and related information are available at the following locations: Beatty Yucca Mountain Information Center, 100 North E. Avenue, Beatty, NV

A.5 69 *FR* 22496, April 26, 2004

22496 Federal Register / Vol. 69, No. 80 / Monday, April 26, 2004 / Notices

DEPARTMENT OF ENERGY

Comment Period Extension and Additional Public Scoping Meetings for an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV

AGENCY: U.S. Department of Energy.

ACTION: Notice of comment period extension and additional public meetings.

SUMMARY: On April 8, 2004, the U.S. Department of Energy (DOE) published a Notice of Intent (69 FR 18565) announcing its intent to prepare an environmental impact statement (EIS) under the National Environmental Policy Act for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada, and announced three public scoping meetings during a 45-day public comment period ending May 24, 2004. In response to a request from the State of Nevada, DOE is now announcing two additional public meetings, one in Las Vegas, Nevada, and one in Reno, Nevada, and extending the comment period to June 1, 2004.

DATES: The additional public meetings will be held at the following locations and times:

- Las Vegas, Nevada. Las Vegas Yucca Mountain Information Center, 4101 B Meadows Lane, May 10, 2004, from 4–8 p.m.
- Reno, Nevada. University of Nevada-Reno, Lawlor Event Center-Silver and Blue Room, 15th & North Virginia, May 12, 2004, from 4–8 p.m.

The comment period on the Notice of Intent is being extended to June 1, 2004. DOE will consider comments on the proposed scope of the Rail Alignment EIS received after June 1, 2004, to the extent practicable.

ADDRESSES: Written comments on the scope of this Rail Alignment EIS, questions concerning the proposed action and alternatives, requests for maps that illustrate the Caliente corridor and alternatives, or requests for additional information on the Rail Alignment EIS or transportation planning in general should be directed to: Ms. Robin Sweeney, EIS Document Manager, Office of National Transportation, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, telephone 1–800–967–3477, or via the Internet at *http://www.ocrwm.doe.gov* under "What's New."

Issued in Washington, DC, on April 20, 2004.

Margaret S. Y. Chu,
Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 04–9524 Filed 4–23–04; 8:45 am]

BILLING CODE 6450–01–P

A.6 69 *FR* 23177, April 28, 2004

Federal Register / Vol. 69, No. 82 / Wednesday, April 28, 2004 / Notices 23177

DEPARTMENT OF ENERGY

Comment Period Extension and Additional Public Scoping Meetings for an Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada; Correction

AGENCY: Department of Energy.

ACTION: Notice of Comment Period Extension and Additional Public Meetings; correction.

SUMMARY: The Department of Energy published a document in the **Federal Register** of April 26, 2004, concerning the additional scoping meetings to be held in support of the Rail Alignment EIS. The document contained an incorrect date and location for the Las Vegas, NV scoping meetings.

FOR FURTHER INFORMATION CONTACT: Robin Sweeney at 1–800–967–3477.

Correction

In the **Federal Register** of April 26, 2004, in FR Vol 69, No. 80, on Page 22496, in the first column, correct the date and location for the Las Vegas, NV scoping meeting to read: Las Vegas, Nevada. Cashman Center, Rooms 103–106, 850 Las Vegas Blvd. North, May 17, 2004, from 4–8 p.m.

Dated: April 26, 2004.

Margaret S.Y. Chu,

Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 04–9719 Filed 4–27–04; 8:45 am]

BILLING CODE 6450–01–P

A.7 70 *FR* 51029, August 29, 2005

Federal Register / Vol. 70, No. 166 / Monday, August 29, 2005 / Notices 51029

DEPARTMENT OF ENERGY

Notice of Availability of the Environmental Assessment Supporting the Department of Energy's Application to the Department of the Interior for a Public Land Order To Withdraw Public Lands Within and Around the Caliente Rail Corridor, Nevada, From Surface Entry and New Mining Claims

AGENCY: Office of Civilian Radioactive Waste Management, U.S. Department of Energy.

ACTION: Notice of availability.

SUMMARY: This notice announces the availability, and opportunity for public review and comment, of the environmental assessment (EA) that supports the Department of Energy's (DOE) application to the Department of the Interior, filed with the Bureau of Land Management (BLM), for a Public Land Order to withdraw public lands within and surrounding the Caliente Rail Corridor. As applied for, the withdrawal would preclude surface entry and new mining claim locations for a 20 year period.

DATES: Comments should be received by DOE no later than September 28, 2005.

ADDRESSES: Comments, or requests for copies of the draft EA, should be sent to Lee Bishop, EA Document Manager, United States Department of Energy, 1551 Hillshire Drive, Las Vegas, NV 89134. Requests for copies of the draft EA may also be made by calling 1–800–225–6972. The draft EA and electronic comment forms are available at *http://www.ocrwm.doe.gov*. Comments may also be faxed to 1–800–967–0739.

FOR FURTHER INFORMATION CONTACT: Lee Bishop, EA Document Manager, at the address above or at 1–800–225–6972.

SUPPLEMENTARY INFORMATION: A notice of proposed withdrawal was published in the **Federal Register** on December 29, 2003 (68 FR 74965–74968), stating that the Bureau of Land Management had received an application from DOE to withdraw for 20 years approximately 308,600 acres of public land from surface entry and mining locations while DOE evaluates the land for the potential construction, operation, and maintenance of a branch rail line. The rail line would be used for the transportation of spent nuclear fuel and high-level radioactive waste as provided under the Nuclear Waste Policy Act of 1982, as amended (42 U.S.C. 10101 *et seq.*). BLM held public meetings on the application in June 2004.

In accordance with 43 CFR 2310.3–2(b)(3), DOE has prepared a draft EA to support its application, with the BLM participating as a cooperating agency. The application seeks a Public Land Order for the purpose of precluding surface entry and the location of new mining claims which could interfere with the evaluation of the land. The proposed Public Land Order would not affect existing mining claims or other activities such as grazing rights, water rights, and recreational uses.

The draft EA may be reviewed on the Internet at *http://www.ocrwm.doe.gov*. Copies of the EA may also be obtained by contacting Mr. Lee Bishop (see address above). Comments may be submitted to Mr. Bishop or through the comment form at the above website, and should be received by September 28, 2005.

Three public meetings on the draft EA will be held as follows:

Monday, September 12, 2005, 4 p.m. to 8 p.m., Longstreet Inn & Casino, Highway 373, Amargosa Valley, NV;

Tuesday, September 13, 2005, 4 p.m. to 8 p.m., Goldfield School Gymnasium, 233 Ramsey, Goldfield, NV; and

Thursday, September 15, 2005, 4 p.m. to 8 p.m., Caliente Youth Center, U.S. Highway 93, Caliente, NV.

Comments received will be considered in finalizing the EA. After the EA is finalized it will be formally submitted to the BLM. The BLM will subsequently make a recommendation to the Secretary of the Interior, who will make a final determination regarding DOE's application for a Public Land Order.

Issued in Washington, DC.

Paul M. Golan,

Principal Deputy Director, Office of Civilian Radioactive Waste Management.

[FR Doc. 05–17143 Filed 8–26–05; 8:45 am]

BILLING CODE 6450–01–P

A.8 70 *FR* 76854, December 28, 2005

76854 Federal Register / Vol. 70, No. 248 / Wednesday, December 28, 2005 / Notices

DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NV–040–1920–ET–4662; NVN–77880; 6–08807]

Public Land Order No. 7653; Withdrawal of Public Lands for the Department of Energy To Protect the Caliente Rail Corridor; Nevada

AGENCY: Bureau of Land Management, Interior.

ACTION: Public Land Order.

SUMMARY: This order withdraws approximately 308,600 acres of public lands within the Caliente Rail Corridor, Nevada, from surface entry and the location of new mining claims, subject to valid existing rights, for a period of 10 years to allow the Department of Energy to evaluate the lands for the potential construction, operation, and maintenance of a rail line which would be used to transport spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository as part of the Department of Energy's responsibility under the Nuclear Waste Policy Act, as amended, 42 U.S.C. 10101 *et seq.*

DATES: Effective Date: December 28, 2005.

FOR FURTHER INFORMATION CONTACT: Dennis J. Samuelson, BLM Nevada State Office, P.O. Box 12000, Reno, Nevada 89520, 775–861–6532.

SUPPLEMENTARY INFORMATION: The evaluation of the Caliente Rail Corridor will assist the Department of Energy to determine through the preparation of the Caliente Corridor rail alignment environmental impact statement, conducted pursuant to the National Environmental Policy Act of 1969, as amended, 42 U.S.C. 4321 *et seq.*, whether to construct the rail line in that location. Construction of a rail line within the Caliente Rail Corridor would require that the Department of Energy apply for and receive a right-of-way grant from the Bureau of Land Management in accordance with the Federal Land Policy and Management Act, as amended, 43 U.S.C. Subchapter V.

Order

By virtue of the authority vested in the Secretary of the Interior by section 204 of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1714 (2000), it is ordered as follows:

1. Subject to valid existing rights, the following described public lands are hereby withdrawn from settlement, sale, location, or entry under the general land laws, including the United States mining laws (30 U.S.C. Ch. 2 (2000)), but not from leasing under the mineral leasing laws, for a period of 10 years, to allow the Department of Energy to evaluate lands within the Caliente Rail Corridor for the potential construction, operation, and maintenance of a rail line which would be used to transport spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository as part of the Department of Energy's responsibility under the Nuclear Waste Policy Act, as amended, 42 U.S.C. 10101 *et seq.*

A corridor 1-mile in width that contains a portion of, or is wholly encompassed within the following sections and/or quarter sections and government lots:

T. 1 N., R. 43 E.,
- Sec. 23, S½;
- Sec. 24, NE¼ and S½;
- Secs. 25 and 26;
- Sec. 27, E½;
- Secs. 34, 35, and 36.

T. 1 S., R. 43 E.,
- Sec. 1, lots 2, 3, and 4, S½NW¼, and SW¼;
- Secs. 2 and 3;
- Sec. 4, E½;
- Sec. 9, E½;
- Secs. 10 and 11;
- Sec. 12, W½;
- Sec. 13;
- Sec. 14, E½ and NW¼;
- Sec. 15;
- Sec. 16, E½;
- Sec. 21;
- Sec. 22, NE¼ and W½;
- Sec. 23, NE¼;
- Sec. 24;
- Sec. 25, E½;
- Sec. 27, W½;
- Secs. 28 and 33;
- Sec. 34, W½.

T. 2 S., R. 43 E.,
- Sec. 3, lots 3 and 4, S½NW¼, and SW¼;
- Secs. 4 and 9;
- Sec. 10, W½;
- Sec. 15, W½;
- Sec. 16 (except patented land);
- Sec. 20, SE¼ (except patented land);
- Sec. 21 (except patented land);
- Sec. 22, W½ (except patented land);
- Sec. 27, SW¼ (except patented land);
- Sec. 28 (except patented land);

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Sec. 29, E½ (except patented land);
Sec. 32, NE¼ (except patented land);
Secs. 33 and 34 (except patented land);
Sec. 35, W½ and SE¼ (except patented land);
Sec. 36, SW¼.
T. 3 S., R. 43 E.,
Secs. 1, 2, and 3 (except patented land);
Sec. 4, NE¼ (except patented land);
Sec. 10 (except patented land);
Secs. 11 and 12;
Sec. 13, NE¼ and W½;
Sec. 14;
Sec. 15, E½;
Sec. 22, E½;
Secs. 23 to 26, inclusive;
Sec. 27, E½;
Sec. 34, E½;
Secs. 35 and 36.
T. 4 S., R. 43 E.,
Sec. 1, lots 2, 3, and 4, S½NE¼, S½NW¼, and SW¼;
Sec. 2;
Sec. 3; lots 1 and 2, S½NE¼, and S½;
Secs. 10 and 11;
Sec. 12, W½;
Secs. 14, 15, and 22;
Sec. 23, W½;
Sec. 26, NW¼;
Sec. 27;
Sec. 28, E½;
Sec. 33;
Sec. 34, NE¼ and W½.
T. 5 S., R. 43 E., Unsurveyed
Sec. 3, NW¼;
Secs. 4, 5, 8, 9, 15, and 16;
Sec. 17 (except patented land);
Secs. 21, 22, 27, 28, 33, 34, and 35.
T. 6 S., R. 43 E., Unsurveyed
Secs. 1, 2, 3, Secs. 10 to 15, inclusive, and Sec. 23;
Secs. 24 and 25 (except patented land);
Sec. 26;
Sec. 27, E½;
Sec. 34, E½;
Secs. 35 and 36.
T. 7 S., R. 43 E., Unsurveyed
Secs. 1 and 2;
Sec. 3, E½;
Secs. 11 to 14, inclusive, Secs. 24 and 25.
T. 1 N., R. 44 E.,
Sec. 19, lots 2, 3, and 4, E½SW¼, and E½;
Secs. 20, 21, and 22;
Sec. 23, W½ and SE¼;
Sec. 24, S½;
Secs. 25 and 26;
Sec. 27, N½;
Sec. 28, N½;
Sec. 29, N½;
Sec. 30, lots 1, 2, and 3, NE¼, E½NW¼, and E½SW¼.
T. 7 S., R. 44 E., Partially Surveyed
Secs. 6, 7, 17, 18, 19, and 20;
Sec. 21, NE¼ and N½NW¼;
Sec. 27;
Sec. 29, W½;
Sec. 29, SE¼ (reserved minerals only);
Secs. 30 and 31.
T. 8 S., R. 44 E., Partially Surveyed
Sec. 2, E½;
Sec. 9, N½ (reserved minerals only);
Sec. 9, S½;
Sec. 10, N½ (reserved minerals only);
Sec. 10, S½;
Sec. 11, SW¼;
Sec. 12, E½;
Secs. 13 to 16, inclusive;
Sec. 22, NE¼;
Secs. 23 to 26, inclusive, and Sec. 36.
T. 1 N., R. 45 E.,
Sec. 19, lot 4, E½SW¼, and SE¼;
Sec. 20, S½;
Sec. 25, S½;
Sec. 26, NW¼ and S½;
Secs. 27 to 30, inclusive;
Sec. 32, N½;
Sec. 33, N½;
Sec. 34, N½;
Secs. 35 and 36.
T. 8 S., R. 45 E., Unsurveyed
Sec. 19 and Secs. 28 to 33, inclusive.
T. 9 S., R. 45 E., Unsurveyed
Secs. 2 to 6, inclusive, Secs. 8 to 14, inclusive, and Sec. 24.
T. 1 N., R. 46 E.,
Sec. 25, NE¼ and S½;
Sec. 26, S½;
Sec. 27, S½;
Sec. 28, S½;
Sec. 29, S½;
Sec. 30, lot 4, E½SW¼, and SE¼;
Secs. 31 to 36, inclusive.
T. 9 S., R. 46 E., Unsurveyed
Sec. 7 and Secs. 17 to 21, inclusive;
Sec. 22, SW¼;
Secs. 26 to 29, inclusive, and Secs. 33 to 36, inclusive.
T. 10 S., R. 46 E., Unsurveyed
Secs. 1, 2, 12, and 13.
T. 1 N., R. 47 E.,
Sec. 1, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and SW¼;
Sec. 2;
Sec. 3, SE¼;
Secs. 10 and 11;
Sec. 12, NW¼;
Sec. 14, NW¼;
Sec. 15;
Sec. 16, NE¼ and S½;
Sec. 20, NE¼ and S½;
Sec. 21;
Sec. 22, NE¼ and W½;
Sec. 28, NE¼ and W½;
Secs. 29 and 30;
Sec. 31, lots 1, 2 and 3, NE¼, and E½NW¼;
Sec. 32 NW¼.
T. 2 N., R. 47 E.,
Sec. 25, NE¼ and S½;
Sec. 35, E½;
Sec. 36.
T. 10 S., R. 47 E., Partially Surveyed
Sec. 6, SW¼;
Secs. 7 and 8;
Sec. 9, SW¼;
Sec. 15, NW ¼ and S½;
Secs. 16, 17, and 18;
Sec. 21, N½ and SE½;
Sec. 22, E½NE¼, W½, and SE¼SE¼;
Sec. 23, S½NW¼ and SW¼;
Sec. 26, W½;
Sec. 27; E½ and SW¼SW¼;
Sec. 28, NE¼;
Sec. 34;
Sec. 35, W½ and SE¼.
T. 11 S., R. 47 E.,
Sec. 1, SW¼;
Sec. 2;
Sec. 3, lots 1 and 2, S½NE¼, and SE¼;
Sec. 11;
Sec. 12, W½ and SE¼;
Sec. 13;
Sec. 14, N½ and SE¼;
Sec. 24, N½ and SE¼;
Sec. 25, NE¼.
T. 2 N., R. 48 E.,
Sec. 2, lots 3 and 4, and S½NW¼;
Sec. 3;
Sec. 4, lot 1, S½NE¼, and S½;
Sec. 8, E½;
Sec. 9;
Sec. 10, NE¼ and W½;
Sec. 16, NE¼ and W½;
Sec. 17;
Sec. 18, SE¼;
Sec. 19, lots 3 and 4, E½, and E½SW¼;
Sec. 20;
Sec. 21, NW¼;
Sec. 29, NW¼;
Sec. 30;
Sec. 31, lots 1 to 4, inclusive, NE¼, and E½NW¼.
T. 3 N., R. 48 E.,
Sec. 13, E½ and SW¼;
Sec. 23, E½;
Sec. 24;
Sec. 25, N½ and SW¼;
Sec. 26;
Sec. 27, SE¼;
Secs. 34 and 35;
Sec. 36, NW¼.
T. 11 S., R. 48 E., Unsurveyed
Sec. 7, S½;
Secs. 8 to 11, inclusive, Secs. 14 to 22, inclusive, and Secs. 27 to 34, inclusive.
T. 12 S., R. 48 E., Unsurveyed
Secs. 2 to 6, inclusive;
Sec. 9, NE¼;
Secs. 10 and 11;
Sec. 13, SW¼;
Secs. 14, 15, and Secs. 23 to 26, inclusive;
Sec. 35, E½;
Sec. 36.
T. 13 S., R. 48 E., Unsurveyed
Secs. 9, 10, 14, 15, 16, and Secs. 22 to 26, inclusive;
Sec. 36, NE¼.
T. 3 N., R. 49 E.,
Sec. 2, lots 3 and 4, and S½NW¼;
Secs. 3 and 4;
Sec. 5, SE¼;
Sec. 7, E½SW¼ and SE¼;
Secs. 8 and 9;
Sec. 10, NW¼;
Sec. 16, NW¼;
Sec. 17, N½ and SW¼;
Sec. 18;
Sec. 19, lots 1, 2, and 3, NE¼, and E½NW¼.
T. 4 N., R. 49 E.,
Sec. 24, SE¼;
Sec. 25;
Sec. 26, NE¼ and S½;
Sec. 33, SE¼;
Secs. 34 and 35;
Sec. 36, N½ and SW¼.
T. 12 S., R. 49 E., Unsurveyed
Sec. 31.
T. 13 S., R. 49 E., Unsurveyed
Secs. 13, 14,
Secs. 22 to 27, inclusive, and
Secs. 29 to 36, inclusive.
T. 14 S., R. 49 E., Unsurveyed
Secs. 1 to 5, inclusive,
Secs. 8 to 11, inclusive,
Secs. 15 and 16.
T. 4 N., R. 49½ E., Unsurveyed
Secs. 25, 26, 27, 34, 35, and 36.

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T. 1 N., R. 50 E.,
Sec. 1, lots 1 and 2, S½NE¼, and SE¼;
Sec. 12, NE¼ (excluding Kawich Wilderness Study Area).
T. 2 N., R. 50 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and SE¼;
Sec. 11, E½;
Secs. 12 and 13;
Sec. 14, NE¼;
Secs. 24 and 25;
Sec. 36, E½ and NW¼.
T. 3 N., R. 50 E., Unsurveyed
Secs. 2, 3, 4, 10, 11, and 14;
Sec. 15, E½;
Sec. 22, NE¼;
Secs. 23 to 26, inclusive, Secs. 35 and 36.
T. 3½ N., R. 50 E., Unsurveyed
Secs. 33 and 34.
T. 4 N., R. 50 E., Partially Surveyed
Secs. 30 and 31;
Sec. 32, SW¼.
T. 13 S., R. 50 E., Unsurveyed
Secs. 30 and 31.
T. 1 N., R. 51 E.,
Sec. 6 (excluding South Reveille Wilderness Study Area);
Sec. 7 (excluding Kawich and South Reveille Wilderness Study Areas);
Sec. 17 (excluding South Reveille Wilderness Study Area);
Sec. 18 (excluding Kawich and South Reveille Wilderness Study Areas);
Sec. 19 NE¼ (excluding Kawich Wilderness Study Area);
Sec. 20 and 28 (excluding South Reveille Wilderness Study Area);
Sec. 29, E½ and NW¼;
Sec. 33, E½ and NW¼;
Sec. 34 (excluding South Reveille Wilderness Study Area).
T. 2 N., R. 51 E.,
Sec. 18, lots 3 and 4;
Sec. 19, lots 1 to 4, inclusive, E½NW¼, and E½SW¼;
Sec. 30, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and SE¼;
Sec. 31, (excluding South Reveille Wilderness Study Area).
T. 1 S., R. 51 E., Unsurveyed
Sec. 2, (excluding South Reveille Wilderness Study Area);
Sec. 3;
Secs. 11, 12, and 13 (excluding South Reveille Wilderness Study Area);
Sec. 14, E½;
Sec. 24; Sec. 25, E½;
Sec. 36, E½.
T. 1 S., R. 51½ E., Unsurveyed
Secs. 19, 29, and 30 (excluding South Reveille Wilderness Study Area);
Sec. 31;
Sec. 32 (excluding South Reveille Wilderness Study Area).
T. 2 S., R. 51½ E., Unsurveyed
Secs. 4 and 5 (excluding South Reveille Wilderness Study Area);
Secs. 6, 7, and 8;
Sec. 9, (excluding South Reveille Wilderness Study Area);
secs, 16 and 17;
Sec. 18, NE¼;
Sec. 20, NE¼;
Sec. 21.
T. 2 S., R. 52 E., Unsurveyed
Secs. 7 and 11 (excluding South Reveille Wilderness Study Area);
Secs 12 and 13;
Secs. 14 to 18, inclusive (excluding South Reveille Wilderness Study Area);
Secs. 19, 20, and 21;
Sec. 22, N½;
Sec. 23, N½.
T. 1 S., R. 53 E.,
Sec. 25;
Sec. 35, E½ and SW¼;
Sec. 36.
T. 2 S., R. 53 E.,
Sec. 1, lots 3 and 4, and S½NW¼;
Sec. 2;
Sec. 3, lot 1, S½NE¼, and S½;
Sec. 7, lot 4, E½SW¼, and SE¼;
Sec. 8, S½;
Secs. 9 and 10;
Sec. 11, N½ and SW¼;
Sec. 15, N½;
Sec. 16, N½ and SW¼;
Secs. 17 and 18.
T. 1 S., R. 54 E.,
Sec. 1, S½NE¼ and S½;
Sec. 10, SE¼;
Secs. 11 and 12;
Sec. 13, N½;
Secs. 14 and 15;
Sec. 16, SE¼;
Sec. 19, lots 3 and 4, E½SW¼, and SE¼;
Sec. 20, S½;
Secs. 21 and 22;
Sec. 23, NW¼;
Sec. 28, N½ and SW¼;
Secs. 29 and 30;
Sec. 31, lots 1 and 2, and E½NW¼;
Sec. 32, NW¼.
T. 1 N., R. 55 E.,
Sec. 13, S½;
Sec. 14, SE¼;
Sec. 21, S½;
Sec. 22, NE¼ and S½;
Secs. 23 and 24;
Sec. 25, NW¼;
Sec. 26, N½;
Secs. 27 and 28;
Sec. 29, NE¼ and S½;
Sec. 30, SE¼;
Secs. 31 and 32;
Sec. 33, N½.
T. 1 S., R. 55 E.,
Sec. 5, lot 4 and S½NW¼;
Sec. 6;
Sec. 7, lots 1, 2, and 3, NE¼, and E½NW¼.
T. 1 N., R. 56 E., Partially Surveyed
Sec. 1;
Sec. 2, S½NE¼ and SE¼;
Sec. 9, S½;
Secs. 10 and 11;
Sec. 12, NE¼ and W½;
Sec. 13, NW¼;
Sec. 14, N½;
Secs. 15, 16, and 17;
Sec. 18, lots 3 and 4, E½, and E½SW¼;
Sec. 19, lots 1, 2, 3, NE¼, E½NW¼, NE¼SW¼, and NW¼SE¼;
Sec. 20, N½;
Sec. 21, N½.
T. 2 N., R. 56 E., Partially Surveyed
Sec. 36.
T. 1 N., R. 57 E., Partially Surveyed
Sec. 3, lots 3 and 4, and S½NW¼;
Sec. 4, lots 1 to 4, inclusive, and S½NW¼;
Sec. 5, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and W½SW¼;
Sec. 6.
T. 2 N., R. 57 E.,
Sec. 13;
Sec. 14, SE¼;
Sec. 22, S½;
Secs. 23 to 28, inclusive;
Sec. 29, S½;
Sec. 31, lots 3 and 4, E½, and E½SW¼;
Secs. 32 to 35, inclusive;
Sec. 36, NE¼ and W½.
T. 2 N., R. 58 E.,
Sec. 2, lots 3 and 4, and S½NW¼;
Secs. 3 and 4;
Sec. 5, S½;
Sec. 7, lot 4, E½SW¼, and E½;
Sec. 8;
Sec. 9, NE¼ and W½;
Sec. 10, NW¼;
Sec. 13, SW¼ and S½SE¼;
Sec. 17, NE¼ and W½;
Sec. 18;
Sec. 19, lots 1 and 2, and E½NW¼;
Sec. 20, S½;
Sec. 21, S½;
Sec. 22, NE¼ and S½;
Secs. 23 and 24;
Sec. 25, N½;
Sec. 26, N½;
Secs. 27 to 30, inclusive;
Sec. 31, lots 1 and 2, NE¼, and E½NW¼;
Sec. 32, N½.
T. 3 N., R. 58 E.,
Sec. 24, SE¼;
Sec. 25;
Sec. 26, NE¼ and S½;
Sec. 33, SE¼;
Secs. 34 and 35;
Sec. 36, N½ and SW¼.
T. 2 N., R. 59 E.,
Sec. 2, lots 2, 3, and 4, and S½NW¼;
Sec. 3, lots 1 to 4, inclusive, S½NE¼, and S½NW¼;
Sec. 4;
Sec. 8, NE¼ and S½;
Sec. 9;
Sec. 16, N½ and SW¼;
Secs. 17, 18, and 19;
Sec. 20, NW¼.
T. 3 N., R. 59 E.,
Sec. 12, E½ and SW¼;
Sec. 13;
Sec. 14, SE¼;
Sec. 19, lots 3 and 4, NE¼, E½SW¼, and SE¼;
Sec. 20;
Sec. 21, S½SW¼ and SE¼;
Sec. 22, NE¼ and S½;
Secs. 23 to 28, inclusive;
Sec. 29, N½;
Sec. 30;
Sec. 33, SE¼;
Secs. 34, 35, and 36.
T. 2 N., R. 60 E., Unsurveyed
Sec. 1.
T. 3 N., R. 60 E., Unsurveyed
Secs. 5 to 8, inclusive, Secs. 18 to 22, inclusive, Secs. 25 to 31, inclusive, Secs. 34, 35, and 36.
T. 4 N., R. 60 E.,
Sec. 20, SE¼;
Sec. 21, S½;
Secs. 22, 23, and 24;
Sec. 25, N½;
Sec. 26, N½;
Sec. 27, E½NE¼ and W½;
Secs. 28 and 29;
Sec. 30, SE¼;

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Sec. 31, lots 3 and 4, E½, and E½SW¼;
Sec. 32;
Sec. 33, NW¼.
T. 2 N., R. 61 E., Unsurveyed
Sec. 6.
T. 3 N., R. 61 E., Unsurveyed
Secs. 2, 3, 4, and Secs. 9 to 15, inclusive;
Sec. 22, SE¼;
Secs. 23 and 24;
Sec. 25 (excluding Weepah Spring Wilderness Area);
Secs. 26 to 33, inclusive.
Secs. 34, 35, and 36 (excluding Weepah Spring Wilderness Area).
T. 4 N., R. 61 E.,
Sec. 19, lots 2, 3, and 4, E½SW¼, and SE¼;
Sec. 20, SW¼;
Sec. 28, SW¼;
Secs. 29 and 30;
Sec. 31, NE¼;
Secs. 32 and 33;
Sec. 34, S½.
T. 1 N., R. 62 E., Unsurveyed
Sec. 1, E½;
Sec. 12, E½;
Sec. 13.
T. 2 N., R. 62 E., Unsurveyed
Secs. 1 to 4, inclusive;
Sec. 5, N½;
Secs. 10 to 14, inclusive;
Sec. 15, NE¼;
Secs. 24 and 25;
Sec. 36, E½.
T. 3 N., R. 62 E.,
Sec. 18, lots 2, 3, and 4, E½SW¼, and SE¼;
Sec. 19;
Sec. 20, W½ and SE¼;
Sec. 28, W½ and SE¼;
Secs. 29 and 30;
Sec. 31 (excluding Weepah Spring Wilderness Area);
Secs. 32, 33, and 34, inclusive;
Sec. 35, SW¼.
T 1 N., R. 63 E., Unsurveyed
Secs. 6, 7, 8, Secs. 17 to 21, inclusive, and Secs. 26 to 30, inclusive;
Secs. 32 and 35, inclusive.
T. 1 S., R. 63 E., Unsurveyed
Secs. 1, 2, 11, 12, and 13.
T. 2 N., R. 63 E.,
Sec. 7, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and SE¼;
Secs. 18, 19, 30, and 31.
T. 1 S., R. 64 E.,
Sec. 7, lots 2, 3, and 4, E½NW¼, E½SW¼, and SE¼;
Sec. 15, SW¼;
Sec. 16, S½;
Secs. 17 and 18;
Sec. 19, NE¼ and E½NW¼;
Secs. 20 to 23, inclusive;
Sec. 24, NW¼ and S½;
Sec. 25;
Sec. 26, N½;
Sec. 27, N½.
T. 1 S., R. 65 E.,
Sec. 19, lots 3 and 4, E½SW¼, and SE¼;
Sec. 20, SW¼;
Sec. 27, W½ and SE¼;
Secs. 28, 29, and 30;
Sec. 32, N½;
Sec. 33, N½ and SE¼;
Sec. 34;
Sec. 35, NW¼ and S½.
T. 2 S., R. 65 E.,
Sec. 1, S½NW¼ and SW¼;
Sec. 2;
Sec. 3, lots 1, 2, and 3, S½NE¼, S½NW¼, and SE¼;
Secs. 11, 12, and 13;
Sec. 14, NE¼.
T. 2 S., R. 66 E., Unsurveyed
Secs. 1 to 5, inclusive, Secs. 7 to 14, inclusive, Secs. 16, 17, 18, 20, and 24;
Secs. 16 to 18, inclusive.
T. 2 S., R. 67 E.,
Sec. 7, E½SE¼;
Sec. 8, S½;
Sec. 9, SW¼;
Sec. 14, SW¼ and W½SE¼;
Sec. 15, NW¼ and S½;
Secs. 16 to 20, inclusive;
Sec. 21, N½ and SE¼;
Sec. 22;
Sec. 23, NE¼NE¼, W½NE¼, W½, and SE¼;
Sec. 24, NW¼SW¼, S½SW¼, and NW¼SE¼;
Sec. 25 NW¼NW¼;
Sec. 26, NE¼;
Sec. 29, NW¼;
Sec. 30, lots 1 and 2, NE¼, and E½NW¼;
Sec. 35, NW¼NE¼;
Sec. 36, W½NE¼, SE¼NE¼, E½NW¼, E½SW¼, SW¼SW¼, and SE¼.
T. 3 S., R. 67 E.,
Sec. 1;
Secs. 12 and 13;
Sec. 16, E½;
Sec. 20, SE¼;
Sec. 21, W½NE¼, SW¼, NW¼SE¼, and N½SW¼SE¼;
Sec. 23, E½;
Secs. 24 and 25;
Sec. 28, W½NW¼, S½SW¼, and SE¼;
Sec. 29, NE¼, SW¼, N½SE¼, and SE¼SE¼;
Sec. 32, E½NE¼, NW¼, W½SW¼, NE¼SW¼, and E½SE¼;
Sec. 33, lots 2 and 3, and NW¼;
Sec. 35, E½;
Sec. 36.
T. 4 S., R. 67 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and SE¼;
Sec. 4, lots 3 and 4, S½NW¼, and SW¼;
Sec. 5, lots 1 and 4, SE¼NE¼, SW¼NW¼, NW¼SW¼, NE¼SE¼, and S½SE¼;
Sec. 6, lot 1, S½NE¼, and SE¼;
Sec. 7, lot 5;
Sec. 8, S½SE¼;
Sec. 9, N½NW¼ and SW¼;
Sec. 12, NE¼, N½NW¼, SE¼NW¼, and SE¼.
T. 2 S., R. 68 E.,
Sec. 23, S½;
Secs. 25 to 29, inclusive;
Sec. 30, E½, SE¼NW¼, and E½SW¼;
Sec. 31, NE¼ and E½NW¼;
Sec. 32, N½;
Sec. 33, N½;
Sec. 34, N½;
Sec. 35, N½;
Sec. 36.
T. 3 S., R. 68 E.,
Sec. 1;
Sec. 12, NE¼;
Sec. 19, lots 3 and 4, and E½SW¼;
Sec. 30, lots 1 to 4, inclusive, E½NW¼, and E½SW¼;
Sec. 31, lots 1 and 2, and E½NW¼.
T. 4 S., R. 68 E.,
Sec. 6, lots 5, 6, and 7, SE¼NW¼, E½SW¼, and SE¼;
Sec. 7, lots 2, 3, and 4, NE¼, E½SW¼, and SE¼;
Sec. 8, W½;
Sec. 17, NW¼;
Sec. 18, lot 1, NE¼, E½NW¼.
T. 2 S., R. 69 E.,
Sec. 30, lots 3 and 4, and E½SW¼;
Sec. 31, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and SE¼;
Sec. 32, S½;
Sec. 33, S½.
T. 3 S., R. 69 E.,
Sec. 3, lot 4, S½NW¼, SW¼, and SE¼;
Secs. 4 to 7, inclusive;
Sec. 8, W½;
Sec. 9, E½ and NW¼;
Sec. 10;
Sec. 11, SW¼;
Sec. 13, S½;
Secs. 14 and 15;
Sec. 22, NE¼;
Secs. 23 and 24;
Sec. 25, N½.
T. 3 S., R. 70 E.,
Sec. 8, S½;
Sec. 9, S½;
Sec. 10, S½;
Sec. 11, S½;
Sec. 12, S½;
Secs. 13 to 17, inclusive;
Sec. 18; lots 8 to 12, inclusive, and E½;
Sec. 19; sec. 20, N½;
Sec. 22, NE¼;
Sec. 23, N½;
Sec. 24, NW¼.

2. This order does not authorize the construction, operation, or maintenance of a rail line to transport spent nuclear fuel and high-level radioactive waste to the Yucca Mountain Repository.

3. All public lands included in this withdrawal will be managed in accordance with applicable Bureau of Land Management land use plans, laws, regulations, and policy. The actions of the Department of Energy in evaluation of the lands covered by this withdrawal will meet the Bureau of Land Management's definition of "casual use" as set forth at 43 CFR 2801.5. The withdrawal made by this order does not alter the applicability of those public land laws governing the use of the lands under lease, license, or permit, or governing the disposal of their mineral or vegetative resources other than under the mining laws.

4. This withdrawal will expire 10 years from the effective date of this order unless, as a result of a review conducted before the expiration date pursuant to section 204(f) of the Federal Land Policy and Management Act of 1976, 43 U.S.C. 1714(f) (2000), the Secretary determines that the withdrawal shall be extended.

(Authority: 43 U.S.C. 1714(a); 43 CFR 2310.3–3(b)(1))

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Dated: December 21, 2005.

Mark Limbaugh,

Assistant Secretary of the Interior.

[FR Doc. 05–24579 Filed 12–27–05; 8:45 am]

BILLING CODE 4310–HC–P

A.9 71 *FR* 60484, October 13, 2006

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DEPARTMENT OF ENERGY

Amended Notice of Intent To Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV

AGENCY: Department of Energy.

ACTION: Amended notice of intent.

SUMMARY: The Department of Energy (DOE or the Department) is providing this Amended Notice of Intent to expand the scope of the ongoing Environmental Impact Statement for the Alignment, Construction and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada (DOE/EIS–0369, Rail Alignment EIS, Notice of Intent, April 8, 2004, 69 FR 18565). In the ongoing Rail Alignment EIS, DOE has undertaken an analysis of alternative rail alignments in which to construct and operate a rail line within what is referred to as the Caliente corridor. Based on new information, DOE now plans to expand the Rail Alignment EIS to incorporate analysis of a new rail corridor alternative. This additional analysis will supplement the corridor analyses in the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, Yucca Mountain Final EIS, February 2002). The expanded analysis will consider the potential environmental impacts of a newly proposed Mina rail corridor at the same level of corridor analysis as is contained in the Yucca Mountain Final EIS, and will review the rail corridor analyses of that Final EIS, and update, as appropriate. The expanded scope will then proceed to include a detailed analysis of alternative alignments within the Mina corridor at the same level of analysis of the ongoing alignment analysis for the Caliente corridor. The result will be to provide the public with information concerning both the potential corridor and alignment impacts of the Mina corridor at the same time DOE presents the potential impacts for the construction and operation of a rail line within the Caliente corridor. The expanded EIS will be entitled the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369).

On April 8, 2004 (69 FR 18557), the Department issued a Record of Decision announcing its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain Final EIS. This decision will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste. To that end, the Department also selected the Caliente rail corridor in which to examine possible alignments for construction of that rail line. On April 8, 2004 (69 FR 18565), DOE issued a Notice of Intent to prepare an EIS under the National Environmental Policy Act (NEPA) for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from a site near Caliente, Nevada, to a geologic repository at Yucca Mountain, Nevada (the Rail Alignment EIS).

During subsequent public scoping, DOE received comments that offered preferences for various rail corridors analyzed in detail in the Yucca Mountain Final EIS, and identified other rail corridors for consideration. In particular, commenters recommended that DOE consider the Mina route, which would include use of an existing rail line from Hazen, Nevada, to the Thorne siding in Hawthorne, Nevada, and the construction of new rail line that would follow an abandoned rail line nearly to Yucca Mountain.

In the Yucca Mountain Final EIS, DOE considered, but eliminated from detailed study, several potential rail routes. One of those potential rail routes, the Mina route, could only connect to an existing rail line by crossing the Walker River Paiute Tribe Reservation northwest of Hawthorne, Nevada, and the Tribe had informed DOE that it would refuse to allow nuclear waste to be transported across its reservation (letter dated December 6, 1991). For this reason, the Department considered the Mina route to pose an unavoidable land use conflict and thus to be unavailable for further consideration.

Following review of the scoping comments for the Rail Alignment EIS, DOE held discussions with the Walker River Paiute Tribe regarding the availability of the Mina route. Subsequently, in May 2006, the Walker River Paiute Tribe informed DOE that the Tribal Council had withdrawn its objection to the completion of an EIS studying the transportation of nuclear waste across its reservation. The Tribe stated that its Tribal Council had not decided to allow such shipments, but indicated that inclusion of the Mina route in an EIS would allow the Tribe

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to make a more informed, final decision about the matter.

In view of the Tribal Council's decision, DOE initiated a study to determine the feasibility of the Mina route, and to identify a specific corridor (Mina corridor) and associated preliminary alternative alignments (described below under Mina Alternative Alignments). Based on DOE's preliminary analysis, in comparison with other rail corridors, the Mina corridor appears to offer potential advantages to the extent it would cross fewer mountain ranges, utilize existing rail bed, and also be a shorter distance. These potential advantages would simplify design and construction of a rail line, and therefore would be less costly to construct. The Mina corridor also would appear to have fewer land use conflicts, and would involve less land disturbance, which tends to result in lower adverse environmental impacts overall.

For these reasons, DOE has concluded that the Mina corridor warrants further detailed study. Accordingly, DOE is announcing its intent to expand the scope of the Rail Alignment EIS to supplement the rail corridor analyses of the Yucca Mountain Final EIS, and analyze the Mina corridor. This Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS [1] also will consider, in detail, alignments for the construction and operation of a rail line within the Caliente and Mina rail corridors.

DATES: The Department invites comments on the scope of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS to ensure that all relevant environmental issues and reasonable alternatives are addressed. Public scoping meetings are discussed below in the **SUPPLEMENTARY INFORMATION** section. DOE will consider all comments received during the 45-day public scoping period, which starts with publication of this Amended Notice of Intent and ends November 27, 2006. Comments received after this date will be considered to the extent practicable.

ADDRESSES: Requests for additional information on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS or transportation planning in general should be directed to: Mr. M. Lee Bishop, EIS Document Manager, Office of Logistics Management, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 011, Las Vegas, NV 89134, Telephone 1–800–967–3477. Written comments on the scope of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS may be submitted to Mr. M. Lee Bishop at this address, by facsimile to 1–800–967–0739, or via the Internet at *http://www.ocrwm.doe.gov* under the caption, What's New.

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

Background

On July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. Subsequently, the Department issued a Record of Decision (April 8, 2004) to announce its selection, both nationally and in the State of Nevada, of the mostly rail scenario analyzed in the Yucca Mountain Final EIS as the mode of transportation for spent nuclear fuel and high-level radioactive waste to the repository. Under the mostly rail scenario, the Department would rely on a combination of rail, truck and possibly barge to transport to the repository site at Yucca Mountain up to 70,000 metric tons of heavy metal of spent nuclear fuel and high-level radioactive waste. Most of the spent nuclear fuel and high-level radioactive waste, however, would be transported by rail.

The Department's decision to select the mostly rail scenario in Nevada ultimately will require the construction of a rail line [2] to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada for the shipment of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes construction of the repository, and receipt and possession of these materials at Yucca Mountain. To that end, in the same Record of Decision, the Department also decided to select the Caliente rail corridor [3] to study possible alignments for this proposed rail line. The Caliente rail corridor originates at an existing siding to the Union Pacific railroad near Caliente, Nevada, and extends in a westerly direction to the northwest corner of the Nevada Test and Training Range, before turning south-southeast to the repository at Yucca Mountain. The Caliente corridor ranges between 512 kilometers (318 miles) and 553 kilometers (344 miles) in length, depending on the alternative alignments considered.

On April 8, 2004, DOE issued a Notice of Intent to prepare an EIS under NEPA for the alignment, construction, and operation of a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials [4] from a site near Caliente, Nevada to a geologic repository at Yucca Mountain, Nevada. During subsequent public scoping, DOE received comments that offered preferences for various rail corridors analyzed in detail in the Yucca Mountain Final EIS, and identified other rail corridors for consideration. In particular, commenters recommended that DOE consider "the Mina route," which would include use of an existing rail line from Hazen, Nevada, to the Thorne siding at Hawthorne, Nevada, and the construction of new rail line that would follow an abandoned rail line nearly to Yucca Mountain.

In the Yucca Mountain Final EIS, DOE considered, but eliminated from detailed study, the Mina route and several other potential rail routes (see Section 2.3.3.1). These other potential rail routes were identified in a series of three transportation studies—"Preliminary Rail Access Study" (January, 1990), the "Nevada Potential Repository Preliminary Transportation Strategy, Study 1" (February, 1995), and the "Nevada Potential Repository Preliminary Transportation Strategy, Study 2" (February, 1996). Based on the latter (1996) study and public scoping, five potential rail corridors were considered in detail in the Yucca Mountain Final EIS.

In the 1996 study, the Mina route was not recommended for further study, because a rail line within the Mina route could only connect to an existing rail line by crossing the Walker River Paiute

[1] Coincident with this Amended Notice of Intent, DOE is publishing a Notice of Intent to prepare a Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1). That Supplement will consider the current repository design and plans for its construction and operation, and the transportation of spent nuclear fuel and high-level radioactive waste from sites around the United States to the repository at Yucca Mountain.

[2] Rail line means the railroad track and underlying earthworks.

[3] A corridor is a strip of land 400 meters (0.25 mile) wide through which DOE would identify an alignment for the construction of a rail line.

[4] Other materials are those related to the construction and operation of the repository.

Tribe Reservation, and the Tribe had informed DOE that it would refuse to allow nuclear waste to be transported across its reservation (letter dated December 6, 1991). For this reason, the Department considered the Mina route to pose an unavoidable land use conflict and thus to be unavailable for further consideration (see Section 2.3.3.1 in the Yucca Mountain Final EIS).

Following review of the scoping comments for the Rail Alignment EIS, DOE held discussions with the Walker River Paiute Tribe regarding the availability of the Mina route. Subsequently, in May 2006, the Walker River Paiute Tribe informed DOE that the Tribal Council had withdrawn its objection to the completion of an EIS studying the transportation of nuclear waste across its reservation. The Tribe stated that its Tribal Council had not decided to allow such shipments, but indicated that inclusion of the Mina route in an EIS would allow the Tribe to make a more informed, final decision about the matter.

In view of the Tribal Council's decision, DOE initiated a study to determine the feasibility of the Mina route, and to identify a specific corridor (the Mina corridor) and associated preliminary alternative alignments. Based on DOE's preliminary analysis, in comparison with other rail corridors, the Mina corridor appears to offer potential advantages to the extent it would cross fewer mountain ranges, utilize existing rail bed, and also be a shorter distance. These potential advantages would simplify design and construction of the rail line, and therefore would be less costly to construct. The Mina corridor also would appear to have fewer land use conflicts, and would involve less land disturbance, which tends to result in lower adverse environmental impacts overall.

For these reasons, DOE has concluded that the Mina corridor warrants further detailed study. Accordingly, DOE is announcing its intent to expand the scope of the Rail Alignment EIS to prepare a Supplemental EIS that will supplement the rail corridor analyses of the Yucca Mountain Final EIS. In the Yucca Mountain Final EIS, DOE evaluated the construction and operation of a rail line within five corridors—Caliente, Caliente-Chalk Mountain, Carlin, Jean and Valley Modified. In the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, DOE will review the environmental information and analyses for these corridors, and update, as appropriate[5]; DOE also plans to consider the Mina corridor at a level of detail commensurate with that of the Yucca Mountain Final EIS. In addition, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will consider, in detail, alignments for the construction and operation of a rail line within the Caliente and Mina corridors.

The Mina corridor originates at an existing rail line near Wabuska, Nevada, where it proceeds southeasterly through Hawthorne to Blair Junction, and then on to Lida Junction. At that point, it becomes coincident with the Caliente corridor trending southeasterly through Oasis Valley before turning north-northeast to Yucca Mountain. The Mina corridor is about 450 kilometers (280 miles) in length; however, construction of new rail line would range between about 386 kilometers (240 miles) and 409 kilometers (254 miles) because the corridor includes the existing Department of Defense rail line from Wabuska to the Hawthorne Army Depot in Hawthorne.

Previous Public Scoping Comments

The Department received more than 4,100 comments during the public scoping period for the Rail Alignment EIS that ended June 1, 2004. In general, many of these comments offered preferences for various rail corridors or requested DOE to evaluate rail corridors other than Caliente, and suggested new alternative alignments or criteria (*e.g.*, avoid wilderness study areas) that could be used to modify the preliminary alignments proposed by DOE or to create new alternative alignments. These comments helped inform DOE's decision to expand the scope of the Rail Alignment EIS as discussed under Background above, and to identify the range of reasonable alternative alignments as discussed under Caliente Alternative Alignments below.

Commenters also requested that DOE allow other commodities to be shipped on the rail line by private entities (referred to herein as shared use). As described under Proposed Action below, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will evaluate shipments of commercial commodities, in addition to shipments of DOE materials.

DOE also received comments regarding analytical methods for various environmental resources such as cultural resources and water use, treatment of cumulative impacts and Native American concerns, the nature of the evaluation of potential accidents and sabotage, and the identification of mitigation measures. These comments and associated issues will be addressed in the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS.

Proposed Action

Under the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, the Proposed Action is to determine a rail alignment[6] (within a rail corridor) in which to construct and operate a rail line for shipments of spent nuclear fuel, high-level radioactive waste, and other materials from an existing railroad in Nevada to a geologic repository at Yucca Mountain, Nye County, Nevada. DOE now plans to review the environmental information and analyses for four rail corridors, and update, as appropriate (Caliente, Carlin, Jean and Valley Modified), include and analyze the Mina corridor, and evaluate in detail two alternatives that would implement the Proposed Action—the Mina Alternative and the Caliente Alternative. Under each implementing alternative, DOE will evaluate the potential environmental impacts from the construction and operation of a rail line along various alternative alignments[7] and common segments.[8] As part of rail line operations, DOE also will evaluate, as an option to the Mina and Caliente implementing alternatives, the shipment of commercial commodities by private entities (shared use).

Preliminary Alternatives

As required by the Council on Environmental Quality and Departmental regulations that implement NEPA, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will analyze and present the environmental impacts associated with the range of reasonable alternatives to meet DOE's purpose and need for a rail line, and a no-action alternative. The preliminary alternative alignments for the Caliente and Mina rail alignments comprise a series of common segments and alternatives (maps may be obtained as described above in

[5] In a letter to the U.S. Air Force (dated December 1, 2004), DOE eliminated from detailed study alignments that would intersect the Nevada Test and Training Range because of concerns regarding military readiness testing and training activities. This letter was in response to a May 28, 2004 letter from the U.S. Air Force. For the same reasons cited in these letters, DOE does not intend to consider further the Caliente-Chalk Mountain rail corridor.

[6] A strip of land less than 400 meters (0.25 mile) wide through which the location of a rail line would be identified.

[7] A geographic region of the rail alignment for which multiple routes for the rail line have been identified.

[8] A geographic region of the rail alignment for which a single route for the rail line has been identified.

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ADDRESSES). The Department is interested in identifying and subsequently evaluating any additional reasonable alternative alignments within the Caliente or Mina corridors that would reduce or avoid known or potential adverse environmental impacts, features having aesthetic values, and land-use conflicts, or alternatives that should be eliminated from detailed consideration. This could include identifying alternative alignments that could avoid environmentally sensitive areas or other land use conflicts.

Caliente Alternative Alignments

DOE's Notice of Intent (April 8, 2004) identified preliminary alternative alignments and common segments to be evaluated in the Rail Alignment EIS. The Notice of Intent also indicated that DOE would consider other potential alternatives if they would minimize, avoid or otherwise mitigate adverse environmental impacts.

Following scoping, DOE evaluated all public comments, as well as information from other sources, that could affect the preliminary alternative alignments and common segments identified in the Notice of Intent. Based on this information, DOE identified additional alternative alignments, and modified the preliminary alignments and common segments identified in the Notice of Intent to create a suite of potential alternatives. This suite was then evaluated using environmental features and engineering and design factors to determine, preliminarily, the range of reasonable alternative alignments. As an example, commenters identified alternative alignments that would avoid Garden Valley by identifying routes through Coal Valley that cross the Golden Gate Range. However, DOE found these alignments are not reasonable alternatives because they would either exceed engineering and design factors or would be far more costly to construct than other alignments that pass through Garden Valley.

On this basis, DOE has identified, preliminarily, alternative alignments at the interface with the Union Pacific Railroad near Caliente, in Garden Valley, near the Reveille Range and the Town of Goldfield, north of Scottys Junction (referred to as Bonnie Claire), and in Oasis Valley. These alternative alignments, which are described below, will be considered in detail in the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS.

Interface With Union Pacific Railroad

DOE has identified two alternative alignments, Caliente and Eccles, either of which alternative alignment would connect the proposed rail line to the existing Union Pacific Railroad in or near the City of Caliente. The Caliente alternative alignment would begin in Caliente, enter Meadow Valley Wash at Indian Cove, and extend generally north through Meadow Valley Wash and along U.S. 93. This alternative alignment would then cross U.S. 93 about 5 kilometers (3 miles) southwest of Panaca and connect to Common Segment 1 about 1 kilometer (0.6 mile) northwest of U.S. 93 and 18 kilometers (11 miles) south of Pioche. The Caliente alternative alignment would be approximately 18 kilometers (11 miles) long.

The Eccles alternative alignment would begin along Clover Creek about 8 kilometers (5 miles) east of Caliente and trend generally north to enter Meadow Valley Wash from the southeast. This alternative alignment would then cross U.S. 93 about 5 kilometers (3 miles) southwest of Panaca and connect to Common Segment 1 about 1 kilometer (0.6 mile) northwest of U.S. 93 and 18 kilometers (11 miles) south of Pioche. The Eccles alternative alignment would be about 18 kilometers (11 miles) long.

Garden Valley

DOE is considering four alternative alignments in the Garden Valley area, referred to as Garden Valley 1, 2, 3, and 8. Garden Valley 1 would run due west through the Golden Gate Range for about 7 kilometers (4 miles), trend in a southwesterly direction through Garden Valley, cross the Lincoln and Nye County line, and connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area, and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 1 alternative alignment would be approximately 35 kilometers (22 miles) long.

Garden Valley 2 would run to the south of Garden Valley 1 and Garden Valley 3, crossing the Lincoln and Nye County line. Garden Valley 2 would continue southwesterly through the Golden Gate Range at Water Gap, turn westward through Garden Valley, and continue southwesterly to connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 2 alternative alignment would be about 37 kilometers (23 miles) long.

Garden Valley 3 would run due west through the Golden Gate Range and then in a northwesterly direction until turning southwest to run along the southeast base of the Quinn Canyon Range. Continuing in a southwesterly direction, it would run through Garden Valley, cross the Lincoln and Nye County line, and connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 3 alternative alignment would be approximately 36 kilometers (22 miles) long.

Garden Valley 8 would run to the south of Garden Valley 1 and Garden Valley 3, crossing the Lincoln and Nye County line. It would continue southwesterly through the Golden Gate Range at Water Gap, would turn westward through Garden Valley, and run in a southwesterly direction before turning sharply westward. Garden Valley 8 would proceed westward and connect to Common Segment 2 about 5 kilometers (3 miles) north of the Worthington Mountains Wilderness Area and 3 kilometers (2 miles) east of the Humboldt Toiyabe National Forest. The Garden Valley 8 alternative alignment would be about 38 kilometers (23 miles) long, 8 kilometers (5 miles) of which parallels Garden Valley Road.

South Reveille

South Reveille 2 and South Reveille 3 alternative alignments would begin 5 kilometers (3 miles) south of the South Reveille Wilderness Study Area. South Reveille 2 would trend to the northwest along the border of the South Reveille Wilderness Study Area. South Reveille 3 would trend northwest a few kilometers to the west and roughly parallel to South Reveille 2. South Reveille 2 or South Reveille 3 would connect to Common Segment 3 in Reveille Valley about 14 kilometers (9 miles) west of State Route 375. South Reveille 2 would be approximately 19 kilometers (12 miles) long and South Reveille 3 would be approximately 20 kilometers (12 miles) long.

Goldfield

DOE is considering three alternative alignments in the Goldfield area, referred to as Goldfield 1, 3, and 4. Goldfield 1 would extend south into the Goldfield Hills area, passing east of Black Butte. It would turn east near Espina Hill and head south to the east of Blackcap Mountain. It would wind around a series of hills and valleys to maintain an acceptable grade. Goldfield 1 would run for approximately 11 kilometers (7 miles) along an abandoned rail line before joining Common Segment 4 about 1 kilometer (0.6 mile) northeast of Ralston. In total, the Goldfield 1 alternative alignment would be 47 kilometers (29 miles) long.

Goldfield 3 would extend south and farther to the east than the other Goldfield alternative alignments. Like Goldfield 1, Goldfield 3 would wind around a series of hills and valleys to maintain an acceptable grade. Also like Goldfield 1, Goldfield 3 would run for approximately 11 kilometers (7 miles) along an abandoned rail line before joining common Segment 4 about 1 kilometer (0.6 mile) northeast of Ralston. In total, the Goldfield 3 alternative alignment would be about 50 kilometers (31 miles) long.

The western Goldfield alternative alignment, Goldfield 4, would depart from Common Segment 3 to the north of Black Butte and trend southwest. It would then cross U.S. 95 and turn south toward Goldfield. After passing through the southwestern edge of Goldfield and crossing U.S. 95 again, Goldfield 4 would turn south to connect with Common Segment 4. Goldfield 4 would be about 53 kilometers (33 miles) long.

Bonnie Claire

DOE is considering two alternative alignments, Bonnie Claire 2 and 3. Bonnie Claire 2 would depart Common Segment 4 about 8 kilometers (5 miles) north of Stonewall Pass and would trend east toward the Nevada Test and Training Range for about 5 kilometers (3 miles) before turning south for an additional 17 kilometers (11 miles). Bonnie Claire 2 generally would follow the Nevada Test and Training Range boundary and would join Common Segment 5 in Sarcobatus Flats to the north of Scottys Junction near the intersection of State Route 267 and U.S. 95. Bonnie Claire 2 would be approximately 20 kilometers long.

Bonnie Claire 3 would depart Common Segment 4 about 8 kilometers (5 miles) north of Stonewall Pass. Bonnie Claire 3 would trend generally south, paralleling U.S. 95 to the east. After approximately 10 kilometers (6 miles), Bonnie Claire 3 would turn southeast and continue for an additional 10 kilometers (6 miles) through Sarcobatus Flats. It would then join Common Segment 5 approximately 4 kilometers (2 miles) north of Scottys Junction near the intersection of State Route 267 and U.S. 95. Bonnie Claire 3 would be approximately 20 kilometers (12 miles) long.

Oasis Valley

DOE is considering two alternative alignments, referred to as Oasis Valley 1 and Oasis Valley 3. Oasis Valley 1 would depart Common Segment 5 about 3 kilometers (2 miles) north of Oasis Mountain and would run southeast and connect to Common Segment 6. Oasis Valley 1 would be approximately 10 kilometers (6 miles) long.

Oasis Valley 3 would also depart Common Segment 5 about 3 kilometers (2 miles) north of Oasis Mountain and would run generally east and then south before crossing Oasis Valley farther to the east than Oasis Valley 1, and then connecting to Common Segment 6. Oasis Valley 3 would be 14 kilometers (9 miles) long.

Mina Alternative Alignments

Following receipt of the letter regarding the Walker River Paiute Tribal Council decision (May, 2006), the Department initiated a study to consider the feasibility of the Mina route, and to identify a specific corridor (Mina corridor) and associated preliminary alternative alignments. The process used to identify the preliminary alternative alignments within the Mina corridor is consistent with that described under Caliente Alternative Alignments. Alternative alignments were identified near the Town of Schurz, around the Montezuma Range, north of Scottys Junction (referred to as Bonnie Claire), and in Oasis Valley. These are described below.

Town of Schurz

DOE has identified three alternative alignments that would bypass the Town of Schurz, Nevada. Schurz Bypass 1 would depart from the existing rail line about 30 kilometers (18 miles) northwest of the Town of Schurz passing along the eastern side of the valley (Sunshine Flat). From there, the alignment passes east of Weber Reservoir and crosses U.S. 95 about 8 kilometers (5 miles) north of the intersection of U.S. 95 and Alternate U.S. 95. Schurz Bypass 1 then trends southeast remaining on the far side of the valley to where it rejoins the existing rail line about 13 kilometers (8 miles) south of Schurz. Schurz Bypass 1 would be 51 kilometers (32 miles) long.

Schurz Bypass 2 also would depart the existing line at the same point of departure as Schurz Bypass 1 and would pass along the eastern side of Sunshine Flat. From there, the alignment passes east of Weber Reservoir and crosses U.S. 95 about 7 kilometers (4 miles) north of the intersection of U.S. 95 and Alternate U.S. 95. From there, the alignment trends to the southeast but staying to the east of Schurz and west of Schurz Bypass 1 until it rejoins the existing rail line about 13 kilometers (8 miles) south of Schurz. Schurz Bypass 2 would be 50 kilometers (31 miles) long.

Schurz Bypass 3 would depart the existing rail line about 9 kilometers (6 miles) northwest of the Town of Schurz where it would cross the Walker River. The alignment then crosses U.S. 95 about 8 kilometers (5 miles) north of the intersection of U.S. 95 and Alternate U.S. 95 at which point it continues southeasterly to a point where it rejoins the existing rail line about 13 kilometers (8 miles) south of Schurz, on the east side of the valley.

Montezuma Range

DOE identified two alternative alignments that depart near Blair Junction at the intersection of U.S. 95 and U.S. 6 to avoid the Montezuma Range; they rejoin at a point just east of Lida Junction. The first alignment, Montezuma Range 1, would depart Blair Junction paralleling State Route 265 to the Town of Silver Peak where it would proceed north to follow the western side of Clayton Ridge. The alignment would then turn south approximately 16 kilometers (10 miles) before Railroad Pass at which point it would turn east between the southern end of the Goldfield Hills and the Cuprite Hills. The alignment would then cross U.S. 95 about 7 kilometers (5 miles) north of Lida Junction and, paralleling U.S. 95, then head south to a point just east of Lida Junction. Montezuma Range 1 would be about 134 kilometers (83 miles) long.

Montezuma Range 2, after departing from the intersection of U.S. 95 and U.S. 6, would follow the abandoned Tonopah and Goldfield rail roadbed east to the north of Lone Mountain, at which point the alignment would head south following the abandoned roadbed. The alignment would traverse Montezuma Valley south to Klondike and would then parallel U.S. 95 as it approaches the Town of Goldfield. Montezuma Range 2 would stay west of Goldfield and then trend southeasterly to a point just east of Lida Junction where it would reconnect with Montezuma Range 1. Montezuma Range 2 would be about 135 kilometers (84 miles) long.

Bonnie Claire and Oasis Valley

The Bonnie Claire and Oasis Valley alternative alignments are as described above under Caliente Alternative Alignments.

No Action Alternative

The Council on Environmental Quality and Departmental regulations that implement NEPA require consideration of the alternative of no action. Under the No Action Alternative, DOE would not select a rail alignment within the Caliente or Mina rail corridors for the construction and operation of a rail line. As such, the No Action Alternative provides a basis for comparison to the Proposed Action.

In the event that DOE were not to select a rail alignment in the Caliente or Mina corridors, the future course that it would pursue is uncertain. DOE recognizes that other possibilities could be pursued, including identifying and evaluating alignments in other corridors considered in the Yucca Mountain Final EIS.

Potential Environmental Issues and Resources To be Examined

The Council on Environmental Quality regulations direct Federal agencies preparing an EIS to focus on significant environmental issues (40 CFR 1502.1) and discuss impacts in proportion to their significance (40 CFR 1502.2). Accordingly, the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will analyze issues and impacts with the amount of detail commensurate with their importance.

To facilitate the scoping process, DOE has identified a preliminary list of issues and environmental resources that it may consider in the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS. The list is not intended to be all-inclusive or to predetermine the scope or alternatives of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, but should be used as a starting point from which the public can help DOE define the scope of the EIS.

- Potential impacts to the concept of multiple use as it applies to public land use planning and management specified by the Federal Land Policy and Management Act of 1976.
- Potential impacts to land use and ownership.
- Potential impacts to plants, animals and their habitats, including impacts to wetlands, and threatened and endangered and other sensitive species.
- Potential impacts to cultural resources.
- Potential impacts to American Indian resources.
- Potential impacts to paleontological resources.
- Potential impacts to the public from noise and vibration.
- Potential impacts to the general public and workers from radiological exposures during incident-free operations of the railroad.
- Potential impacts to the general public and workers from radiological exposures from potential accidents during operations of the railroad.
- Potential impacts to water resources and floodplains.
- Potential impacts to aesthetic values.
- Potential disproportionately high and adverse impacts to low-income and minority populations (environmental justice).
- Irretrievable and irreversible commitment of resources.
- Compliance with applicable Federal, state and local requirements.

The Department specifically invites comments on the following relative to the Mina corridor and its alternative alignments:

1. Should additional alternative alignments be considered that might minimize, avoid or mitigate adverse environmental impacts (for example, looking beyond the 0.25 mile wide Mina corridor, avoiding environmentally sensitive areas)?
2. Should any of the preliminary alternatives be eliminated from detailed consideration?
3. Should additional environmental resources be considered?
4. What mitigation measures should be considered?

In addition, the Department is interested in identifying any significant changes to, or new information relevant to, the rail corridors analyzed in the Yucca Mountain Final EIS.

Schedule

The DOE intends to issue the Draft Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS in 2007 at which time its availability will be announced in the **Federal Register** and local media. A public comment period will start upon publication of the Environmental Protection Agency's Notice of Availability in the **Federal Register**. The Department will consider and respond to comments received on the Draft in preparing the Final Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS.

Other Agency Involvement

Currently, the U.S. Bureau of Land Management, U.S. Air Force and the U.S. Surface Transportation Board are cooperating agencies in the preparation of the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS. The Department also expects to invite the following to be cooperating agencies: Walker River Paiute Tribe, U.S. Bureau of Indian Affairs, and the U.S. Army. The Tribe and these agencies have management and regulatory authority over lands traversed by alternative rail alignments within the Mina and Caliente rail corridors, or special expertise germane to the construction and operation of a rail line. DOE will consult with the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, U.S. Nuclear Regulatory Commission, Native American Tribal organizations, the State of Nevada, and Nye, Lincoln, Esmeralda, Mineral, Churchill and Lyon Counties regarding the environmental and regulatory issues germane to the Proposed Action. DOE invites comments on its identification of cooperating and consulting agencies and organizations.

Public Scoping Meetings

DOE will hold public scoping meetings on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS. The meetings will be held at the following locations and times:

- Amargosa Valley, Nevada. Longstreet Hotel Casino, Nevada State Highway 373, November 1, 2006 from 4–7 p.m.[9]
- Caliente, Nevada. Caliente Youth Center, U.S. 93 North, November 8, 2006 from 6–8 p.m.
- Goldfield, Nevada. Goldfield School Gymnasium, Hall and Euclid, November 13, 2006 from 4–7 p.m.
- Hawthorne, Nevada. Hawthorne Convention Center, 932 E. Street, November 14, 2006 from 4–7 p.m.
- Fallon, Nevada. Fallon Convention Center, 100 Campus Way, November 15, 2006 from 4–7 p.m.

The public scoping meetings will be an open meeting format without a formal presentation by DOE. Members of the public are invited to attend the meetings at their convenience any time during meeting hours and submit their comments in writing at the meeting, or in person to a court reporter who will be available throughout the meeting. This open meeting format increases the opportunity for public comment and provides for one-on-one discussions with DOE representatives involved with

[9] DOE will hold a joint public scoping meeting on the Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1) and Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369) in Amargosa Valley, Longstreet Hotel Casino, Nevada State Highway 373, November 1 from 4–7 pm. Additional public scoping meetings on the Supplemental Yucca Mountain EIS will be held in Washington, DC, L'Enfant Plaza Hotel, 480 L'Enfant Plaza, SW, October 30 from 4–7 pm; and Las Vegas, Cashman Center, 850 North Las Vegas Blvd., November 2 from 4–7 pm.

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the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS, and transportation planning in general.

The public scoping meetings will be held during the public scoping comment period. The comment period begins with publication of this Amended Notice of Intent in the **Federal Register** and closes November 27, 2006. Comments received after this date will be considered to the extent practicable. Written comments may be provided in writing, facsimile, or by the Internet to Mr. Lee Bishop, EIS Document Manager (see **ADDRESSES** above).

Public Reading Rooms

Documents referenced in this Amended Notice of Intent and related information are available at the following locations: Beatty Yucca Mountain Information Center, 100 North E. Avenue, Beatty, NV 89003, (775) 553–2130; Esmeralda County Yucca Mountain Oversight Office, 274 E. Crook Avenue, Goldfield, NV 89013, (775) 485–3419; Las Vegas Yucca Mountain Information Center, 4101–B Meadows Lane, Las Vegas, NV 89107, (702) 295–1312; Lincoln County Nuclear Waste Project Office, 100 Depot Avenue, Caliente, NV 89008, (775) 726–3511; Nye County Department of Natural Resources and Federal Facilities, 1210 E. Basin Road, Suite #6, Pahrump, NV 89060 (775) 727–7727; Pahrump Yucca Mountain Information Center, 2341 Postal Drive, Pahrump, NV 89048, (775) 571–5817; University of Nevada, Reno, The University of Nevada Libraries, Business and Government Information Center, M/S 322, 1664 N. Virginia Street, Reno, NV 89557, (775) 784–6500, Ext. 309; and the U.S. Department of Energy Headquarters Office Public Reading Room, 1000 Independence Avenue SW., Room 1E–190 (ME–74) FORS, Washington, DC 20585, 202–586–3142.

Issued in Washington, DC, October 10, 2006.

David R. Hill,

General Counsel.

[FR Doc. 06–8675 Filed 10–10–06; 4:15 pm]

BILLING CODE 6450–01–P

A.10 71 *FR* 60490, October 13, 2006

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DEPARTMENT OF ENERGY

Supplement to the Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, NV

AGENCY: U.S. Department of Energy.

ACTION: Notice of intent.

SUMMARY: The U.S. Department of Energy (DOE or the Department) is announcing its intent to prepare a Supplement to the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (DOE/EIS–0250F, February 2002) (Yucca Mountain Final EIS). The Proposed Action addressed in the Yucca Mountain Final EIS is to construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain in southern Nevada for the disposal of spent nuclear fuel and high-level radioactive waste.

The Yucca Mountain Final EIS considered the potential environmental impacts of a repository design for surface and subsurface facilities, a range of canister packaging scenarios and repository thermal operating modes, and plans for the construction, operation and monitoring, and eventual closure of the repository. The Yucca Mountain Final EIS also considered the environmental impacts of the transportation of spent nuclear fuel and high-level radioactive waste from commercial and DOE sites to the repository by two principal modes—mostly truck and mostly rail. In the Yucca Mountain Final EIS DOE recognized that these repository design concepts and operational plans would continue to develop during the design and engineering process.

Since publication of the Yucca Mountain Final EIS, DOE has continued to develop the repository design and associated plans. As now planned, the proposed surface and subsurface facilities would allow DOE to operate the repository following a primarily canistered approach in which most commercial spent nuclear fuel would be packaged at the commercial sites in multipurpose transport, aging and disposal canisters (TADs), and all DOE materials would be packaged in disposable canisters at the DOE sites. Waste packages would be arrayed in the repository underground to achieve what is referred to as a higher-thermal operating mode, and most spent nuclear fuel and high-level radioactive waste would arrive at the repository by rail.

To evaluate the potential environmental impacts of the current repository design and operational plans, DOE has decided to prepare a Supplement to the Yucca Mountain Final EIS [1], consistent with the National Environmental Policy Act (NEPA) and the Nuclear Waste Policy Act, as amended (Pub. L. 97–425) (NWPA). This Supplemental Yucca Mountain EIS (DOE/EIS–0250–S1) is being prepared to assist the U.S. Nuclear Regulatory Commission (NRC) in satisfying its NEPA responsibilities pursuant to the NWPA (Section 114(f)(4)) [2].

DATES: The Department invites comments on the scope of the Supplemental Yucca Mountain EIS to ensure that all relevant environmental issues are addressed. Public scoping meetings are discussed below in the **SUPPLEMENTARY INFORMATION** section. DOE will consider all comments received during the 45-day public scoping period, which starts with publication of this Notice of Intent and ends November 27, 2006. Comments received after this date will be considered to the extent practicable.

ADDRESSES: Requests for additional information on the Supplemental Yucca Mountain EIS or on the repository program in general, should be directed to: Dr. Jane Summerson, EIS Document Manager, Regulatory Authority Office, Office of Civilian Radioactive Waste Management, U.S. Department of Energy, 1551 Hillshire Drive, M/S 010, Las Vegas, NV 89134, Telephone 1–800–967–3477. Written comments on the scope of the Supplemental Yucca Mountain EIS may be submitted to Dr. Jane Summerson at this address, or by facsimile to 1–800–967–0739, or via the Internet at *http://www.ocrwm.doe.gov* under the caption What's New.

FOR FURTHER INFORMATION CONTACT: For general information regarding the DOE NEPA process contact: Ms. Carol M. Borgstrom, Director, Office of NEPA Policy and Compliance, U.S. Department of Energy, 1000 Independence Ave., SW., Washington, DC 20585, Telephone 202–586–4600, or leave a message at 1–800–472–2756.

SUPPLEMENTARY INFORMATION:

[1] Coincident with this Notice of Intent, DOE is publishing an Amended Notice of Intent to prepare a Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369). That EIS will review the rail corridor analyses of the Yucca Mountain Final EIS, and update, as appropriate, and will analyze the proposed Mina corridor; it also will include detailed analyses of alternative alignments for the construction and operation of a rail line within the Mina corridor, as well as the Caliente corridor.

[2] Section 114(f)(4) of the NWPA provides that any environmental impact statement "prepared in connection with a repository * * * shall, to the extent practicable, be adopted by the Commission [NRC] in connection with the issuance by the Commission of a construction authorization and license for such repository. To the extent such statement is adopted by the Commission, such adoption shall be deemed to also satisfy the responsibilities of the Commission under the National Environmental Policy Act of 1969 * * *."

Background

Section 111(a)(4) of the NWPA states that the Federal government has the: "responsibility to provide for the permanent disposal of high-level radioactive waste and such spent nuclear fuel as may be disposed of in order to protect the public health and safety and the environment."

The NWPA directs the Secretary of Energy, if the Secretary decides to recommend approval of the Yucca Mountain site for development of a repository, to submit a final environmental impact statement with any recommendation to the President. The Department prepared the Yucca Mountain Final EIS to fulfill that requirement.

On February 14, 2002, the Secretary, in accordance with the NWPA, transmitted his recommendation (including the Yucca Mountain Final EIS) to the President for approval of the Yucca Mountain site for development of a geologic repository. The President considered the site qualified for application to the NRC for a construction authorization and recommended the site to the U.S. Congress. Subsequently, on July 23, 2002, the President signed into law (Pub. L. 107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste. The Department is now preparing a license application for submittal to the NRC seeking authorization to construct the repository, as required by the NWPA (Section 114(b)).

In the Yucca Mountain Final EIS, DOE considered the potential environmental impacts of a repository design for surface and subsurface facilities, a range of canister packaging scenarios and repository thermal operating modes, and plans for the construction, operation and monitoring, and eventual closure of the repository. The Yucca Mountain Final EIS also described and evaluated the transportation of spent nuclear fuel and high-level radioactive waste from commercial and DOE sites to the repository by two principal modes—mostly truck and mostly rail. DOE recognized at that time that these repository design concepts and operational plans would continue to develop during the design and engineering process.

More specifically, the Yucca Mountain Final EIS included evaluations of separate canistered and uncanistered packaging scenarios for commercial spent nuclear fuel, and a repository design comprised of three primary surface operations areas (North Portal Operations Area, South Portal Development Area, Ventilation Shaft Operations Area) in which spent nuclear fuel and high-level radioactive waste would be handled in two principal facilities (Carrier Preparation Building, Waste Handling Building). The Yucca Mountain Final EIS also evaluated a range of underground thermal operating modes (referred to as lower- and higher-temperature modes) in which heat from the waste packages would raise the temperature of the adjacent rock to a range of temperatures from below the boiling point of water to above the boiling point. Two scenarios, mostly truck and mostly rail, were analyzed for the transportation of spent nuclear fuel and high-level radioactive waste from the commercial and DOE sites to the repository.

Since publication of the Yucca Mountain Final EIS, DOE has continued to develop the repository design and associated plans. As now planned (and described in greater detail in the Proposed Action below), the proposed surface and subsurface facilities would allow DOE to operate the repository following a primarily canistered approach in which most commercial spent nuclear fuel would be packaged at the commercial sites in TADs, and all DOE materials would be packaged in disposable canisters at the DOE sites. These TADs and disposable canisters then would be transported mostly by rail [3] to the repository where they would be placed on aging (or staging) [4] pads prior to disposal, or inserted into waste packages and disposed of in the repository underground.

At the repository site, spent nuclear fuel and high-level radioactive waste would now be handled in up to six principal facilities located within three primary surface operations areas. A fourth operations area would be developed to support excavation of the underground repository. A higher-thermal (temperature) operating mode would be employed.

Based on the current planning, the Department does not believe that any of the developments to the repository design or operational plans would have a significant impact on the environmental effects considered in the Yucca Mountain Final EIS. Nevertheless, to assist NRC in satisfying its NEPA responsibilities pursuant to the NWPA (Section 114(f)(4)), DOE has decided to prepare this Supplemental EIS.

Proposed Action

Under the Proposed Action, DOE would construct, operate and monitor, and eventually close a geologic repository at Yucca Mountain for the disposal of up to 70,000 metric tons of heavy metal (MTHM) of commercial and DOE-owned spent nuclear fuel and high-level radioactive waste.[5] DOE would dispose of these materials in the repository using the inherent, natural geologic features of the mountain and engineered barriers to ensure long-term isolation of the spent nuclear fuel and high-level radioactive waste from the human environment. These materials would be emplaced underground at least 200 meters (660 feet) below the surface and at least 160 meters (530 feet) above the water table. The NRC, through its licensing process, would regulate repository construction, operation and monitoring, and closure.

Under the Proposed Action, most spent nuclear fuel and high-level radioactive waste would be shipped from 72 commercial and 4 DOE sites [6] to the repository in NRC-certified transportation casks placed on trains dedicated only to these shipments. Some shipments, however, would arrive at the repository by truck.

Under the Proposed Action, all DOE spent nuclear fuel and high-level radioactive waste would be placed in disposable canisters at the DOE sites, and as much as 90 percent of the commercial spent nuclear fuel would be placed in TADs at the commercial sites prior to shipment. Upon arrival at the repository, both types of canisters (DOE disposable and TADs) would be placed into corrosion-resistant overpacks

[3] On April 8, 2004 (69 FR 18557), the Department issued a Record of Decision selecting, both nationally and in the State of Nevada, the mostly rail scenario analyzed in the Yucca Mountain Final EIS. This decision will ultimately require the construction of a rail line to connect the repository site at Yucca Mountain to an existing rail line in the State of Nevada.

[4] The terminology refers to retaining commercial spent nuclear fuel on the surface at the repository to meet waste package thermal limits (aging), or to provide a surge capacity to maintain flexibility in waste handling operations (staging).

[5] The 70,000 MTHM includes 63,000 MTHM of commercial spent nuclear fuel, about 2,333 MTHM of DOE fuel (includes about 65 MTHM of naval fuel), and about 4,667 MTHM of DOE high-level radioactive waste.

[6] In 2002, fifty-four additional sites, primarily domestic research reactors, were expected to ship spent nuclear fuel to two DOE sites prior to disposal at the repository (see Records of Decision June 1, 1995 at 60 FR 28680, and March 8, 1996 at 61 FR 9441). Also, the Yucca Mountain Final EIS analyzed fuel shipments from 5 DOE sites, including Fort St. Vrain, to the repository. Presently, it is anticipated that fuel from Fort St. Vrain will be shipped to Idaho National Laboratory prior to being shipped to the repository.

(waste packages) prior to emplacement in the repository underground.

The remaining commercial spent nuclear fuel (about 10 percent) would be transported to the repository in dual-purpose canisters (canisters suitable for storage and transportation), or would be uncanistered. At the repository, uncanistered spent nuclear fuel would be placed directly into TADs and then waste packages for disposal. Commercial spent nuclear fuel arriving in dual-purpose canisters would first be removed from the canisters, placed into TADs and then into waste packages for disposal.

Handling of spent nuclear fuel and high-level radioactive waste would take place in the geologic repository operations area, which includes the North Portal area, the South Portal development area, a North Construction Portal development area, and the surface shaft areas. The surface portion of the geologic repository operations area also would include the facilities necessary to receive, package, and support emplacement of spent nuclear fuel and high-level radioactive waste in the repository. Waste transfer operations would be conducted inside reinforced concrete and metal frame buildings designed and constructed to withstand earthquakes and other phenomena. Workers and the public would be protected from radiation by shielded transfer equipment and walls, exhaust filtering systems, and the use of remotely controlled equipment to remove the waste forms from the transportation casks for insertion into waste packages.

The primary surface waste handling facilities include a wet handling facility, a receipt facility, and three separate canister receipt and closure facilities. DOE also is considering an initial handling facility. These facilities would allow the various types of materials received at the repository to be prepared for disposal.

The wet handling facility would receive commercial spent nuclear fuel as bare fuel assemblies (uncanistered) or in dual-purpose canisters, either in truck or rail transportation casks. Commercial spent nuclear fuel would be transferred underwater from the transportation casks or dual-purpose canisters into TADs. The wet handling facility would include provisions for opening transportation casks and dual-purpose canisters, and for drying and closing the loaded TADs. Loaded TADs either would be placed into overpacks for placement on aging/staging pads, or would be transferred to the canister receipt and closure facilities for loading into waste packages for disposal.

The receipt facility would receive TADs and dual-purpose canisters in rail transportation casks. The TADs and dual-purpose canisters would be transferred (dry) from the transportation casks either to overpacks for placement on the aging/staging pads, or to shielded transfer casks for transfer to the canister receipt and closure facilities. Shielded transfer casks also would transfer dual-purpose canisters to the wet handling facility, as necessary.

The canister receipt and closure facilities would receive DOE disposable canisters and TADs in rail transportation casks, shielded transfer casks and aging/staging overpacks. These facilities also could receive truck casks. There, TADs and DOE disposable canisters would be placed into waste packages for disposal.

If constructed, the initial handling facility would receive DOE high-level radioactive waste canisters and naval spent nuclear fuel canisters in truck and rail transportation casks. These canisters would be removed from the transportation casks and transferred to waste packages for disposal.

Waste packages containing TADs, naval nuclear spent fuel, or DOE disposable canisters would be placed on pallets and loaded onto shielded waste package transporters. The shielded waste package transporters would transfer the waste packages to the underground for emplacement in dedicated tunnels (drifts). In these drifts, waste packages would be aligned end-to-end. Emplacement drifts would be excavated in a series of panels, phased to match the anticipated throughput rate of the surface waste handling facilities.

The repository also would have other underground excavations. These would include, for example, main drifts to provide access to the surface and the emplacement drifts, and exhaust mains to exhaust ventilation air from the emplacement drifts.

Under the Proposed Action, thermal output of the waste packages would heat the adjacent rock in excess of the boiling temperature of water (i.e., higher-thermal operating mode). In this higher-thermal mode, the repository emplacement drifts would remain open and ventilated for a nominal period of 50 years after emplacement of the spent nuclear fuel and high-level radioactive waste; ventilation would remove much of the heat and humidity from the emplacement drifts during this period. The higher thermal operating mode would be achieved by a combination of closely spaced waste packages, a nominal ventilation period of 50 years, and managing waste package thermal output by mixing lower heat output waste packages with higher heat output packages in the drifts (for example).

After the repository is closed and sealed, the rock around the emplacement drifts would dry, minimizing the amount of water that might contact the waste packages for hundreds of years. However, a substantial portion of the rock between the drifts would remain at temperatures below boiling, and this would promote drainage of water through the central portions of the rock, rather than into the emplacement drifts.

The surface and subsurface facilities and associated infrastructure,[7] such as the on-site road and water distribution networks and emergency response facilities, would be constructed in phases to accommodate the expected receipt rates of spent nuclear fuel and high-level radioactive waste. Emplacement (disposal) operations, which would last up to 50 years, would be followed by a preclosure monitoring period of 50 years. Towards the end of the preclosure monitoring period, titanium drip shields would be installed over the waste packages. The drip shields would divert moisture that might drip from the drift walls, as well as condensed water vapor around the waste packages, to the drift floor thereby increasing the life expectancy of the waste packages. Drip shields also would protect the waste packages from rock falls.

Under the Proposed Action, emplaced waste packages could be retrieved at any time prior to 100 years after the start of emplacement. Following waste emplacement, surface facilities would be decommissioned and after the monitoring period the repository would be closed. Closure would involve sealing the shafts, ramps, exploratory boreholes and other repository openings. The main drifts would be filled with crushed rock and surface caps would be installed to discourage human intrusion. A network of monuments and markers would be erected around the site surface to warn

[7] DOE published a "Draft Environmental Assessment for the Proposed Infrastructure Improvements for the Yucca Mountain Project, Nevada" on July 6, 2006 (71 FR 38391). DOE proposes to repair, replace, or improve certain infrastructure at the site to enhance safety and to safely continue operations, scientific testing, and maintenance until such time as NRC decides whether to authorize construction of a repository. To the extent that activities proposed by DOE in its environmental assessment, such as construction of a new access road or new power lines, may not be undertaken in the timeframe considered in the environmental assessment, they will be considered in this Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1).

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future generations of the presence and nature of the buried radioactive waste.

No Action Alternative

Under the No Action Alternative, DOE would terminate activities at Yucca Mountain and undertake site reclamation to mitigate any significant adverse environmental impacts. Commercial nuclear power utilities and DOE would continue to manage spent nuclear fuel and high-level radioactive waste at sites throughout the United States. The No Action Alternative was analyzed in the Yucca Mountain Final EIS as a basis for comparison with the Proposed Action.

Since completion of the Yucca Mountain Final EIS, DOE has not identified any relevant changes in circumstances or information bearing on environmental concerns regarding the No Action Alternative. For this reason, DOE anticipates that the Supplemental Yucca Mountain EIS will incorporate by reference the information describing and analyzing the No Action Alternative presented in the Yucca Mountain Final EIS (pursuant to Council on Environmental Quality (CEQ) regulations at 40 Code of Federal Regulations (CFR) 1502.21).

Potential Environmental Issues and Resources To Be Examined

The CEQ regulations direct Federal agencies preparing an EIS to focus on significant environmental issues (40 CFR 1502.1) and discuss impacts in proportion to their significance (40 CFR 1502.2). Accordingly, the Supplemental Yucca Mountain EIS will analyze issues and impacts with the amount of detail commensurate with their importance. Under these guidelines, aspects of the Proposed Action with clearly small environmental impacts usually would require less depth and breadth of analysis. To the degree that the Proposed Action would affect public health or safety, however, the potential impacts generally are a matter of public interest, regardless of their significance. Therefore, DOE plans to pay particular attention to worker and public health and safety associated with the handling and disposal, and transportation of spent nuclear fuel and high-level radioactive waste, even where such impacts would not be significant.

To facilitate the scoping process, DOE has identified a preliminary list of issues and environmental resources that it may consider in the Supplemental Yucca Mountain EIS. The list is not intended to be all-inclusive, but should be used as a starting point for public input on the scope of the Supplemental Yucca Mountain EIS.

- Radiological releases. The potential impacts (i.e., latent cancer fatalities) to the public and workers from potential radiological releases during routine loading of canisters and transportation casks at the commercial sites, and from handling and disposal operations at the repository.
- Worker safety and health. Potential health and safety impacts (i.e., injuries and fatalities) to workers during handling and disposal operations at the commercial and DOE sites and the repository.
- Transportation. The potential radiological and non-radiological impacts (i.e., traffic injuries and fatalities) to the public and workers associated with the shipment of materials to the repository under the mostly rail scenario.
- Accidents. The potential radiological impacts to workers and the public from reasonably foreseeable accidents during loading of canisters at the sites, transportation and repository operations, including any accidents with low probability but high potential consequences.
- Sabotage. The potential radiological impacts to workers and the public from sabotage of transportation and repository operations.
- Waste isolation. Potential radiological and non-radiological impacts (e.g., chemically toxic materials) associated with the long-term performance of the repository.
- Socioeconomic conditions. Potential local regional socioeconomic impacts to the surrounding communities from construction, operation and closure of the repository.
- Water and air resources. Potential impacts to air resources, and water quality and use.
- Cultural resources. Potential impacts to archaeological and historic resources and American Indian issues of concern.
- Biological resources. Potential impacts to plants, animals and their habitats, including impacts to endangered and threatened species.
- Cumulative impacts from the Proposed Action and other past, present and reasonably foreseeable future actions.
- Environmental justice. Potential for disproportionately high and adverse impacts on minority or low-income populations.

Schedule

The DOE intends to issue the Draft Supplemental Yucca Mountain EIS in 2007, at which time its availability will be announced in the **Federal Register** and in media in Nevada. A public comment period will start upon publication of the Environmental Protection Agency's Notice of Availability in the **Federal Register**. DOE will hold public hearings during the comment period. The Department will consider and respond to comments received on the Draft Supplemental Yucca Mountain EIS in preparing the Final Supplemental Yucca Mountain EIS.

Other Agency Involvement

The Department intends to consult with Federal agencies, such as the U.S. Army Corps of Engineers, U.S. Bureau of Land Management, U.S. Air Force, and the U.S. Department of the Navy, and with state agencies, such as the Nevada Department of Transportation and the Nevada Division of Environmental Protection, during preparation of the Supplemental Yucca Mountain EIS.

Public Scoping Meetings

DOE will hold public scoping meetings on the Supplemental Yucca Mountain EIS. The meetings will be held at the following locations and times:

- Washington, District of Columbia, L'Enfant Plaza Hotel, 480 L'Enfant Plaza, SW., October 30 from 4–7 p.m.
- Amargosa Valley, Nevada. Longstreet Hotel Casino, Nevada State Highway 373, November 1 from 4–7 p.m.[8]
- Las Vegas, Nevada. Cashman Center, 850 North Las Vegas Blvd., November 2 from 4–7 p.m.

The public scoping meetings will be an open meeting format without a formal presentation by DOE. Members of the public are invited to attend the meetings at their convenience any time during meeting hours and submit their comments in writing at the meeting, or in person to a court reporter who will be available throughout the meeting. This open meeting format increases the opportunity for public comment and provides for one-on-one discussions with DOE representatives involved with

[8] DOE will hold a joint public scoping meeting on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS (DOE/EIS–0250F–S2 and DOE/EIS–0369) and on the Supplemental Yucca Mountain EIS (DOE/EIS–0250F–S1) in Amargosa Valley, Longstreet Hotel Casino, Nevada State Highway 373, November 1 from 4–7 pm. Additional public scoping meetings on the Supplemental Yucca Mountain Rail Corridor and Rail Alignment EIS will be held in Caliente, Caliente Youth Center, U.S. 93 North, November 8 from 6–8 pm; Goldfield, Goldfield School Gymnasium, Hall and Euclid, November 13 from 4–7 pm; Hawthorne, Hawthorne Convention Center, 932 E. Street, November 14 from 4–7 pm; and Fallon, Fallon Convention Center, 100 Campus Way, November 15, from 4–7 pm.

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the Supplemental Yucca Mountain EIS and the repository program.

The public scoping meetings will be held during the public scoping comment period. The comment period begins with publication of this Notice of Intent in the **Federal Register** and closes November 27, 2006. Comments received after this date will be considered to the extent practicable. Written comments may be provided in writing, by facsimile, or via the Internet to Dr. Jane Summerson, EIS Document Manager (see **ADDRESSES** above).

Public Reading Rooms

Documents referenced in this Notice of Intent and related information are available at the following locations: Beatty Yucca Mountain Information Center, 100 North E. Avenue, Beatty, NV 89003, (775) 553–2130; Esmeralda County Yucca Mountain Oversight Office, 274 E. Crook Avenue, Goldfield, NV 89013, (775) 485–3419; Las Vegas Yucca Mountain Information Center, 4101–B Meadows Lane, Las Vegas, NV 89107, (702) 295–1312; Lincoln County Nuclear Waste Project Office, 100 Depot Avenue, Caliente, NV 89008, (775) 726–3511; Nye County Department of Natural Resources and Federal Facilities, 1210 E. Basin Road, Suite #6, Pahrump, NV 89060 (775) 727–7727; Pahrump Yucca Mountain Information Center, 2341 Postal Drive, Pahrump, NV 89048, (775) 571–5817; University of Nevada, Reno, The University of Nevada Libraries, Business and Government Information Center, M/S 322, 1664 N. Virginia Street, Reno, NV 89557, (775) 784–6500, Ext. 309; and the U.S. Department of Energy Headquarters Office Public Reading Room, 1000 Independence Avenue, SW., Room 1E–190 (ME–74) FORS, Washington, DC, 20585, 202–586–3142.

Issued in Washington, DC, October 10, 2006.

David R. Hill,

General Counsel.

[FR Doc. 06–8676 Filed 10–10–06; 4:15 pm]

BILLING CODE 6450–01–P

A.11 72 *FR* 1235, January 10, 2007

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DEPARTMENT OF THE INTERIOR

Bureau of Land Management

[NV–930–1920–ET–4662; NVN 82752; 7–08807]

Notice of Proposed Withdrawal and Opportunity for Public Meeting; Nevada

AGENCY: Bureau of Land Management, Interior.

ACTION: Notice.

SUMMARY: The Department of Energy (DOE) has filed an application with the Bureau of Land Management (BLM) requesting the Secretary of the Interior to withdraw 208,037 acres of public lands from surface entry and mining through December 27, 2015, to evaluate the lands for the potential construction, operation, and maintenance of a rail line for the transportation of spent nuclear fuel and high-level radioactive waste in the event the Nuclear Regulatory Commission authorizes a geologic repository at Yucca Mountain as provided for under the Nuclear Waste Policy Act of 1982, as amended. This notice segregates the lands from surface entry and mining for up to 2 years while various studies and analyses are made to support a final decision on the withdrawal application.

DATES: Comments and requests for a public meeting should be received on April 10, 2007.

ADDRESSES: Comments and meeting requests should be sent to the Nevada State Director, BLM, P.O. Box 12000, Reno, Nevada 89520–0006.

FOR FURTHER INFORMATION CONTACT: Dennis J. Samuelson, BLM Nevada State Office, 775–861–6532.

SUPPLEMENTARY INFORMATION: The DOE has filed an application with the BLM requesting the Secretary of the Interior to withdraw the following described public lands from settlement, sale, location, or entry under the general land laws, including the United States mining laws, but not from leasing under the mineral leasing laws, subject to valid existing rights:

Mount Diablo Meridian

A corridor 1-mile in width that contains a portion of, or is wholly encompassed within the following sections and/or quarter sections and government lots:

Caliente Rail Corridor (additional lands)

T. 1 S., R. 42 E.,
 Sec. 36, E½SE¼.
T. 2 S., R. 42 E.,
 Sec. 1;
 Sec. 2, SE¼;
 Sec. 10, SE¼;
 Sec. 11;
 Sec. 12, N½ and SW¼;
 Sec. 13, NW¼NW¼;
 Secs. 14 and 15 (except patented land);
 Sec. 22 (except patented land);
 Sec. 23, W½NW¼ and W½SW¼ (except patented land);
 Sec. 26, W½NW¼ and W½SW¼ (except patented land);
 Secs. 27 and 34 (except patented land);
 Sec. 35, W½ (except patented land).
T. 3 S., R. 42 E.,
 Sec. 3 (except patented land);
 Sec. 10, E½ and NE¼NW¼;
 Secs. 11 and 12 (except patented land);
 Sec. 13, N½ and N½SE¼;
 Sec. 14, NE¼ and NE¼NW¼.
T. 1 N., R. 43 E.,
 Sec. 33, SE¼SW¼ and SE¼.
T. 1 S., R. 43 E.,
 Sec. 4, W½;
 Sec. 5, SE¼NE¼ and SE¼;
 Sec. 8, E½;
 Sec. 9, W½;
 Sec. 13, SW¼SW¼;
 Sec. 14, SW¼;
 Sec. 16, W½;
 Sec. 17, E½;
 Sec. 20;
 Sec. 22, SE¼;
 Sec. 23, W½ and SE¼;
 Sec. 24, W½NW¼;
 Sec. 26;
 Sec. 27, E½;
 Sec. 29;
 Sec. 30, E½ and SE¼SW¼;
 Sec. 31;
 Sec. 32, NW¼NE¼ and W½;
 Sec. 34, E½;
 Sec. 35;
 Sec. 36, W½ and W½SE¼.
T. 2 S., R. 43 E.,
 Sec. 1;
 Sec. 2, E½ and SE¼SW¼;
 Sec. 6;
 Sec. 7, NW¼NW¼;
 Sec. 8, E½SE¼;
 Sec. 11;
 Sec. 12, NW¼NE¼, NW¼, and W½SW¼;
 Sec. 13, W½;
 Sec. 14;
 Sec. 17, SE¼SE¼ (except patented land);
 Sec. 20, NE¼ and SE¼SW¼ (except patented land);
 Sec. 23, E½ and E½NW¼;
 Sec. 24, NW¼NE¼, W½, and W½SE¼;
 Sec. 25;
 Sec. 26, NE¼ and E½SE¼ (except patented land);
 Sec. 29, E½NW¼ and E½SW¼ (except patented land);
 Sec. 32, NE¼NW¼ (except patented land);
 Sec. 35, NE¼;
 Sec. 36, E½ and NW¼.
T. 3 S., R. 43 E.,
 Sec. 4, SE¼ (except patented land);
 Sec. 7, (except patented land);
 Sec. 8, S½ (except patented land);
 Sec. 9, NE¼NE¼ (except patented land);
 Sec. 13, SE¼;
 Sec. 16, W½NW¼ and W½SW¼;
 Sec. 17 (except patented land);
 Sec. 18, lots 1, 2, and 3, NE¼, E½NW¼, NE¼SW¼, and N½SE¼ (except patented land);
 Sec. 19, E½ and SE¼SW¼;
 Sec. 20;

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Sec. 21, NW¼NW¼;
Sec. 27, SW¼;
Sec. 28, S½NW¼ and S½;
Sec. 29;
Sec. 30, E½, E½NW¼, and NE¼SW¼;
Sec. 31, NE¼NE¼;
Sec. 32, N½;
Sec. 33, N½, NE¼SW¼, and N½SE¼;
Sec. 34, W½.
T. 4 S., R. 43 E.,
Sec. 3, lot 3 and SE¼NW¼;
Sec. 13, W½NW¼ and W½SW¼;
Sec. 21, SE¼SE¼;
Sec. 23, E½;
Sec. 24, NW¼NW¼;
Sec. 28, SE¼SW¼;
Sec. 32, SE¼SE¼.
T. 5 S., R. 43 E.,
Sec. 20, E½NE¼ and E½SE¼;
Sec. 29, NE¼NE¼.
T. 6 S., R. 44 E., Unsurveyed
Sec. 7;
Sec. 18, E½, E½NW¼, and E½SW¼;
Sec. 19, E½ and E½NW¼;
Sec. 20;
Secs. 28 and 29;
Sec. 30, E½NE¼;
Sec. 32, NE¼NE¼;
Sec. 33.
T. 7 S., R. 44 E., Partially Surveyed
Sec. 3, W½NW¼ and W½SW¼;
Sec. 4;
Sec. 5, S½SW¼ and SE¼SE¼;
Secs. 8 and 9;
Sec. 10, SW¼NW¼ and SW¼;
Secs. 15, 16, and 22;
Sec. 23, W½ and SW¼SE¼;
Sec. 25, SW¼SW¼;
Sec. 26;
Sec. 34, NE¼NE¼;
Sec. 35;
Sec. 36, W½ and SW¼SE¼.
T. 8 S., R. 44 E.,
Sec. 1;
Sec. 13, E½;
Sec. 24, NE¼NE¼.
T. 8 S., R. 45 E.,
Sec. 6, W½SW¼;
Sec. 7, W½ and SW¼SE¼;
Sec. 17, SW¼SW¼;
Sec. 19;
Sec. 20, W½.
T. 1 N., R 46 E.,
Sec. 30, lot 3.
T. 9 S., R. 46 E.,
Sec. 8, SW¼SW¼;
Sec. 16, SW¼ and SW¼SE¼;
Sec. 22, NW¼ and SE¼;
Sec. 23, S½SW¼.
T. 10 S., R. 46 E.,
Sec. 11, NE¼.
T. 1 N., R. 47 E.,
Sec. 9, SE¼SE¼;
Sec. 31, NE¼SW¼.
T. 2 N., R. 47 E.,
Sec. 24, SE¼SE¼;
Sec. 35, SE¼SW¼.
T. 10 S., R. 47 E.,
Sec. 9, SE¼;
Sec. 10, S½ and SE¼NE¼;
Sec. 11, S½NE¼, S½NW¼, and S½;
Sec. 13, W½;
Sec. 14 (except patented land);
Sec. 15, NE¼;
Sec. 22, W½NE¼ (except patented land);
Sec. 23, E½ and N½NW¼ (except patented land);
Sec. 24, W½NW¼;
Sec. 26, W½NE¼ and NW¼SE¼.
T. 11 S., R. 47 E.,
Sec. 10, NE¼NE¼;
Sec. 23, NE¼NE¼;
Sec. 24, E½SW¼;
Sec. 25, NE¼SE¼;
Sec. 36, E½NE¼.
T. 2 N., R. 48 E.,
Sec. 8, SE¼SW¼;
Sec. 19, SE¼NW¼.
T. 3 N., R. 48 E.,
Sec. 23, SE¼SW¼;
Sec. 33, SE¼SE¼.
T. 3 N., R. 49 E.,
Sec. 7, SE¼NE¼.
T. 3 N., R. 50 E.,
Sec. 22, E½SE¼.
T. 1 S., R. 51 E.,
Sec. 10, E½NE¼;
Sec. 14, E½NW¼;
Sec. 23, NE¼NE¼;
Sec. 25, W½;
Sec. 36, E½NW¼ and E½SW¼.
T. 2 N., R. 51 E.,
Sec. 18, lot 2.
T. 2 S., R. 52 E.,
Sec. 24, N½NE¼ and N½NW¼.
T. 1 S., R. 53 E.,
Sec. 26, SE¼SE¼;
Sec. 35, SE¼NW¼.
T. 1 S., R. 54 E.,
Sec. 1, lot 1;
Sec. 13, NW¼SW¼;
Sec. 16, SE¼SW¼;
Sec. 20, NE¼ and SE¼NW¼;
Sec. 23, NW¼NE¼.
T. 1 N., R. 55 E.,
Sec. 22, SE¼NW¼;
Sec. 29, S½NW¼.
T. 1 N., R. 56 E.,
Sec. 12, NW¼SE¼;
Sec. 14, NW¼SW¼;
Sec. 18, SE¼NW¼.
T. 1 N., R. 57 E.,
Sec. 2, lots 1 to 4, inclusive, and S½NW¼;
Sec. 3, NE¼;
Sec. 4, S½NE¼;
Sec. 5, NE¼SW¼ and NW¼SE¼;
Sec. 7, lot 1.
T. 2 N., R. 57 E.,
Sec. 1, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and SW¼;
Sec. 2;
Sec. 3, SE¼NE¼ and SE¼;
Sec. 9, SE¼SE¼;
Sec. 10;
Sec. 11, N½ and SW¼;
Sec. 14, NW¼NW¼;
Sec. 15;
Sec. 16, E½ and S½SW¼;
Sec. 20, E½ and SW¼;
Sec. 21;
Sec. 22, NW¼NE¼ and NW¼;
Sec. 29, N½;
Sec. 30, E½ and SE¼SW¼;
Sec. 31, lots 1 and 2, and E½NW¼;
Sec. 36, SE¼.
T. 3 N., R. 57 E.,
Sec. 25, SE¼SE¼;
Sec. 35, SE¼;
Sec. 36.
T. 2 N., R. 58 E.,
Sec. 6, lot 4;
Sec. 25, S½;
Sec. 26, S½;
Sec. 31, lots 3 and 4, E½SW¼, and SE¼;
Sec. 32, S½;
Secs. 33 and 34;
Sec. 35, N½, SW¼, and NW¼SE¼;
Sec. 36, NW¼NW¼.
T. 3. N., R. 58 E.,
Sec. 13, S½NE¼, S½NW¼, and S½;
Sec. 14, S½NE¼, S½NW¼, and S½;
Sec. 15, S½;
Sec. 16, SE¼SE¼;
Sec. 20, SE¼SW¼ and SE¼;
Secs. 21 and 22;
Sec. 23, N½;
Sec. 24, N½;
Sec. 27, NW¼NW¼;
Sec. 28, N½ and SW¼;
Sec. 29;
Sec. 30, lots 3 and 4, S½NE¼, E½SW¼, and SE¼;
Sec. 31;
Sec. 32, NW¼NE¼ and NW¼.
T. 2 N., R. 59 E.,
Sec. 5, SE¼SE¼;
Sec. 7, SE¼SE¼;
Sec. 20, NW¼NE¼;
Sec. 30, lots 1 and 2, and E½NW¼.
T. 3 N., R. 59 E.,
Sec. 14, NE¼ and SW¼;
Sec. 17, SW¼SW¼;
Sec. 18, lots 2, 3, and 4, E½SW¼, and SE¼;
Sec. 19, lots 1 and 2, and W½NE¼;
Sec. 33, NE¼ and E½SW¼.
T. 4 N., R. 60 E.,
Sec. 21, S½NE¼ and SE¼NW¼;
Sec. 31, SE¼NW¼.
T. 4. N., R. 61 E.,
Sec. 19, S½NE¼ and SE¼NW¼;
Sec. 20, SW¼SE¼.
T. 2 N., R. 62 E.,
Sec. 9, NE¼NE¼;
Sec. 15, NE¼SE¼;
Sec. 23, E½ and NE¼NW¼.
T. 1 N., R. 63 E.,
Sec. 22, SW¼SW¼.
T. 1 S., R. 64 E.,
Sec. 19, lot 1.
T 2 S., R. 65 E.,
Sec. 1, lots 3 and 4, and S½NW¼.
T. 1 S., R. 66 E.,
Sec. 35, S½SW¼ and S½SE¼.
T. 2 S., R. 67 E.,
Sec. 21, E½SW¼;
Sec. 24, NE¼SW¼.
T. 3 S., R. 67 E.,
Sec. 21, SE¼NW¼ and S½SW¼SE¼;
Sec. 26, E½NE¼.
T. 4 S., R. 68 E.,
Sec. 7, E½NW¼;
Sec. 8, W½SE¼;
Sec. 17, NW¼NE¼.

The additional lands for the Caliente Corridor aggregate 68,646 acres in Esmeralda, Lincoln, and Nye Counties.

Mina Rail Corridor

T. 15 N., R. 26 E.,
Sec. 26, S½SE¼;
Sec. 35, lots 2, 3, and 4, E½NW¼, NE¼, and SE¼;
Sec. 36.
T. 9 N., R. 31 E.,
Sec. 32, lots 1 to 4, inclusive, N½SW¼, and N½SE¼.
T. 8 N., R. 32 E.,
Sec. 7, lots 3 and 4, E½SW¼;

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Sec. 13, S½SW¼ and S½SE¼;
Sec. 14, S½SW¼ and S½SE¼;
Sec. 15, SW¼ and S½SE¼;
Sec. 16, S½NE¼, W½, and SE ¼;
Sec. 17, SE¼SW¼;
Sec. 19, N½NE¼ and N½NW¼;
Sec. 20, NE¼ and N½NW¼;
Sec. 21, N½ and N½SE¼ (except patented land);
Sec. 22, N½, N½SW¼, and SE¼;
Secs. 23 and 24.
T. 8 N., R. 33 E.,
Sec. 17, S½SW¼ and S½SE¼;
Sec. 18, lot 4, SE¼SW¼, and S½SE¼;
Secs. 19 to 24, inclusive;
Sec. 25, N½;
Sec. 26, N½;
Sec. 27, N½NE¼ and N½NW¼;
Sec. 28, N½NE¼ and N½NW¼;
Sec. 29, N½NE ¼ and N½NW ¼.
T. 7 N., R. 34 E.,
Sec. 1, lot 1 and SE¼NE¼.
T. 8 N., R. 34 E.,
Sec. 19, lots 2, 3, and 4, S½NE¼, SE¼NW¼, W½SW¼, and SE¼;
Sec. 20, S½NE¼, S½NW¼, and S½;
Sec. 21, S½NE¼, S½NW¼, and S½;
Sec. 22, S½;
Sec. 23, S½;
Sec. 24, S½ (except patented land);
Sec. 25;
Sec. 26, N½, N½SW¼, and N½SE¼;
Sec. 27, N½, N½SW¼, and N½SE¼;
Sec. 28, N½ and N½SE¼;
Sec. 29, N½;
Sec. 30, lots 1 and 2, NE¼, and E½NW¼;
Sec. 36, E½ and N½NW¼.
T. 4 N., R. 35 E.,
Sec. 1, N½ and SE¼;
Sec. 2, NE¼;
Sec. 12, N½NE¼.
T. 5 N., R. 35 E.,
Sec. 1, S½NE¼, S½NW¼, and S½;
Sec. 2;
Sec. 3, lots 1, 2, and 3, S½NE¼, and SE¼;
Sec. 11, NE¼ and N½NW¼;
Sec. 12, E½, NW¼, and E½SW¼;
Sec. 13, NE¼ and E½SE¼;
Sec. 24, E½;
Sec. 25, E½, E½NW¼, and SW¼;
Sec. 36.
T. 6 N., R. 35 E.,
Sec. 4, lot 4, SW¼NW¼, SW¼, and S½SE¼;
Sec. 5;
Sec. 8 (except patented lands);
Sec. 9;
Sec. 10, S½NW¼ and SW¼;
Sec. 15, W½ and W½SE¼;
Sec. 16, E½, NW¼, and E½SW¼;
Sec. 21, E½;
Sec. 22, W½NE¼, W½, and W½SE¼;
Sec. 27, W½NE¼, W½, and W½SE¼;
Sec. 28, NE¼ and N½SW¼;
Sec. 33, E½ (except patented land);
Sec. 34;
Sec. 35, S½SW¼.
T. 7 N., R. 35 E.,
Sec. 5, lot 4, S½NW¼, and SW¼;
Sec. 6;
Sec. 7, N½NE¼, E½NW¼, and SE¼;
Sec. 8, W½NE¼, W½, and SE¼;
Sec. 16, W½NW¼ and SW¼;
Sec. 17;
Sec. 18, E½NE¼;
Sec. 20;
Sec. 21, W½;
Sec. 28, NW¼ and W½SW¼;
Sec. 29;
Sec. 30, S½SE¼;
Sec. 31, E½NE¼;
Sec. 32;
Sec. 33, W½SW¼.
T. 8 N., R. 35 E.,
Sec. 30, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and W½SE¼ (except patented land);
Sec. 31 (except patented land).
T. 3 N., R. 36 E.,
Sec. 1;
Sec. 12, E½, E½NW¼, and E½SW¼;
Sec. 13, E½;
Sec. 24, E½;
Sec. 25, N½NE¼.
T. 4 N., R. 36 E., Unsurveyed
Sec. 5, SW¼;
Sec. 6;
Sec. 7, N½ and SE¼;
Sec. 8, W½ and SE¼;
Sec. 9, S½SW¼;
Sec. 15, SW¼;
Sec. 16, W½ and SE¼;
Sec. 17;
Sec. 18, NE¼;
Sec. 20, NE¼;
Sec. 21, N½ and SE¼;
Sec. 22;
Sec. 23, S½;
Sec. 25, W½;
Sec. 26;
Sec. 27, N½;
Sec. 35, N½ and SE¼;
Sec. 36.
T. 5 N., R. 36 E., Unsurveyed
Sec. 6, SW¼;
Sec. 7, W½;
Sec. 18, W½;
Sec. 19, W½;
Sec. 30, W½;
Sec. 31, W½.
T. 2 N., R. 37 E.,
Sec. 4, W½SW¼;
Sec. 5;
Sec. 6, lots 1 and 2, S½NE¼, and E½SE¼;
Sec. 8;
Sec. 9, W½NW¼, SW¼, and S½SE¼;
Sec. 13, S½NE¼, S½NW¼, and S½;
Sec. 14, S½NE¼ and S½;
Sec. 15, NW¼ and S½;
Sec. 16;
Sec. 17, N½NE¼, SE¼NE¼, E½NW¼, and E½SE¼;
Sec. 21, NE¼;
Sec. 22, N½, N½SW¼, and N½SE¼;
Sec. 23, N½ and N½SW¼;
Sec. 24, N½.
T. 3 N., R. 37 E., Unsurveyed
Sec. 6, W½;
Sec. 7, W½ and E½SE¼;
Sec. 18, W½NE¼, W½, and W½SE¼;
Sec. 19;
Sec. 29, W½;
Sec. 30;
Sec. 31, E½ and E½NW¼;
Sec. 32, W½NE¼, W½, and W½SE¼.
T. 4 N., R. 37 E., Unsurveyed
Sec. 31, S½SW¼.
T. 1 N., R. 38 E., Unsurveyed
Sec. 3, W½NW¼ and SW¼;
Sec. 4;
Sec. 5, E½NE¼;
Sec. 9, E½ and E½NW¼;
Sec. 10;
Sec. 11, SW¼;
Sec. 14, W½NE¼, W½, and SE¼;
Sec. 15, E½ , NW¼, and N½SW¼;
Sec. 16, N½NE¼;
Sec. 22, NE¼;
Sec. 23;
Sec. 24, W½ and W½SE¼;
Sec. 25;
Sec. 26, NE¼ and E½SE¼;
Sec. 36, NE¼ and N½NW¼.
T. 2 N., R. 38 E., Unsurveyed
Sec. 13, S½SW¼ and SE¼;
Sec. 16, S½NW¼ and SW¼;
Secs. 17 and 18;
Sec. 19, N½;
Sec. 20, E½ and NW¼;
Sec. 21, W½ and SE¼;
Sec. 22, S½;
Sec. 23, NE¼, S½NW¼, and S½;
Sec. 24;
Sec. 25, N½NW¼;
Sec. 26, N½;
Sec. 27, N½;
Sec. 28;
Sec. 29, E½;
Sec. 32, E½;
Sec. 33.
T. 1 N., R. 38.2 E., Unsurveyed
Sec. 30, S½NW¼, SW¼, and S½SE¼;
Sec. 31, N½, N½SW¼, and SE¼;
Sec. 32, W½ and SE¼.
T. 2 N., R. 38.2 E.,
Sec. 4;
Sec. 5, S½SE¼;
Sec. 7, S½SE¼;
Sec. 8, E½, S½NW¼, and SW¼;
Sec. 9;
Sec. 16, N½NW¼;
Sec. 17, N½, SW¼, and N½SE¼;
Sec. 18;
Sec. 19, N½ and N½SW¼;
Sec. 20, N½NW¼.
T. 1 S., R. 39 E.,
Sec. 4, lots 3 and 4, S½NW¼, and S½;
Sec. 5;
Sec. 6, lots 1 and 2, and S½NE¼;
Sec. 8, NE¼;
Sec. 9;
Sec. 10, W½NW¼ and SW¼;
Sec. 14, W½SW¼;
Sec. 15;
Sec. 16, E½ and E½NW¼;
Sec. 21, N½NE¼;
Sec. 22;
Sec. 23, W½NW¼ and W½SW¼;
Sec. 26, W½NW¼ and W½SW¼;
Sec. 27, E½, E½NW¼, and E½SW¼;
Sec. 34, E½, E½NW¼, and SW¼;
Sec. 35, W½.
T. 2 N., R. 39 E., Unsurveyed
Sec. 4, NW¼;
Sec. 5, N½ and SW¼;
Sec. 6;
Sec. 7, N½ and SW¼.
T. 2 S., R. 39 E.,
Sec. 2, lot 4, S½NW¼, and SW¼;
Sec. 3, lots 1 to 4, inclusive, S½NE¼, S½NW¼, E½SW¼, and SE¼;
Sec. 10, E½, E½NW¼, and E½SW¼;
Sec. 11, W½;
Sec. 14, W½NE¼, W½, and W½SE¼;
Sec. 15, E½ and E½NW¼;
Sec. 22 (except patented land);
Sec. 23, W½NE¼, W½, and W½SE¼;
Sec. 25, S½SW¼;

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Sec. 26;
Sec. 27, E½;
Sec. 34, N½NE¼;
Sec. 35;
Sec. 36, W½ and SE¼.
T. 3 N., R. 39 E.,
Sec. 13, S½SE¼;
Sec. 22, S½SE¼;
Sec. 23, S½NE¼ and S½;
Sec. 24;
Sec. 25, N½ and N½SW¼;
Secs. 26 and 27;
Sec. 28, S½NE¼ and S½;
Sec. 29, S½SE¼;
Sec. 31, S½SW¼ and SE¼;
Secs. 32 and 33;
Sec. 34, N½ and N½SW¼;
Sec. 35, N½NW¼.
T. 3 S., R. 39 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and E½SE¼;
Sec. 12, NE¼.
T. 2 S., R. 40 E.,
Sec. 22, S½SW¼ and SE¼;
Sec. 23, S½ and S½NE¼;
Sec. 24, NE¼, S½NW¼, and S½;
Sec. 25, N½;
Sec. 26, N½, N½SW¼, and N½SE¼;
Sec. 27;
Sec. 28, lot 1 and lots 3 to 8, inclusive, and SW¼;
Sec. 29, S½SE¼;
Sec. 31, E½SW¼ and SE¼;
Sec. 32;
Sec. 33, N½, SW¼, and N½SE¼;
Sec. 34, NW¼.
T. 3 N., R. 40 E.,
Sec. 8, S½SE¼;
Sec. 9, S½NE¼ and S½;
Sec. 10 (except patented land);
Sec. 11 (except patented land);
Sec. 12, S½NE¼, S½NW¼, and S½;
Sec. 13, N½ and N½SE¼;
Sec. 14, N½ (except patented land);
Sec. 15, N½ and N½SW¼;
Secs. 16 and 17;
Sec. 18, lot 4, S½NE¼, E½SW¼, and SE¼;
Sec. 19;
Sec. 20, N½ and N½SW¼;
Sec. 21, N½NW¼;
Sec. 30, lot 1 and E½NW¼.
T. 3 S., R. 40 E.,
Sec. 4, lot 4;
Sec. 5, lots 1 to 4, inclusive, S½NE¼, S½NW¼, and SW¼;
Sec. 6;
Sec. 7, lot 1, E½NW¼, and N½NE¼.
T. 2 S., R. 40.2 E., Unsurveyed
Sec. 4, S½SE¼;
Sec. 8, E½ and SW¼;
Sec. 9;
Sec. 16, N½;
Sec. 17;
Sec. 18, S½NE¼, S½SW¼, and SE¼;
Sec. 19;
Sec. 20, NE¼ and W½;
Sec. 30, N½.
T. 1 N., R. 41 E.,
Sec. 1;
Sec. 2, lots 1 and 2, S½NE¼, and E½SE¼;
Sec. 12, N½, E½SW¼, and SE¼;
Sec. 13, E½.
T. 2 N., R. 41 E.,
Sec. 3, lots 2, 3, and 4, S½NE¼, S½NW¼, and S½;
Sec. 4, lots 1, 2, and 3, S½NE¼, S½NW¼, and SE¼;
Sec. 9, NE¼;
Sec. 10;
Sec. 11, W½;
Sec. 14;
Sec. 15, E½ and E½NW¼;
Sec. 22, N½NE¼;
Sec. 23;
Sec. 24, W½NW¼ and W½SW¼;
Sec. 25, W½;
Sec. 26, E½, NW¼, and E½SW¼;
Sec. 35, E½ and E½NW¼;
Sec. 36, W½NE¼, W½, and SE¼.
T. 2 S., R. 41 E.,
Sec. 3, W½SW¼;
Sec. 4, S½NE¼, S½NW¼, and S½;
Sec. 5, S½NE¼ and S½;
Sec. 6, lots 10 to 16, inclusive, and S½SE¼;
Secs. 7, 8, and 9;
Sec. 10, W½NW¼ and W½SW¼;
Sec. 15, W½NW¼;
Sec. 16;
Sec. 17, E½ and SW¼;
Sec. 18, N½NE¼;
Sec. 19, E½NE¼ and E½SE¼;
Sec. 20;
Sec. 21, NW¼ and N½SW¼;
Sec. 29, NE¼, W½, and W½SE¼;
Sec. 30, E½;
Sec. 31, lots 8 to 11, inclusive, and E½;
Sec. 32, N½NE¼ and W½.
T. 3 N., R. 41 E.,
Sec. 7, lots 3 and 4, E½SW¼, and SE¼;
Sec. 8, SW¼;
Sec. 16, S½SW¼; secs. 17 and 18;
Sec. 19, N½NE¼;
Sec. 20;
Sec. 21, W½ and W½SE¼;
Sec. 27, S½SW¼;
Sec. 28;
Sec. 29, E½;
Sec. 32, N½NE¼;
Sec. 33;
Sec. 34, W½ and S½SE¼.
T. 3 S., R. 41 E.,
Sec. 4, lot 4 and S½NW¼;
Sec. 5;
Sec. 6, lot 1, SE¼NE¼, and SE¼;
Sec. 7, E½;
Sec. 8, W½NE¼, W½, and W½SE¼;
Sec. 16, SW¼ and S½SE¼ (except patented land);
Sec. 17;
Sec. 18, E½;
Sec. 19, N½NE¼;
Sec. 20, N½ and SE¼;
Sec. 21;
Sec. 22, S½NE¼, W½, and SE¼;
Sec. 23, S½;
Sec. 24, S½;
Sec. 25;
Sec. 26, N½, N½SW¼, and N½SE¼;
Sec. 27, N½;
Sec. 28, NE ¼.
T. 1 N., R. 42 E.,
Sec. 6, lots 6 and 7, and E½SW¼;
Sec. 7, lots 1 to 4, inclusive, E½NW¼, E½SW¼, and W½SE¼;
Sec. 17, SW¼;
Sec. 18;
Sec. 19, lot 1, E½NW¼, and E½;
Sec. 20;
Sec. 21, SW¼;
Sec. 28, W½NE¼, W½, and SE¼;
Sec. 29;
Sec. 30, N½NE¼;
Sec. 32, NE¼;
Sec. 33;
Sec. 34, W½ and W½SE¼.
T. 1 S., R. 42 E.,
Sec. 3;
Sec. 4, lots 1 and 2, S½NE¼, and SE¼;
Sec. 9, E½NE¼;
Sec. 10;
Sec. 11, W½SW¼;
Sec. 14, W½NW¼ and W½SW¼;
Secs. 15 and 22;
Sec. 23, W½;
Sec. 26, W½;
Sec. 27, E½, E½NW¼, and E½SW¼;
Sec. 34, E½, E½NW¼, and E½SW¼;
Sec. 35, W½.
T. 2 S., R. 42 E.,
Sec. 2, lots 3 and 4, S½NW¼, and W½SW¼;
Sec. 3, lots 1, 2, and 3, S½NE¼, S½NW¼, E½SW¼, and SE¼;
Sec. 10;
Sec. 11, W½NW¼ and W½SW¼;
Sec. 14, W½NW¼ and W½SW¼ (except patented land);
Secs. 15 and 22 (except patented land);
Sec. 23, W½NW¼ and W½SW¼ (except patented land);
Sec. 26, W½NW¼ and W½SW¼ (except patented land);
Secs. 27 and 34 (except patented land);
Sec. 35, W½NW¼ and W½SW¼ (except patented land).
T. 3 S., R. 42 E.,
Sec. 3, lots 1, 2, and 3, S½NE¼, S½NW¼, E½SW¼, and SE¼ (except patented land);
Sec. 10, NE¼ and E½SE¼ (except patented land);
Secs. 11 and 12 (except patented land);
Sec. 13, N½ (except patented land);
Sec. 14, N½NE¼ (except patented land);
Sec. 19, lots 4 to 9 inclusive, and S½SE¼;
Sec. 20, S½SW¼ and S½SE¼;
Sec. 28, W½NE¼, W½, and SE¼;
Secs. 29 and 30;
Sec. 32, N½NE¼ and S½SE¼;
Sec. 33.
T. 4 S., R. 42 E.,
Sec. 4;
Sec. 5, lot 1, S½NE¼, and SE¼;
Sec. 8, E½, E½NW¼, and E½SW¼;
Sec. 9, W½NE¼ and W½;
Sec. 16, W½;
Sec. 17;
Sec. 18, S½SE¼;
Sec. 19, E½NE¼ and E½SE¼;
Sec. 20;
Sec. 23, S½SW¼ and S½SE¼;
Sec. 24, S½SW¼ and S½SE¼;
Secs. 25 and 26;
Sec. 27, NE¼ and S½;
Sec. 28, W½NW¼, W½SW¼, and SE¼;
Secs. 29, 32, and 33;
Sec. 34, N½, SW¼, and N½SE¼;
Sec. 35, N½NE¼ and NW¼.
T. 5 S., R. 42 E., Unsurveyed
Sec. 4, N½NE¼ and N½NW¼;
Sec. 5, N½NE¼.
T. 3 S., R. 43 E.,
Sec. 7 (except patented land);
Sec. 8, S½ (except patented land);
Sec. 16, W½NW¼ and W½SW¼;
Secs. 17 and 18 (except patented land);

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Sec. 19, E½ and E½SW¼;
Sec. 20;
Sec. 21, N½NW¼;
Sec. 27, S½;
Sec. 28, S½NE¼, S½NW¼, and S½;
Sec. 29;
Sec. 30, E½ and E½NW¼;
Sec. 31, N½NE¼;
Sec. 32, N½;
Sec. 33, N½ and SE¼;
Sec. 34;
Sec. 35, E½NW¼ and E½SW¼.
T. 5 S., R. 43 E., Unsurveyed
Sec. 6;
Sec. 7, E½ and E½NW¼;
Sec. 18, N½NE¼.

The lands in the Mina Corridor aggregate 139,391 acres in Esmeralda, Lyon, and Mineral Counties.

Public Land Order (PLO) No. 7653, 70 FR 76854–76858 (December 28, 2005), withdrew approximately 308,600 acres of public lands from surface entry and mining for the purpose of evaluating a suite of alternative rail alignments along the Caliente Corridor, as described in the DOE's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, February 2002. The evaluation is for the potential construction, operation, and maintenance of a rail line which would be used to transport spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain Repository as part of the DOE's responsibility under the Nuclear Waste Policy Act, as amended, 42 U.S.C. 10101 *et seq.*

The DOE has identified an additional 68,646 acres of public lands for evaluation along the Caliente Corridor. Since PLO No. 7653 can not be amended to add lands, the DOE has filed this new withdrawal application for those additional lands.

The DOE's withdrawal application also includes 139,391 acres of public lands for the purpose of evaluating the potential construction, operation, and maintenance of a rail line along a suite of alternative rail alignments referred to by the DOE as the "Mina Route." The width of the withdrawal is 1 mile.

The expiration date for this proposed withdrawal would be the same as the expiration date for PLO No. 7653, which is December 27, 2015.

The use of a right-of-way, interagency agreement, or cooperative agreement would not adequately constrain non-discretionary uses that could irrevocably affect the evaluation of these lands for a potential rail line alignment.

There are no suitable alternative sites, since the lands described identify the alternative alignments that need to be evaluated.

No water rights will be needed to fulfill the purpose of the withdrawal.

Possible mineral deposits present in the above-described land areas include some locatable and salable minerals.

For a period of 90 days from the date of publication of this notice, all persons who wish to submit comments, suggestions, or objections in connection with the proposed withdrawal may present their views in writing to the BLM Nevada State Director.

Comments, including names and street addresses of respondents, will be available for public review at the BLM Nevada State Office, 1340 Financial Blvd., Reno, Nevada, during regular business hours, 7:30 a.m. to 4:30 p.m., Monday through Friday, except holidays. Individual respondents may request confidentiality. If you wish to withhold your name or address from public review or from disclosure under the Freedom of Information Act, you must state this prominently at the beginning of your comments. Such requests will be honored to the extent allowed by the law. All submissions from organizations or businesses, and from individuals identifying themselves as representatives or officials of organizations or businesses, will be made available for public inspection in their entirety.

Notice is hereby given that in addition and subsequent to the 90-day public comment period mentioned above, there will be at least one public meeting in connection with the proposed withdrawal to be announced at a later date. A notice of the time, place, and date will be published in the **Federal Register** and a local newspaper at least 30 days before the scheduled date of a meeting.

This withdrawal proposal will be processed in accordance with the regulations set forth in 43 CFR part 2300.

For a period of 2 years from the date of publication of this notice in the **Federal Register,** the lands described above will be segregated as specified above unless the application is denied or cancelled or the withdrawal is approved prior to that date.

Licenses, permits, cooperative agreements, or discretionary land use authorizations of a temporary nature which will not significantly impact the purpose of the proposed withdrawal may be allowed with the approval of the authorized officer of the BLM during the segregative period.

(Authority: 43 CFR 2310.3–1(a))

Dated: October 30, 2006.

Margaret L. Jensen,

Deputy State Director, Natural Resources, Lands, and Planning.

[FR Doc. E7–84 Filed 1–9–07; 8:45 am]

BILLING CODE 4310–HC–P

A.12 72 *FR* 40139, July 23, 2007

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DEPARTMENT OF ENERGY

Office of Civilian Radioactive Waste Management; Safe Routine Transportation and Emergency Response Training; Technical Assistance and Funding

AGENCY: Department of Energy.

ACTION: Notice of revised proposed policy and request for comments.

SUMMARY: The Department of Energy (DOE) is publishing this notice of revised proposed policy to set forth its revised plans for implementing Section 180(c) of the Nuclear Waste Policy Act of 1982 (the NWPA). Under Section 180(c) of the NWPA, DOE shall provide technical and financial assistance for training of local public safety officials to States and Indian Tribes through whose jurisdictions the DOE plans to transport spent nuclear fuel or high-level

radioactive waste to a facility authorized under Subtitle A or C of the NWPA (NWPA-authorized facility). The training is to cover both safe routine transportation and emergency response procedures. The purpose of this notice is to communicate to stakeholders the revised proposed policy of DOE regarding Section 180(c) issues and request comments on this revised proposed policy and the questions specified herein. Written and electronic comments may be submitted to DOE on this document.

DATES: Comments must be received by DOE on or before October 22, 2007.

ADDRESSES: Written comments should be directed to Ms. Corinne Macaluso, U.S. Department of Energy, c/o Patricia Temple, Bechtel SAIC Company, LLC, 955 N. L'Enfant Plaza, SW., Suite 8000, Washington, DC 20024. The revised proposed policy and electronic comment forms are also available at *http://www.ocrwm.doe.gov*. Fill out the form and click "submit" to send your comments in through the Web site. Persons submitting comments should include their name and address. Receipt of written comments in response to this notice will be acknowledged if a stamped, self-addressed postal card or envelope is enclosed. Electronic comments will receive an electronic notice of receipt.

FOR FURTHER INFORMATION CONTACT: For further information on the transportation of spent nuclear fuel and high-level radioactive waste under the NWPA, please contact: Ms. Corinne Macaluso, Office of Logistics Management, Office of Civilian Radioactive Waste Management (RW–10), U.S. Department of Energy, 1000 Independence Avenue, SW., Washington, DC, 20585, Telephone: 202–586–2837.

General program information is available on the Office of Civilian Radioactive Waste Management (OCRWM) Web site located at *www.ocrwm.doe.gov*.

Copies of comments received will be posted on the OCRWM Web site. Please allow up to two weeks after DOE receives comments to view them on the Web site.

Request for Comments: DOE will consider all comments submitted by the closing date. Comments received after that date will be considered to the extent practicable. DOE requests that commenters pay particular attention to the questions at the end of this revised proposed policy.

SUPPLEMENTARY INFORMATION:

I. Purpose and Need for Agency Action

Under the NWPA, DOE is responsible for the transportation of spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. In particular, under Section 180(c) of the NWPA, DOE is responsible for providing technical and financial assistance for training of local public safety officials to States and Indian Tribes through whose jurisdiction the Secretary plans to transport spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility. Section 180(c) further provides that such training cover procedures required for both safe routine transportation of these materials and for dealing with emergency response situations. Section 180(c) identifies the Nuclear Waste Fund as the source of funds for this assistance.

DOE has announced a schedule to begin shipping spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility in 2017.[1] Subject to the availability of appropriated funds, DOE plans to conduct a pilot program for 180(c) grants beginning in fiscal year 2008. DOE will evaluate public comments received on this revised proposed policy prior to implementing the pilot program. After review of the comments received on this revised proposed policy and completion of the pilot program, DOE plans to issue a new revised proposed policy for public comment and thereafter to issue a final policy prior to awarding the first 180(c) grants. The first grants are planned to be issued approximately four years prior to the commencement of shipments through a State or Tribe's jurisdiction to support assessing the need for and planning for training.

The *Office of Civilian Radioactive Waste Management, Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions* calls for DOE to work closely with State Regional Groups and individual impacted States and Tribes as it makes operational decisions regarding shipments to an NWPA-authorized facility. The DOE's practice of involving States, Tribes, industry, utilities, and other interested parties in transportation planning has contributed to a decades-long record of safely transporting such material. This revised proposed policy supports the DOE's OCRWM objective to develop and begin implementation of a comprehensive national spent fuel transportation plan that accommodates State, local, and Tribal concerns and input to the greatest extent practicable.

II. Background

On January 3, 1995, DOE issued a proposed policy on how it would implement Section 180(c) of the NWPA (60 FR 99). DOE subsequently issued several notices relating to its proposed 180(c) policy in the **Federal Register** on July 18, 1995 (60 FR 36793), May 16, 1996 (61 FR 24772), July 17, 1997 (62 FR 38272), and April 30, 1998 (63 FR 23753). DOE is publishing this Notice of Revised Proposed Policy to set forth and communicate to stakeholders the revised policy by which DOE currently intends to implement Section 180(c). DOE previously requested comments on the 1998 Notice of Revised Proposed Policy and Procedures. Those comments were reviewed and considered during the development of this revised proposed policy.

As part of its longstanding commitment to work with stakeholders on transportation matters, DOE has engaged in ongoing discussions on how to implement Section 180(c). Such discussions have taken place in the context of the Transportation External Coordination (TEC) Working Group, which is comprised of representatives of State, Tribal, and local governments, and professional, technical, and industry associations, and which meets biannually to identify and discuss issues related to the transport of radioactive materials. In 2004, DOE formed a TEC Topic Group specifically to discuss Section 180(c) issues, and the Topic Group met at least monthly from June 2004 through November 2005. In addition, DOE has discussed Section 180(c) issues with the six national and regional organizations with which DOE has cooperative agreements. These agreements enable DOE to exchange information and solicit input regarding the planned transportation activities of OCRWM, including Section 180(c) activities. These organizations comprise the four State Regional Groups (the Southern States Energy Board, Western Interstate Energy Board, Council of State Governments Midwestern Office, and Council of State Governments Eastern Regional Conference), the Commercial Vehicle Safety Alliance, and the

[1] The schedule for the proposed Yucca Mountain repository is based on factors within the control of DOE, appropriations consistent with optimum Project execution, issuance of an Nuclear Regulatory Commission (NRC) Construction Authorization consistent with the three year period specified in the Nuclear Waste Policy Act, and the timely issuance by the NRC of a Receive and Possess license. This schedule also is dependent on the timely issuance of all necessary other authorizations and permits, the absence of litigation related delays, and the enactment of legislation proposed by the Administration.

National Conference of State Legislatures.

Through the TEC Section 180(c) Topic Group, discussions with the national and regional organizations described above, and other stakeholder interactions, DOE received valuable comments and views on 180(c) issues which have been considered in the development of this revised proposed policy. The Topic Group reached significant agreement on eligibility requirements and timing of the grants and allowable uses of the funding.

This policy is intended to be consistent with Homeland Security Presidential Directives Number 5, "Management of Domestic Incidents," issued February 28, 2003, and Number 8, "National Preparedness," issued December 17, 2003; the Department of Homeland Security's National Preparedness Goal, issued December 2005; the National Preparedness Guidance issued April 27, 2005; the National Incident Management System, issued March 1, 2004; and the National Response Plan, issued December 2004.

III. Policy

Policy Statement

Section 180(c) of the NWPA states:

> The Secretary [of DOE] shall provide technical assistance and funds to States for training for public safety officials of appropriate units of local government and Indian tribes through whose jurisdiction the Secretary plans to transport spent nuclear fuel or high-level radioactive waste under subtitle A or under subtitle C. Training shall cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations.

This proposed policy addresses the provision of technical and financial assistance for training, both for normal transportation operations and for potential incidents that may require emergency response during shipments of spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility. Technical assistance to support 180(c) activities will consist of non-monetary assistance that the Secretary of Energy can provide from DOE's specific knowledge, expertise, and existing resources to aid training of public safety officials on procedures for safe routine transportation and for emergency response situations during the transport of spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. Technical assistance includes, but is not limited to, access to DOE's regional and Headquarters representatives involved in the planning and operation of NWPA transportation or emergency preparedness activities, provision of information packets that include materials about the OCRWM Program and shipments, and provision of other training materials and information. Financial assistance will consist of assessment and planning grants and annual training grants. The provision of grants will be subject to the criteria described herein, as well as the availability of appropriated funds.

This revised proposed policy is consistent with DOE's longstanding commitment to meet or exceed requirements and standards applicable to the transport of spent nuclear fuel and high-level radioactive waste; to cooperate with States, Tribes, and local governments; and to make use of the existing expertise of States, Tribes, and local governments to the maximum extent practicable.

Section 180(c) funds are intended to be used for training specific to shipments of spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. DOE will work with States and Tribes to evaluate current preparedness for safe routine transportation and emergency response capability and will provide funding as appropriate to ensure that State, Tribal, and local officials are prepared for OCRWM shipments. Section 180(c) funds and related training are intended to supplement but not duplicate existing training for safe routine transportation and emergency preparedness. DOE will work with States and Tribes to coordinate and integrate Section 180(c) activities with existing training programs designed for State, Tribal, and local public safety officials. Equipment purchased with Section 180(c) funds is intended to be used for training to prepare for the specific hazards presented by shipments to an NWPA-authorized facility. If necessary, such equipment could then be used for inspections and for responding to emergencies. Since State and Tribal governments have primary responsibility to protect the public health and safety in their jurisdictions, they will have flexibility to decide which allowable activities to request Section 180(c) assistance to meet their unique needs within the limits of the NWPA and DOE and other Federal financial assistance regulations and restrictions.

Training with Section 180(c) funds should be to the level of detail and to the degree necessary to prepare for shipments to an NWPA-authorized facility. When necessary or appropriate, training should be consistent with the Occupational Safety and Health Administration (OSHA) awareness or operations levels, as those terms are defined in 29 CFR 1910.120, and the jurisdiction's emergency response plans. Any deficiency in basic emergency response capability may be addressed through consultation and technical assistance.

Funding Mechanism

DOE will implement Section 180(c) by funding direct grants to eligible States and Tribes. The grants program will be administered in accordance with the DOE Financial Assistance rules (10 CFR part 600), which implement applicable Office of Management and Budget circulars, and applicable law. The grant application process will require States and Tribes to describe and justify their proposed work in the format of a five-year project with a more detailed two-year work plan. Applications will only be accepted through the Federal government's electronic grant application system at *www.grants.gov.*

Basis for Cost Estimate/Grant Funding Allocation to States

DOE anticipates providing funds to States in accordance with the approach described below. Specifically, DOE expects to make two grants available to States: An assessment and planning grant and an annual training grant.[2]

The assessment and planning grant to each eligible State will support an initial needs assessment to identify training needs that might be addressed in future training grants to that State. The amount of the assessment and planning grant is not expected to exceed $200,000, adjusted annually for inflation, for each eligible State based on appropriated funds available for that purpose in a particular fiscal year. The annual training grant to each eligible State will support allowable activities as specified in the grant. The annual training grant for each eligible State will consist of a base amount not expected to exceed $100,000, adjusted annually for inflation, as well as a variable amount. The base amount for each grant depends on Congressional appropriations. DOE selected the amounts of the base grants based on experience with similar training programs and discussions with State and emergency response officials about the scope of work likely for each grant.

The variable amount of the training grant will be determined through a risk-based formula using the factors of population along routes, route miles,

[2] DOE has recently begun meeting with Indian Tribes to discuss the funding allocation options for grants to Tribes. The proposed funding allocation approach described herein applies only to States.

number of shipments, and shipping sites. The population figure, calculated from U.S. Census Bureau data, acts as a surrogate for either the number of responders requiring training or the number of jurisdictions requiring training. Total route miles (for all shipping modes) acts as a surrogate for the accident risk. The number of shipments addresses the additional burden placed on States that are heavily impacted by shipments. Finally, the number of shipping sites will factor in the additional training burden placed on States that must prepare for point-of-origin inspections of both the package and the vehicle. Shipping sites will include commercial nuclear power plants, DOE sites, and any other entity shipping spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility.

The amount of the annual training grants will be based on the appropriated funds available for that purpose in a particular fiscal year. Available funds will be first used to fund the base portion of the grant, which would be the same for each eligible State. Remaining available funds will be used to fund the variable portion of the grant for each eligible State on the basis of the following five-step formula.

The steps are as follows:

Step 1: Collect raw data with respect to the factors of population along routes, route miles, number of shipments, and shipping sites for each State.

Step 2: Divide the raw State data for each factor by the national total for each factor. The result is each State's percentage of the national total for each factor.

Step 3: Multiply each State's percentage of each factor by the correspondent weighting for each factor as specified below; the result would be summed to reach a total for each State, as follows:

0.3 × Percentage of Population Along Route Corridors
+ 0.3 × Percentage of Route Miles
+ 0.3 × Percentage of Number of Shipments
+ 0.1 × Percentage of Shipping Sites
= Total for Each State

Step 4: Sum the total for each State to obtain a national total.

Step 5: Divide each State's total by the national total to reach each State's percentage of available funds for the year.

DOE will work with applicants to ensure consistent sources are used to estimate the raw data for each factor of the formula. All factors are specific to the shipping year. The specific sources DOE will use for the raw data are as follows:

• The population factor will be calculated using the population within 2,500 meters of the route as calculated by the Transportation Routing Analysis Geographic Information System (TRAGIS), DOE's routing model. TRAGIS uses U.S. Census Bureau data as its source for population.

• For route miles, DOE will calculate the national total using TRAGIS to estimate the route miles for each year's projected shipments.

• The number of shipments annually through a State will be estimated based on DOE's projected shipments for each year.

• The number of shipping sites will be based on the number of defense and civilian sites originating a shipment within the State for the year for which an applicant is applying for funding.

Eligibility and Timing of the Grants Program

DOE will provide grants and technical assistance to those States and Tribes through whose jurisdictions the Secretary of Energy plans to transport spent nuclear fuel and high-level radioactive waste to an NWPA-authorized facility. Where a route constitutes a border between two States, a State and a Tribal reservation, or two Tribal reservations, every jurisdiction with emergency response responsibility and inspection authority over the route will be eligible for Section 180(c) assistance. If a State or Tribe will *not* have shipments but has cross-deputization or mutual aid agreements with a jurisdiction that *will* have shipments, the non-shipment jurisdiction may work with DOE to receive funding.

DOE will send a letter to the Governor or Tribal leader's office notifying them of their State or Tribe's eligibility to apply for Section 180(c) grants approximately five years before shipments are scheduled through that State or Tribe's jurisdiction. Each State or Tribe shall designate which agency or staff member of the State or Tribe will administer its Section 180(c) grants. Subsequently, DOE will communicate with the State or Tribe's designated agency or staff person regarding Section 180(c) grants.

Subject to the availability of appropriated funds, DOE expects to begin making assessment and planning grants available to a State or Tribe approximately four years prior to the first shipment to an NWPA-authorized facility through that State or Tribe's jurisdiction.

DOE intends to issue training grants in each of the three years prior to a scheduled shipment through a State or Tribe's jurisdiction and every year that shipments are scheduled.

Allowable Activities

DOE intends to allow a broad array of eligible planning and training activities, thus providing the recipients flexibility to direct funds toward their individual needs. DOE will require applicants to describe and justify the need for proposed activities, training, and purchases in the application package for review and approval by DOE.

Under Section 180(c) of the NWPA, DOE shall provide technical and financial assistance to States and Indian Tribes through whose jurisdictions the DOE plans to transport spent nuclear fuel or high-level radioactive waste to an NWPA-authorized facility. States and Tribes should describe in their grant applications how the grants will be used to provide training to local public safety officials. States and Tribes are expected to coordinate with local public safety officials during the assessment and planning phase and in developing their applications for the annual training grants. DOE recognizes that, depending on the State or Tribe, the role of local public safety officials in responding to incidents involving radioactive materials varies from a minimal role of crowd and traffic control to the primary role of incident command. Therefore, the benefit to local public safety officials should be consistent with established State, Tribal, and local roles in dealing with routine transportation and in responding to an incident involving NWPA shipments.

Potential activities for the Assessment and Planning Grant include:

• Assessment of the jurisdiction's needs for training on procedures related to safe routine transportation and emergency response situations.

• Development of mutual aid agreements among neighboring jurisdictions and with Federal agencies.

• Planning for how to provide needed training for public safety officials.

• Participation in DOE, regional, and national transportation planning meetings.

• Intra- and interstate and Tribal planning and coordination.

• Support for exercises to test plans and training.

• Review of DOE transportation, emergency management, communications, and security plans, including threat assessments and civil disobedience/law enforcement planning.

• Obtaining access to DOE data and systems, such as the Transportation Tracking and Communications system

(TRANSCOM) for information and shipment tracking.

• Evaluation and identification of alternative routes for DOE non-classified radioactive materials shipments according to 49 CFR 397, *Transportation of Hazardous Materials' Driving and Parking Rules* (referred to as HM–164).

• Risk assessments.

• Participation in DOE's Transportation Emergency Preparedness Program (TEPP).[3]

• Coordination with DOE's Radiological Assistance Program (RAP) training, exercises, and planning activities.[4]

• Planning activities using Transportation Routing Analysis Geographic Information System (TRAGIS) or other DOE route or risk assessment models.

• Participation in carrier evaluation programs that may be implemented through other agencies or organizations.

• Staff costs related to planning and needs assessments.

The Training Grant has two categories of allowable activities: Activities related to safe routine transportation and activities related to emergency response.

Activities for the safe routine transportation aspects of the Training Grant may include:

• Continuation of the activities initiated under the Assessment and Planning Grant, such as coordination with agencies within the State or Tribe, assessment of training needs, and assessment of technical assistance needs.

• Training and staff costs associated with the Department of Transportation's State Rail Safety Participation Program. The Federal Railroad Administration will provide informal outreach and training opportunities to Tribal nations, since there is no statutory authority for participation by Indian Tribes in the State Safety Participation Program as outlined in 49 CFR 212.

• Training for public safety officials in safety and enforcement inspections of highway shipments (drivers, vehicles, and shipping containers).

• Training related to accident prevention (e.g., for safe parking, bad weather, and road conditions).

• Training for appropriate local, State, and Tribal officials on the proper handling of information and documents, including secure and confidential shipments.

• Training for radiological inspections, both rail and truck.

• Training on a satellite tracking system.

• Equipment purchases, calibration, and maintenance for training purposes.[5]

• Staff costs related to training.

Activities for the emergency response aspects of the Training Grant may include:

• Continuation of planning activities begun under the Assessment and Planning Grant.

• Training in implementation of mutual aid agreements among neighboring jurisdictions and agreements with Federal agencies.

• Training for public safety officials in hazardous materials emergency response procedures. When necessary or appropriate, training should be consistent with OSHA awareness or operations levels, as those terms are defined in 29 CFR 1910.120, and the jurisdiction's emergency response plans.

• Participation in DOE's TEPP.

• Equipment purchases, calibration, and maintenance for training purposes.

• Training for emergency medical personnel, including hospital emergency medical personnel.

• Designing, conducting, and evaluating drills and exercises, including the implementation of mutual aid agreements and emergency response plans and procedures.

• Staff costs related to training.

IV. Merit Review Criteria

States and Tribes will have flexibility to decide for which allowable activities to request Section 180(c) assistance to meet their unique needs within the limits of the NWPA and DOE and other Federal financial assistance regulations and restrictions. Grant applications will be reviewed in accordance with 10 CFR 600.13, *Merit Review.*

The merit review process consists of a board of technically qualified reviewers who evaluate each grant application on pre-established criteria. The merit review board advises the DOE's selection officials as to the merits of each proposed activity and the overall quality of the application. The DOE's selection officials will make final funding determinations and notify successful applicants of their award in accordance with standard grant procedures.

The proposed criteria, which the merit review board will use for its review, are described below in *Table 1, Assessment and Planning Grant and Table 2, Training Grant.* The applicant's narrative should address each of these criteria in accordance with the instructions provided.

TABLE 1.—ASSESSMENT AND PLANNING GRANT

Criteria	Instructions
Conduct a needs assessment and develop a training plan to prepare for NWPA shipments through the applicant's jurisdiction.	In the grant application narrative, make sure the scope of the assessment and plan development is clear and thorough: a. Describe how the State or Tribe will assess needs, including how the State or Tribe will determine what additional planning, training, equipment, and exercises may be needed. b. Describe the technical assistance that will be requested from DOE or other Federal agencies in order to conduct the needs assessment. c. Describe the cost and timeframe of each proposed assessment and planning activity. d. Describe what planning will occur within the State or Tribe and with local jurisdictions. e. Identify all mutual aid agencies that will be contacted to complete the needs assessment and training plan. f. Describe how the proposed grant funding does not supplant or duplicate existing funding from Federal or State sources.

[3] DOE's TEPP integrates transportation emergency preparedness activities for DOE non-classified shipments of radioactive materials to address the emergency response concerns of State, Tribal, and local officials affected by such shipments. TEPP is implemented on a regional basis, with a TEPP Coordinator for each region. TEPP ensures responders have access to the model plans and procedures, training, and technical assistance necessary to respond safely, efficiently, and effectively to transportation incidents.

[4] DOE's RAP is a team of DOE and DOE contractor personnel specifically trained to perform radiological emergency response activities. The RAP teams may deploy at the request of DOE sites; other Federal agencies; State, Tribal or local governments; or from any private organization or individual. Teams are located at eight sites around the Nation.

[5] Grant funds can be used to purchase equipment for training purposes. They can also be used to calibrate and maintain equipment as long as the equipment is training-related and specific to the needs created by the NWPA shipments.

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TABLE 1.—ASSESSMENT AND PLANNING GRANT—Continued

Criteria	Instructions
Prepare public safety officials of appropriate units of local government.	The narrative should completely and accurately describe: a. How local public safety officials were involved in developing the grant application. b. How local public safety officials will be involved in the needs assessment consistent with their role in radioactive/hazardous materials transportation as defined by the State.
Prepare sufficiently to reassure the public of adequate preparedness.	The narrative should accurately and completely describe: a. How the applicant will assess what is needed to respond to inquiries from the public and the media. b. What activities and measures, if any, are needed to reassure the public of adequate preparedness.
Train for the increment of need specific to NWPA shipments.	The narrative should accurately and completely describe: a. What the applicant is already doing to prepare for radioactive materials shipments. b. How each proposed needs assessment activity is specific to the NWPA shipments.

TABLE 2.—TRAINING GRANT

Criteria	Instructions
Conduct training on procedures for safe routine transportation to help prevent accidents and respond in a timely and appropriate fashion to incidents involving NWPA shipments.	The narrative should accurately and completely describe: a. How many public safety officials will be trained and what training they will receive, based on the needs assessment conducted under the Assessment and Planning Grant. b. List the equipment the applicant proposes to purchase, describe why this equipment is necessary for training for these shipments, and how it is consistent with the training level to which the responders will be trained. c. How the proposed grant funding does not supplant or duplicate existing funding from Federal or State sources. d. How the actions listed in this section help the applicant increase its capability to prevent accidents and respond appropriately to accidents. e. The technical assistance that will be requested from DOE, either from OCRWM, RAP teams, TEPP coordinators, or other Federal agencies. f. How the training and technical assistance will be integrated with assistance received from other Federal Government sources.
Help prepare public safety officials of appropriate units of local government.	The narrative should accurately and completely describe: a. How local public safety officials will benefit from the proposed activities. b. Whether those local public safety officials support the activities proposed in this application and how their level of support is determined.
Prepare sufficiently to reassure the public of adequate preparedness.	The narrative should accurately and completely describe: a. How the applicant will train to respond to inquiries from the public and the media. b. What activities and measures, if any, will be taken to reassure the public of adequate preparedness.
Train in the increment of need specific to NWPA shipments.	The narrative should accurately and completely describe: a. How each proposed activity is specific to the NWPA shipments. b. How the training will be integrated with assistance received from other DOE programs or Federal agencies for radioactive materials transportation preparedness.
Assess level of preparedness after training, exercises, and technical assistance.	The narrative should accurately and completely describe: a. How the applicant will assess their level of preparedness after conducting the proposed activities. The proposed assessment should measure readiness against the objectives described in the applicant's project narrative. b. How the applicant will assess how well it utilized the technical assistance requested.

V. Request for Comments

DOE requests that interested parties comment on this notice of revised proposed policy, including the specific questions identified below:

Question 1

(a) Would $200,000 be an appropriate amount for the assessment and planning grant to conduct an initial needs assessment?

(b) Should the amount be the same for each eligible State and Tribe?

(c) Would there be a need to update the initial needs assessment and, if so, at what intervals and should funding be made available for this purpose and in what amount?

Question 2

(a) Would $100,000 be an appropriate amount for the annual training grant?

(b) Recognizing that, after commencement of shipments through an eligible State or Tribe, training to maintain capability may become less costly with increased expertise and efficiency, should the base amount of subsequent annual training grants be adjusted downward to reflect the number of years that annual training grants have been received?

(c) What should be the allocation of available appropriated funds for a fiscal year between the base amount and the variable amount of the annual training grants?

(d) Should the entire training grant be variable based on the funding allocation formula described herein?

Question 3

(a) Should the amount of funding be adjusted where a route forms a border between two States, a State and a Tribal reservation, or two Tribal reservations?

(b) Should States or Tribes with mutual aid responsibilities along a route outside their borders be eligible for

180(c) grants on the basis of the mutual aid agreement?

(c) If so, how should the amount of funding be calculated, and should the calculation take into account whether or not the State or Tribe would otherwise be eligible for a grant?

(d) Should the State or Tribe that received notification of eligibility from DOE indicate in their grant application that a neighboring State or Tribe has a mutual aid agreement along a particular route, whereupon DOE would then notify the neighboring State or Tribe of its eligibility?

Question 4

(a) Do assessment and planning grants need to be undertaken four years prior to an initial scheduled shipment through a State or Tribe's jurisdiction?

(b) Do training grants need to commence three years prior to a scheduled shipment through a State or Tribe's jurisdiction?

(c) Do training grants need to be provided every year that shipments are scheduled?

Question 5

(a) Should the Section 180(c) grants be adjusted to account for fees levied by States or Tribes on the transportation of spent nuclear fuel or high-level radioactive waste through their jurisdiction?

(b) How should DOE determine if a fee covers all or part of the cost of activities allowed under Section 180(c) grants?

(c) Is the language in this policy, requiring States and Tribes to explain in their grant application how the fees and Section 180(c) grant awards are separate and distinct, sufficient to prevent DOE from paying twice for the same activity?

Question 6

(a) How should Section 180(c) grants be adjusted to reflect other funding or technical assistance from DOE or other Federal agencies for training for safe routine transportation and emergency response procedures?

(b) In particular, how should DOE account for TEPP and other similar programs that provide funding and/or technical assistance related to transportation of radioactive materials?

(c) To what extent is Section 180(c) funding necessary where funding and/or technical assistance are being or have been provided for other DOE shipping campaigns such as to DOE's Waste Isolation Pilot Plant?

Issued in Washington, DC, on July 18, 2007.

Edward F. Sproat III,

Director, Office of Civilian Radioactive Waste Management.

[FR Doc. E7–14181 Filed 7–20–07; 8:45 am]

BILLING CODE 6450–01–P

APPENDIX B

INTERAGENCY AND INTERGOVERNMENTAL INTERACTIONS

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APPENDIX B

INTERAGENCY AND INTERGOVERNMENTAL INTERACTIONS

This appendix describes DOE interagency and intergovernmental interactions during the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS.

During the preparation of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, the U.S. Department of Energy (DOE or the Department) has interacted with a number of government agencies and other organizations. These interaction efforts have several purposes, as follows:

- To discuss issues of concern with organizations having an interest in or authority over land that the Proposed Action would directly affect, or organizations having other interests that some aspect of the Proposed Action could affect
- To obtain information pertinent to the environmental impacts analyses
- To initiate consultations or permitting processes, including providing data to agencies with oversight, review, or approval authority over some aspect of the Proposed Action

Sections B.1 through B.7 describe agency and organization interests in the proposed railroad project and DOE consultations and interactions with those agencies and organizations.

B.1 Cooperating Agencies

The Bureau of Land Management (BLM or the Bureau), the Surface Transportation Board (STB), and the U.S. Air Force are cooperating agencies in the preparation of the Rail Corridor SEIS and the Rail Alignment EIS, pursuant to Council on Environmental Quality regulations at 40 Code of Federal Regulations 1501.6.

B.1.1 BUREAU OF LAND MANAGEMENT

DOE met routinely with the BLM to discuss project direction and coordination. DOE has held numerous briefings and working meetings with the BLM, including staff from the Tonopah, Ely, Battle Mountain, Las Vegas, Reno, and Carson City BLM field offices, regarding the status of the National Environmental Policy Act (NEPA) analyses. Table B-1 summarizes major DOE interactions with the BLM. In addition, a BLM staff member resided in DOE offices during the development of the Nevada Rail Corridor SEIS and the Rail Alignment EIS to facilitate communications and interactions between DOE and the BLM.

B.1.2 SURFACE TRANSPORTATION BOARD

The U.S. Department of Transportation has the authority to regulate several aspects of the transportation of spent nuclear fuel and high-level radioactive waste to the repository. The general authority of the U.S. Department of Transportation to regulate carriers and shippers of hazardous materials includes packaging procedures and practices, shipping of hazardous materials, routing, carrier operations, shipping container instruction, and receipt of hazardous material.

Table B-1. Summary of DOE interactions with the BLM[a] (page 1 of 2).

Date	Office	Summary of interaction
07/14/04	DOE Las Vegas	Discussed the schedule for preparation of the Rail Alignment EIS and reviewed the preliminary scope and outline for the EIS
12/02/04	DOE Las Vegas	Reviewed the nature of the Proposed Action and alternatives (including alternative segments) and the locations of railroad construction and operations support facilities for purposes of analysis
12/14/04	BLM Ely	• Obtained initial information for biological surveys and physical setting • Discussed unique natural features; soil surveys; BLM special status species; fencing; grazing allotments; wetlands; and various wildlife species
12/15/04	BLM Tonopah	• Obtained initial information for biological surveys and physical setting • Discussed soil surveys; invasive species; wetlands; BLM special status species; fencing; grazing allotments; wetlands; and various wildlife species
01/03/05	BLM Las Vegas	Obtained and discussed BLM input on key observation points for aesthetics analysis
01/04/05	BLM Ely	Obtained and discussed BLM input on key observation points for aesthetics analysis
01/06/05	BLM Battle Mountain	Obtained and discussed BLM input on key observation points for aesthetics analysis
02/08/05	BLM Tonopah	• Discussed fencing, land segregation, invasive species, and land-use conflicts • Identified potential activities to be considered in the Shared-Use Option and the cumulative impact analysis
02/16/05	BLM Las Vegas	• Provided an overview of proposed rail alignment and alternative actions for BLM • Learned of BLM concerns
03/17/05	DOE Las Vegas	Discussed the approach for addressing mitigation measures
04/06/05	BLM Ely	Discussed caves, paleontology, and unique natural features
04/06/05	BLM Las Vegas	Formal presentation to BLM on the Rail Alignment EIS to review historical perspective; discuss decisions supported by the EIS; the Proposed Action and alternatives; use of conceptual design information; approaches to analyzing resources; land acquisition; and schedule
04/12/05	DOE Las Vegas	Discussed the approach for addressing mitigation measures and a preferred alignment
04/21/05	BLM Las Vegas	Reviewed the approach for land acquisition; discussed economic or value assessment of mineral resources and ore bodies
05/18/05	BLM Las Vegas	• Provided an update regarding the Rail Alignment EIS • Discussed BLM concerns • Presented and discussed approach to analysis of cumulative impacts
05/24/05	BLM Ely	• Discussed availability of mapping of visual resource management classifications, and the record of decision for Caliente Management Framework • Planned for and discussed the upcoming Resource Management Plan for the Garden Valley area

Table B-1. Summary of DOE interactions with the BLM[a] (page 2 of 2).

Date	Office	Summary of interaction
05/26/05	BLM Battle Mountain	• Coordinated use of BLM geographical information system data
06/07/05	BLM Ely	• Provided an update regarding the Rail Alignment EIS • Learned of BLM Resource Management Plan update and identified projects that should be included in the Rail Alignment EIS • Discussed Rail Alignment EIS cumulative impact analysis
06/22/05	BLM Tonopah	• Provided an update regarding the Rail Alignment EIS
06/29/05	BLM Battle Mountain	• Provided an update regarding the Rail Alignment EIS
02/07/06-02/08/06	DOE Las Vegas	• Presented the DOE preferred alternative segments and received input from cooperating agencies
03/14/06-3/16/06	BLM Ely	• Draft EIS workshop to discuss Proposed Action and potential impacts
11/28/06	BLM Reno	• Provided an update regarding the Nevada Rail Corridor SEIS and the Rail Alignment EIS
2/13/07	BLM Carson City	• Provided an update regarding the Nevada Rail Corridor SEIS and the Rail Alignment EIS

a. BLM = Bureau of Land Management; DOE = U.S. Department of Energy; EIS = environmental impact statement; SEIS = supplemental environmental impact statement.

During the preparation of the NEPA analyses, DOE met routinely with the STB to discuss project direction and coordination. The STB:

- Participated in a meeting on July 14, 2004, to discuss the Rail Alignment EIS preparation schedule and to review the preliminary scope and outline of the EIS
- Participated in a meeting on December 2, 2004, to review the nature of the Proposed Action and alternatives (including alternative segments) and to review the proposed locations of construction and operations support facilities for purposes of analysis
- Received a formal presentation from DOE on March 16, 2005, to review the proposed Caliente rail alignment alternative segments, use of conceptual design information, framework of the Shared-Use Option, and approaches to analyzing various environmental resources
- Participated in a meeting on April 12, 2005, to discuss the approach for addressing mitigation measures and a preferred alignment along the Caliente rail corridor and to review the approach for acquiring land
- Provided, on April 19, 2005, input regarding the extent to which truck traffic carrying general commodities should be evaluated under the No-Action Alternative
- Participated in a 2-day meeting on February 7 and 8, 2006, to discuss the DOE preferred alternative segments along the Caliente rail alignment

B.1.3 U.S. AIR FORCE

The U.S. Air Force participated in a meeting on July 14, 2004, to discuss the NEPA document preparation schedule and to review the preliminary scope and outline of the Rail Alignment EIS, and a 2-day meeting on February 7 and 8, 2006, to discuss the DOE preferred alternative segments along the Caliente rail alignment.

B.1.4 U.S. ARMY

The U.S. Army has participated in the following meetings:

- December 23, 2006, to discuss the status of document preparation, and the inclusion of the Mina rail alignment as part of the NEPA analysis
- January 8, 2007, to discuss rail alignment infrastructure in relation to the U.S. Army-established safety zones around munitions storage areas
- February 19, 2007, to discuss the location and use of switching yards from the existing U.S. Department of Defense Branchline

B.2 Other Federal Agencies

B.2.1 U.S. DEPARTMENT OF THE INTERIOR

The U.S. Department of the Interior is responsible for most federally owned public lands and natural resources. Department of the Interior activities potentially affected by the Proposed Action include managing lands and resources, conducting scientific research and investigations, developing resources, and carrying out trust responsibilities of the U.S. Government with respect to American Indians. The Department of the Interior oversees various bureaus with jurisdictional responsibilities or interests that would be affected by the proposed railroad, including the Bureau of Indian Affairs, the Bureau of Land Management, and the U.S. Fish and Wildlife Service.

The Bureau of Indian Affairs is responsible for administering and managing land held in trust by the United States for American Indians, Indian tribes, and Alaska Natives. The Bureau of Indian Affairs is responsible for developing forestlands, leasing assets on these lands, directing agricultural programs, protecting water and land rights, developing and maintaining infrastructure, and economic development.

On September 20, 2004, DOE responded to a letter from the Bureau of Indian Affairs, indicating that the Department had eliminated one Caliente alternative segment from further consideration based on the Bureau's concern that it would cross lands held in trust for the Timbisha Shoshone Tribe (DIRS 174558-Sweeney 2004, all).

Under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*), as amended, the U.S. Fish and Wildlife Service, a bureau of the U.S. Department of the Interior, has responsibility to determine if projects such as the proposed railroad would have an adverse impact on endangered or threatened species, on species proposed for listing as endangered or threatened, or on designated critical habitat.

- DOE met with staff from the U.S. Fish and Wildlife Service on January 27, 2005, March 2, 2006, and December 13, 2006, to introduce the project; discuss compliance with the Endangered Species Act; and consider potential impacts to threatened and endangered species.
- On April 12, 2006, representatives of the U.S. Fish and Wildlife Service and DOE visited the Caliente area to evaluate habitat for southwestern willow flycatchers and discuss impacts to that endangered species.

- On March 18, 2005, the U.S. Fish and Wildlife Service sent DOE a list of threatened and endangered species and candidate species that occur in the region of influence of the Caliente rail alignment (DIRS 174439-Williams 2005, all).
- On December 13, 2006, and April 11, 2007, DOE met with staff from the U.S. Fish and Wildlife Service Reno Office to discuss compliance with the Endangered Species Act and requested a list of endangered species that occur in the Mina rail alignment region of influence.
- On March 8, 2007, the Fish and Wildlife Service sent DOE a species list for the Mina rail alignment and an updated list for the Caliente rail alignment.

B.2.2 U.S. ARMY CORPS OF ENGINEERS

The Clean Water Act of 1977 (33 U.S.C. 1251 *et seq.*) gives the U.S. Army Corps of Engineers permitting authority over activities that discharge dredge or fill material into Waters of the United States. If DOE activities associated with the proposed railroad would discharge dredge or fill into any such waters, the Department might need to obtain a permit from the U.S. Army Corps of Engineers.

On November 4, 2004, March 7, 2006, November 27, 2006, and March 5, 2007, DOE met with the U.S. Army Corps of Engineers to provide an overview of the plans for constructing a rail line to Yucca Mountain along the Caliente rail alignment and to obtain initial information from the U.S. Army Corps of Engineers on the permitting process for Section 404 of the Clean Water Act. At these meetings, DOE and the Corps of Engineers discussed the required state permits; Corps of Engineers jurisdiction over isolated waters; the type of permit DOE would have to obtain; content and timing of the permit application; potential mitigation; the addition of the Mina rail alignment and related construction plans; and compliance with the National Environmental Policy Act.

B.2.3 U.S. DEPARTMENT OF AGRICULTURE

The U.S. Department of Agriculture is responsible for ensuring that the potential for federal programs to contribute to unnecessary and irreversible conversion of farmlands to nonagricultural uses is kept to a minimum.

On March 9, 2007, DOE sent a letter to the Natural Resources Conservation Service requesting that the Service identify prime farmland along the Caliente and Mina rail alignments.

B.3 State of Nevada

If DOE decided to construct the proposed railroad along the Caliente rail alignment or the Mina rail alignment, the Department would need to obtain a range of permits and approvals from the State of Nevada (Rail Alignment EIS, Chapter 6, Statutory, Regulatory, and Other Applicable Requirements).

- On March 23, 2005, DOE met with personnel from the Nevada Department of Wildlife to identify information that they had regarding wildlife and sensitive animal species that could be included in the Rail Alignment EIS. Various species were discussed, as was fencing along the Caliente rail alignment. DOE had numerous informal follow-up meetings and conversations with the Nevada Department of Wildlife occurred to coordinate sharing of wildlife information.
- On March 23, 2005, DOE met with personnel from the Nevada Division of Forestry to identify pertinent information to be used in the Rail Alignment EIS. The Division of Forestry provided direction regarding where to obtain pertinent information.

- On December 20, 2005, DOE met with personnel from the Nevada Department of Transportation to introduce DOE plans for constructing a rail line to Yucca Mountain along the Caliente rail alignment and to inquire about standards or requirements for road upgrades/improvements, requirements for grade-crossing protection, anticipated improvement projects, and other related topics.
- On January 10, 2006, DOE met with the Nevada Bureau of Air Quality concerning air quality permits and the Rail Alignment EIS. The purpose of the meeting was to present to the Bureau a general overview of the Nevada Rail Project, and a description of air quality permitting that will be included in this EIS.
- On November 31, 2006, and December 18, 2006, DOE met with the Nevada Division of Water Resources to discuss water appropriations for construction and operation of the proposed railroad along the Caliente rail alignment and the process for developing and submitting permit applications.

B.4 Federal and State Agencies Consulted Jointly

DOE, the Advisory Council on Historic Preservation, the Nevada State Office of Historic Preservation, the BLM, and the STB held numerous meetings during 2005 and 2006 to develop a Programmatic Agreement (see Appendix M) to address DOE responsibilities under Sections 106 and 110 of the National Historic Preservation Act and the Council's implementation regulations. The Programmatic Agreement provides that an appropriate level of field investigation, including on-the-ground intensive surveys, evaluations of all recorded resources in the *National Register of Historic Places*, assessments of adverse effects, and applicable mitigation of identified impacts, be completed prior to commencement of any ground-disturbing construction activities (DIRS 176912-Wenker et al. 2006, all). Cultural resource requirements for the segment of the rail alignment and the Rail Equipment Maintenance Yard and geologic repository operations area interface inside the Yucca Mountain Site boundary are covered by the existing programmatic agreement for *Development for the Nuclear Waste Deep Geologic Repository at Yucca Mountain, Nevada* (DIRS 104558-DOE 1988, all) between the DOE Office of Civilian Radioactive Waste Management, the Advisory Council on Historic Preservation, and the Nevada State Office of Historic Preservation.

Although not a formal signatory, the Nevada State Historic Preservation Officer has the right at any time, on request, to participate in monitoring DOE compliance with the Programmatic Agreement. In addition, DOE must provide opportunities for consultations with the Advisory Council on Historic Preservation, the Nevada State Historic Preservation Officer, the BLM, the STB, and American Indian tribes as appropriate throughout the process of implementing the Programmatic Agreement. DOE will submit an annual report to the Advisory Council, the Nevada State Historic Preservation Officer, the BLM, and the STB describing the activities it conducts each year to implement the stipulations of the Programmatic Agreement. DOE will continue to seek input from the Advisory Council on Historic Preservation, the Nevada State Historic Preservation Officer, the BLM, and the STB and will interact appropriately to meet the reporting and other stipulations of the Programmatic Agreement.

B.5 Local Agencies

Units of local government that would be affected by construction and operation of the proposed railroad along the Caliente rail alignment include Lincoln, Nye, and Esmeralda. These counties and the City of Caliente have formed the Central Nevada Community Protection working group to address, in a collaborative effort, issues of concern to their communities related to the Proposed Action.

Under a Cooperative Agreement with DOE, Nye County conducted a mail survey to property owners along or near the Caliente rail alignment to obtain their concerns and thoughts on potential mitigation measures (DIRS 182923-DOE 2003, all). Also under the Cooperative Agreement with DOE, the Nye County Department of Natural Resources and Federal Facilities conducted an assessment of the potential economic benefits of the proposed railroad to Lincoln, Nye, and Esmeralda Counties (DIRS 174090-Wilbur Smith Associates 2005, all).

DOE has interacted with Esmeralda, Lincoln, and Nye Counties and the City of Caliente on a regular basis throughout the preparation of this Nevada Rail Corridor SEIS and the Rail Alignment EIS. For example:

- On March 23, 2005, DOE conducted an all-day project status meeting with the affected units of government, which includes Inyo, Churchill, Esmeralda, Nye, Mineral, White Pine, Lincoln, Clark, Lander, and Eureka Counties. Each county provided an oversight activity report.
- On May 24, 2005, DOE provided an annual program update to the Lander County Commissioners.
- On January 9, 2007, DOE met with Nye County to provide an update on the Nevada Rail Corridor SEIS and the Rail Alignment EIS.
- On January 12, 2007, DOE met with Mineral, Churchill, Esmeralda, and Nye Counties to discuss potential economic opportunities that would be associated with the Shared-Use Option.
- On February 2, 2007, DOE met with the Nye County Economic Development representatives to discuss the potential location of an industrial park the county is considering building near the Yucca Mountain Repository.
- On February 26, 2007, DOE met with Lincoln, Mineral, Nye, and Esmeralda Counties to discuss potential water appropriations applications that would be required to construct and operate the proposed railroad.

B.6 American Indian Tribes

In 1987, DOE initiated the Native American Interaction Program to solicit input from and interact with tribes and organizations on the characterization of the Yucca Mountain site and the possible construction and operation of a repository. These tribes and organizations - Southern Paiute; Western Shoshone; and Owens Valley Paiute and Shoshone people from Arizona, California, Nevada, and Utah - have cultural and historic ties to both the Yucca Mountain area and to the larger region that includes portions of the Caliente and Mina rail alignments.

The Native American Interaction Program concentrates on the protection of cultural resources at Yucca Mountain and contributes to a government-to-government relationship with the tribes and organizations. Its purpose is to help DOE comply with various federal laws and regulations, including the American Indian Religious Freedom Act (42 U.S.C. 1996); the Archaeological Resources Protection Act (16 U.S.C. 470aa *et seq.*); the National Historic Preservation Act (16 U.S.C. 470 *et seq.*); the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001); the American Indian and Alaska Native Tribal Government Policy; DOE Order 1230.2, *American Indian and Tribal Government Policy*; Executive Order 13007, *Indian Sacred Sites*; and Executive Order 13084, *Consultation and Coordination with Indian Tribal Governments*. These regulations and Executive Orders mandate the protection of archaeological sites and cultural items and require agencies to include American Indians and federally recognized tribes in discussions and interactions on major federal actions.

Initial ethnographic studies identified three tribal groups – the Southern Paiute, the Western Shoshone, and the Owens Valley Paiute and Shoshone – whose cultural heritage includes the Yucca Mountain region. Additional ethnographic efforts eventually led to the involvement of 17 tribes and organizations in the Yucca Mountain Project American Indian and cultural resource studies.

The 17 tribes and organizations have formed the Consolidated Group of Tribes and Organizations (an informal coalition), which consists of officially appointed tribal representatives who are responsible for presenting their respective tribal concerns and perspectives to DOE. A major priority of this group has been the protection of cultural resources and environmental restoration at Yucca Mountain. Members of the group have participated in many ethnographic interviews and have provided DOE valuable insights into American Indian cultural and religious values and beliefs. These interactions have produced several reports that record the regional history of American Indian people and the interpretation of American Indian cultural resources in the Yucca Mountain region.

On June 2, 2004, DOE met with the Consolidated Group of Tribes and Organizations to introduce the rail alignment project and learn of their concerns. In October 2004, a small group of designated tribal representatives participated in a field reconnaissance trip along the proposed rail alignment, followed by a meeting with the larger consolidated group in late November 2004.

Based on these efforts, these tribal representatives known as the American Indian Writers Subgroup, a subgroup of the Consolidated Group of Tribes and Organizations, prepared *American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy Yucca Mountain Project* (DIRS 174205-Kane et al. 2005, all). This document provides insight into American Indian viewpoints and concerns regarding cultural resources along the Caliente rail alignment and long-term impacts of DOE selection of a rail system to transport spent nuclear fuel and high-level radioactive waste to a geologic repository at Yucca Mountain, Nevada. This document is a supplement to the American Indian Writers Subgroup document produced in 1998 titled *American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement* (DIRS 102043-AIWS 1998, all).

- In July 2005, DOE held a tribal update meeting with the Consolidated Group of Tribes and Organizations. The rail alignment project and the document prepared by the American Indian Writers Subgroup were topics of discussion.
- In September 2005, DOE held a special meeting with the Consolidated Group of Tribes and Organizations for discussions on the Environmental Assessment associated with the DOE request for a Public Land Order to prevent new mining claims along the Caliente rail corridor study area.
- In April 2006, DOE again met with the American Indian Writers Subgroup for continued discussions and updates on the Caliente rail alignment. After each meeting between DOE and the Consolidated Group of Tribes and Organizations or the designated American Indian Writers Subgroup, the tribal representatives prepared a series of recommendations for DOE consideration.
- On November 29, 2006, DOE met with the Consolidated Group of Tribes and Organization to discuss the inclusion of the Mina rail alignment for analysis in the Nevada Rail Corridor SEIS and the Rail Alignment EIS and to provide an update on analysis of the Caliente rail alignment.

DOE recognized that the Walker River Paiute Tribe, as a sovereign nation, would play a prominent role in the preparation and review of the Nevada Rail Corridor SEIS and the Rail Alignment EIS, because the Mina rail alignment would cross the Walker River Reservation through one of four alternative segments. Before withdrawing from the EIS process in April 2007, the Walker River Paiute Tribe served as a cooperating agency, and participated in several status meetings to discuss the Proposed Action and environmental analyses and document preparation.

B.7 Government Organization Having Oversight of DOE Activities Related to the Proposed Railroad, Nuclear Waste Technical Review Board

The Nuclear Waste Policy Amendments Act of 1987 (42 U.S.C. 10101 *et seq.*) created the 11-member Nuclear Waste Technical Review Board to evaluate DOE scientific and technical activities related to the management and disposal of the Nation's commercial spent nuclear fuel. The Technical Review Board's primary responsibility is to evaluate (1) the site characterization phase of the Yucca Mountain Project and the activities associated with determining whether the Yucca Mountain Site is suitable for further development as a geologic repository, and (2) the packaging and transportation of spent nuclear fuel and high-level radioactive waste.

The mandate of the Nuclear Waste Technical Review Board is to evaluate the scientific and technical work DOE is performing in its commercial nuclear waste disposal program. The Technical Review Board makes scientific and technical recommendations to DOE.

B.8 REFERENCES

102043	AIWS 1998	AIWS (American Indian Writers Subgroup) 1998. American Indian Perspectives on the Yucca Mountain Site Characterization Project and the Repository Environmental Impact Statement. Las Vegas, Nevada: Consolidated Group of Tribes and Organizations. ACC: MOL.19980420.0041.
104558	DOE 1988	DOE (U.S. Department of Energy) 1988. Programmatic Agreement Between the United States Department of Energy and the Advisory Council on Historic Preservation for the Nuclear Waste Deep Geologic Repository Program Yucca Mountain, Nevada. Washington, D.C.: U.S. Department of Energy. ACC: HQX.19890426.0057.
182923	DOE 2003	DOE 2003. Proposed New Cooperative Agreement Number DE-FC28-03RW12223 for Yucca Mountain Transportation Issues and Concerns Unique to the Destination County Memorandum w/enclosures ACC: MOL.20030922.0177.
174205	Kane et al. 2005	Kane, G.; Cornelius, B.; Charles, J.; Moose, G.; Frank-Churchill, M.; and Arnold, R. 2005. American Indian Perspectives on the Proposed Rail Alignment Environmental Impact Statement for the U.S. Department of Energy's Yucca Mountain Project. [Las Vegas, Nevada]: American Indian Writers Subgroup, Consolidated Group of Tribes and Organizations. ACC: ESU.20050707.0001.
174558	Sweeney 2004	Sweeney, R.L. 2004. Response to Bureau of Indian Affairs Letter dated June 18, 2004 Concerning Timbisha Shoshone Tribe and Rail Alignment, Environmental Impact Statement. Correspondence from R.L. Sweeney (DOE/ORD) to A.L. Dutschke (Bureau of Indian Affairs), September 20, 2004, 0921043296, MFR:OSPD:RLS-1755. ACC: MOL.20041129.0011.

176912	Wenker et al. 2006	Wenker, R.; Lanthum, J.G.; Baldrica, A.M.; and Rutson, V. 2006. Programmatic Agreement Among the U.S. Department of Interior Bureau of Land Management, Nevada (BLM); the U.S. Department of Energy (DOE); Surface Transportation Board (STB); and the Nevada State Historic Preservation Office (SHPO) Regarding the Nevada Rail Project (NRP). Agreement that Construction of the NRP Shall be Administered in Accordance with Stipulations in the Agreement to Ensure that Historic Properties Will be Treated to Avoid or Mitigate Effects to the Extent Practicable, Regardless of Surface Ownership, and to Satisfy DOE and BLM Section 106 Responsibilities for All Aspects of the Undertaking. ACC: MOL.20060531.0087.
174090	Wilbur Smith Associates 2005	Wilbur Smith Associates 2005. Final Report, Rail Transportation Economic Impact Evaluation & Planning. Nye County, Nevada: Nye County, Department of Natural Resources and Federal Facilities. TIC: 257526.
174439	Williams 2005	Williams, R.D. 2005. “Species List for U.S. Department of Energy Rail Line from near Caliente, Lincoln County, Nevada to Yucca Mountain, Nye County, Nevada.” Letter from R.D. Williams (Nevada Fish and Wildlife Service) to R. Sweeney (DOE), March 18, 2005, File No. 1-5-05-SP-439. ACC: MOL.20050714.0434.

APPENDIX C

EVOLUTION OF ALTERNATIVE SEGMENTS AND COMMON SEGMENTS

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APPENDIX C

EVOLUTION OF COMMON SEGMENTS AND ALTERNATIVE SEGMENTS

This appendix describes the process the DOE used to evaluate and determine the range of alternative segments considered in the Rail Alignment EIS and the results of that process.

Section C.7 defines terms shown in ***bold italics***.

Section C.1 of this appendix describes how the U.S. Department of Energy (DOE or the Department) developed the preliminary range of ***alternative segments***. Section C.2 describes the public scoping process and the comments DOE received and used as input to development of the sets of alternative segments and ***common segments*** analyzed in detail in the Rail Alignment EIS. Section C.3 describes the alignment identification and analysis process. Section C.4 describes alternative segments eliminated from detailed analysis. Section C.5 describes the process DOE used to refine the alternative segments.

C.1 Development of the Range of Alternative Segments

To develop the range of alternative segments for evaluation in the Rail Alignment EIS, DOE evaluated a suite of potential alternative segments for the Caliente Implementing Alternative and the Mina Implementing Alternative to determine whether they would be practical or feasible from a technical, environmental, and economic standpoint. To develop the range of alternative segments, DOE:

Alternative segments are portions of the rail alignments for which DOE is considering two or more routes for the rail line.

Common segments are portions of the rail alignments for which DOE has identified a single route for the rail line.

- Identified public comments related to alternative segments; considered comments that suggested specific alternative segments, and comments that could be construed as criteria to modify the preliminary alternative segments and common segments described in the Notices of Intent (69 *FR* 18565, April 18, 2004; and *FR* 60484, October 13, 2006, or as criteria to identify new alternative segments.
- Identified engineering factors relevant to the design and construction of a rail line; considered factors consistent with those of railroad-industry standards and practices.
- Identified environmental features to determine whether they would be directly affected by potential alternative segments and common segments; considered features such as springs, wetlands, and Wilderness Study Areas.
- Identified potential conflicts with land uses, including American Indian lands, private lands, and mineral resources.
- Evaluated then-currently available information, such as U.S. Geological Survey topographic maps and associated databases.

- Evaluated the suite of potential alternative segments to determine whether they could be constructed to satisfy the engineering factors and avoid environmental features.
- Estimated costs to construct each potential alternative segment.

The process involved a number of steps for each rail corridor, as depicted on Figure C-1. Sections C.2.1 through C.5 describe the evaluative process and results in more detail.

C.1.1 DEVELOPMENT OF THE RANGE OF ALTERNATIVE SEGMENTS WITHIN THE CALIENTE RAIL CORRIDOR

In the *Notice of Intent to Prepare an EIS for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, Nevada* (69 *Federal Register* [*FR*] 18565, April 8, 2004) (Notice of Intent), DOE identified preliminary alternative segments and common segments to be evaluated in the Rail Alignment EIS (Figure C-2).

The Department estimated that about 55 percent of the length of the Caliente rail corridor would not have alternative segments and these areas would be referred to as common segments. In the Notice of Intent, DOE indicated it would consider potential alternative segments outside the 0.4-kilometer (0.25-mile)-wide Caliente rail corridor that might minimize, avoid, or otherwise mitigate adverse environmental ***impacts***. More specifically, DOE invited comment on the following:

- Should additional alternative segments be considered that might minimize, avoid, or mitigate adverse environmental impacts, such as avoiding Wilderness Study Areas, American Indian Trust Lands, or encroachment on the Nevada Test and Training Range?
- Should any of the preliminary alternative segments be eliminated from detailed study?

C.1.2 DEVELOPMENT OF THE RANGE OF ALTERNATIVE SEGMENTS WITHIN THE MINA RAIL CORRIDOR

In the *Amended Notice of Intent to Expand the Scope of the Environmental Impact Statement for the Alignment, Construction, and Operation of a Rail Line to a Geologic Repository at Yucca Mountain, Nye County, NV* (71 *FR* 60484, October 13, 2006) (Notice of Intent), DOE announced that it had identified preliminary alternative segments and common segments for the Mina rail corridor to be evaluated in the Rail Alignment EIS (Figure C-3). In response to communications with the Walker River Paiute Tribe, DOE initiated a study to determine the feasibility of a rail line in the Mina rail corridor and to identify preliminary alternative segments (DIRS 180222-BSC 2006, all).

Based on this preliminary feasibility study, and the resultant alternative segments and common segments, DOE determined that the Mina rail corridor did warrant further detailed study.

The resulting alternative segments and common segments were presented in the Amended Notice of Intent. Through the Notice, DOE solicited input from the public regarding either the elimination of alternative segments, or identification and evaluation of any additional alternative segments within the Caliente rail corridor or Mina rail corridor that would reduce or avoid potential adverse environmental impacts.

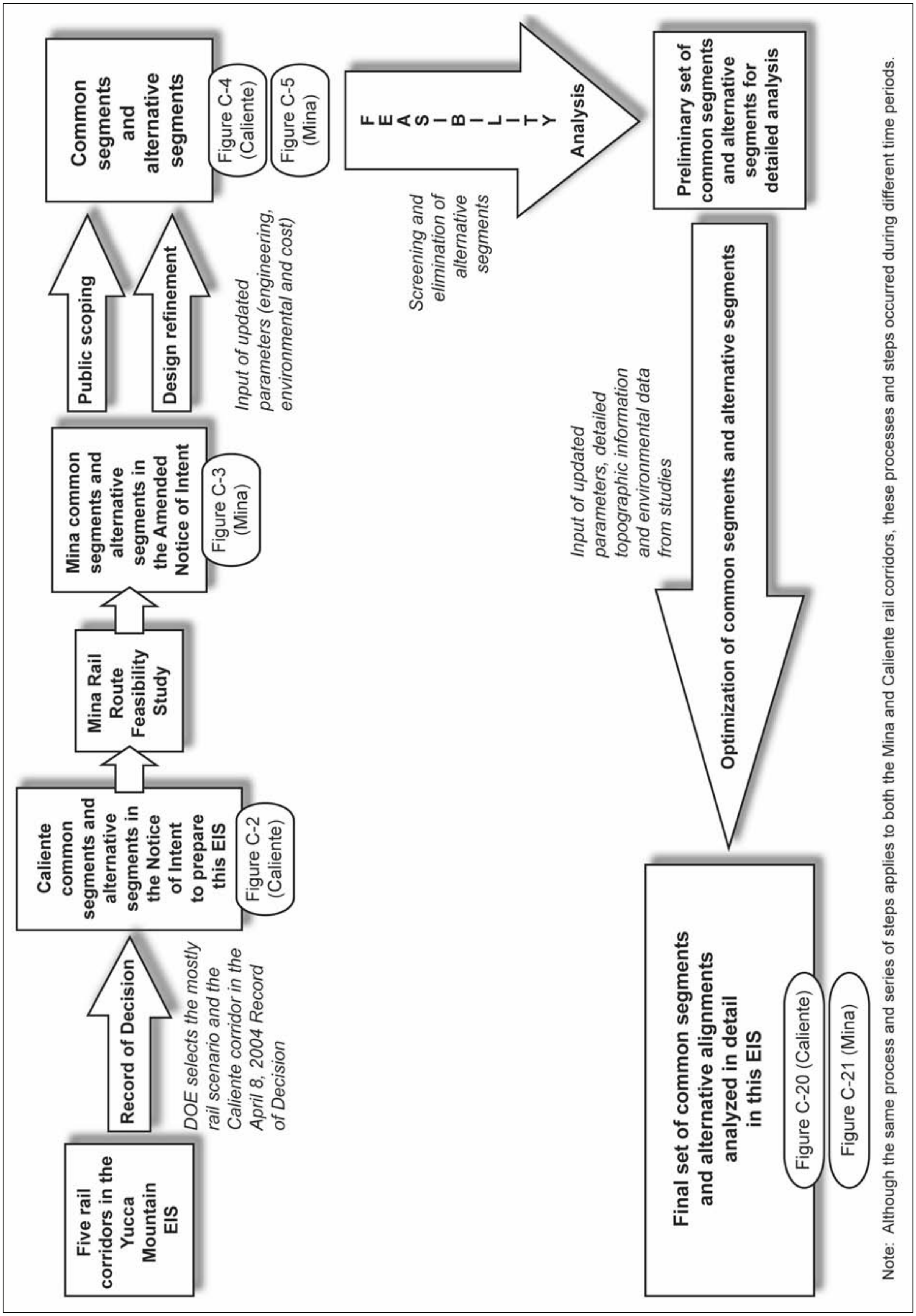

Figure C-1. Process used to evaluate the Caliente and Mina rail corridors.

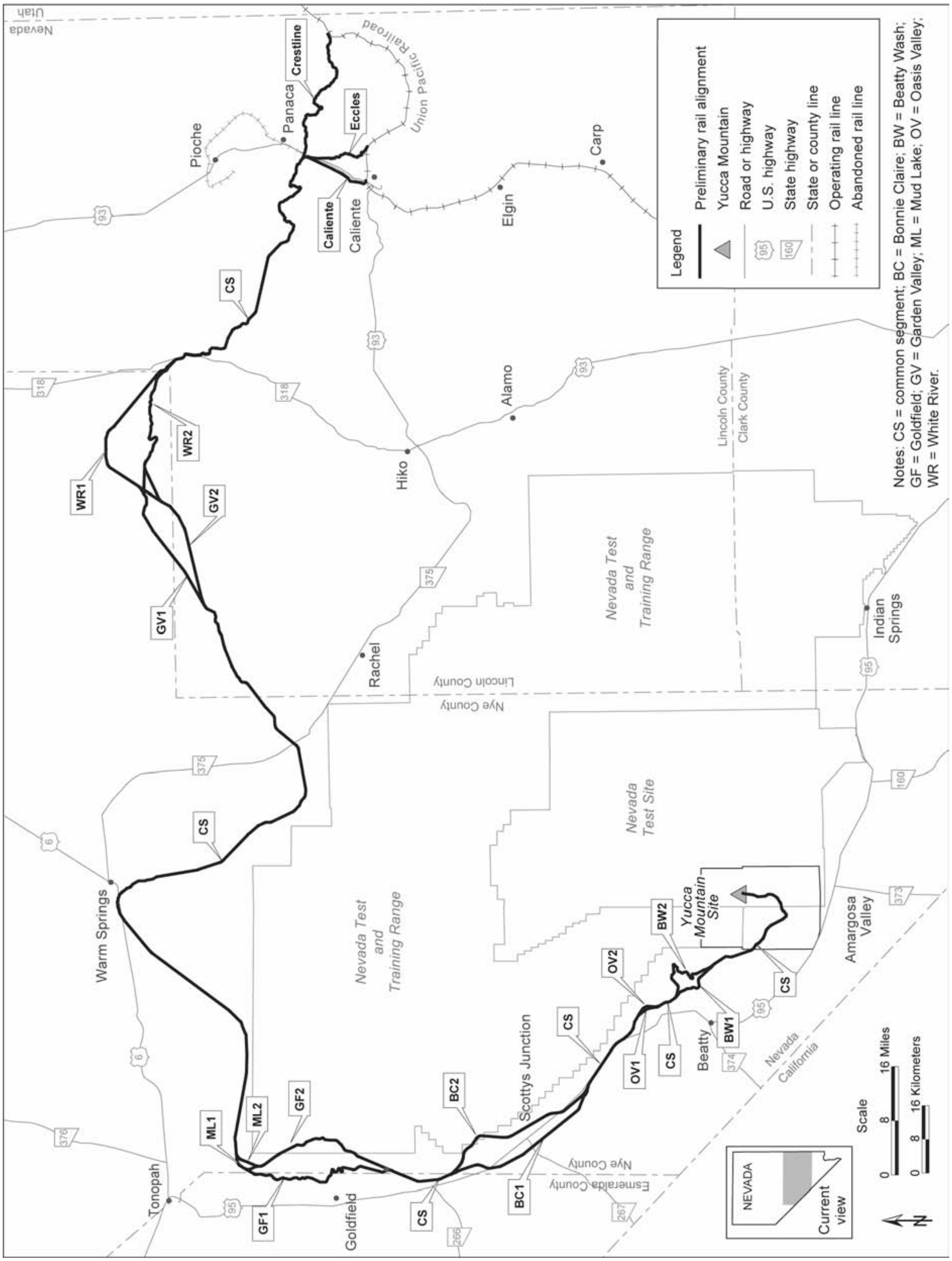

Figure C-2. Caliente rail corridor preliminary alternative segments and common segments as identified in the Notice of Intent.

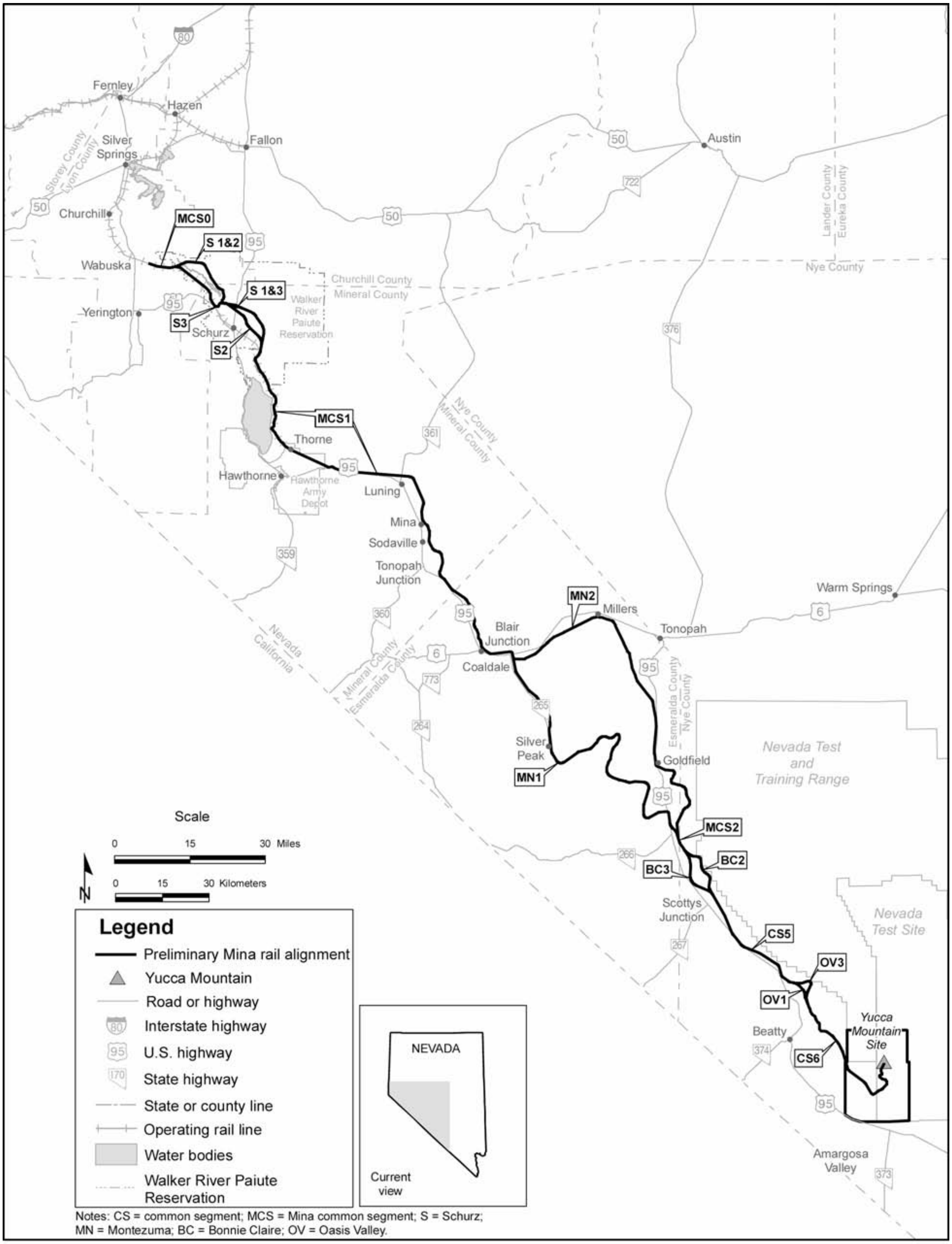

Figure C-3. Mina rail corridor preliminary alternative segments and common segments as identified in the Amended Notice of Intent.

C.2 Public Scoping

C.2.1 CALIENTE RAIL ALIGNMENT PUBLIC SCOPING

The Notice of Intent identified preliminary alternative segments to be evaluated in the Rail Alignment EIS. DOE evaluated all public comments received as a result of the public scoping process.

The Department considered comments the Bureau of Land Management (BLM) received during its public meetings on the DOE proposed land ***withdrawal*** from surface and mining entry for the Caliente rail corridor (see Chapter 1 of the Rail Alignment EIS) and information from interviews conducted by Lincoln and Nye Counties.

From these sources, DOE identified and evaluated all comments that could affect the preliminary alternative segments identified in the Notice of Intent and common segments. Some commenters offered specific recommendations or alternative segments, such as:

- Establish the interface with the Union Pacific Railroad near Elgin, Nevada.
- Start in Caliente, Nevada, and follow U.S. Highway 93 and State Route 375 to avoid Garden Valley.
- Cross south of the Weepah Springs Wilderness and pass through Seaman Narrows to Murphy Gap and then north to avoid Garden Valley.
- Bypass Goldfield to the west to avoid the town and its historic mining district.

Commenters also suggested that DOE use various criteria to modify the preliminary alternative segments and to identify new alternative segments. For example, commenters suggested that DOE avoid conflicts with, or impacts to, sensitive biological and cultural resources, mineral resources, mining operations, American Indian Trust Lands, the Nevada Test and Training Range, ranching and grazing land uses, and private lands.

C.2.2 MINA RAIL ALIGNMENT PUBLIC SCOPING

In the Amended Notice of Intent, DOE invited public comments concerning the evaluation of the Mina rail alignment in the Rail Alignment EIS. DOE developed a range of alternative segments for the Mina rail corridor to be evaluated in the EIS. The initial alternative segments and common segments were documented in the *Mina Rail Route Feasibility Study* (DIRS 180222-BSC 2006, all). DOE presented the preliminary alternative segments at public scoping meetings and through information provided at reading rooms in various towns in the general vicinity of the Mina rail corridor (see Chapter 1 of the Rail Alignment EIS).

DOE considered comments that suggested specific alternative segments and comments that could be construed as criteria to modify the preliminary alternative segments and common segments described in the Amended Notice of Intent, or as criteria to identify new alternative segments. Some commenters offered specific recommendations or alternative segments, for example:

- Follow the existing (unused) rail roadbed through Tonopah to minimize impacts.
- Follow the existing rail roadbed where feasible.
- Move Mina rail alignment Montezuma alternative segment 2/Caliente rail alignment Goldfield alternative segment 4 as far west as possible to avoid mining claims in the area.
- Avoid all communities.

DOE considered all comments and in some cases identified alternative segments that warranted further investigation. Commenters also suggested that DOE use various criteria to modify the preliminary alternative segments and to identify new alternative segments.

C.3 Alignment Identification and Analysis

C.3.1 CALIENTE RAIL CORRIDOR ALIGNMENT IDENTIFICATION AND ANALYSIS

Following the public scoping process, DOE identified additional alternative segments for the Caliente rail alignment, and modified the preliminary alternative segments and common segments identified in the Notice of Intent. To do so, DOE used a computer-based modeling system that allowed the Department to consider multiple alternative segments within the geographic area of the Caliente rail corridor.

First, DOE used the computer modeling system to evaluate topographic data to determine whether common segments and alternative segments would be relatively linear, or whether they would need to curve to avoid or reduce conflicts with areas having greater topographic relief, such as mountain ranges or associated foothills. Topographic data were based on U.S. Geological Survey maps compiled from two sets of information: (1) year 2003 roads, streams, and other landmarks and (2) year 2000 (or more recent) contour data. The system integrated topographic data with engineering factors, specifically the project-specific design elements and the associated standard. Table C-1 lists the primary engineering factors and standards DOE considered.

Table C-1. Primary engineering factors considered in the identification and analysis of Caliente and Mina alternative segments and common segments[a] (page 1 of 2).

Design element	Standard	Refinement software input
Civil works design speed	60 miles per hour[b]	Included in curvature and grade specifications
Operating train speed	Maximum 50 miles per hour	Included in curvature and grade specifications
Construction right-of-way width	1,000 feet[c] (nominal)	Defined 1,000-foot-wide right-of-way
Operations right-of-way width (minimum)	200 feet (nominal); expected to be narrower than the construction right-of-way in most cases. In some areas it could be the same width as the construction right-of-way. Actual operations right-of-way would be defined during final design.	Addressed by setting cut bench width
Vertical curves: rate of change between track gradients	Comply with American Railway Engineering and Maintenance-of-Way Association speed-based criteria	Defined in network data settings
Rail roadbed section		
Roadbed width (fill)	15 feet 6 inches[d] from centerline, 31 feet total	Generalized cross sections addressed through settings of cut bench width and geotypes
Roadbed width (cut)	62 feet total	
Subballast depth	Minimum 6 inches	

Table C-1. Primary engineering factors considered in the identification and analysis of Caliente and Mina alternative segments and common segments[a] (page 2 of 2).

Design element	Standard	Refinement software input
Vertical grades		
Maximum (allowable)	2 percent (curve-compensated)	Network data set so that grades on curves had to be compensated at 0.04 percent per degree of curve
Horizontal curve	6°–00" (mainline); radius = 955 feet	Defined in network data settings
Maximum degree of curve for yards and sidings	10°–00"; radius = 574 feet	
Minimum length of spiral per 0.5 inch of superelevation	30 feet	
Tangent lengths (between horizontal reverse curves)	300 feet 150 feet (yards, sidings, and back tracks)	Approximated with stiffness parameter in network data settings
Clearances for highway overpass		
Vertical	24 feet minimum	Vertical clearances requirements set as linear feature crossing rule

a. Source: DIRS 176584-Nevada Rail Partners 2006, all.
b. To convert miles per hour to kilometers per hour, multiply by 1.6093.
c. To convert feet to meters, multiply by 0.3048.
d. To convert inches to centimeters, multiply by 2.54.

DOE considered the following environmental and land-use features:

- Springs
- Wilderness Areas, Wilderness Study Areas, and wildlife preserves
- Locations of sensitive biological species
- Cultural resources
- Private lands, including patented mining claims
- Native American Trust Lands
- Federally managed lands, including the Nevada Test and Training Range, U.S. Forest Service lands, and National Parks

With this integrated information, the computer modeling system identified and evaluated several million routes within the geographic limits defined by the input of start and stop points. The system, however, identified the 20 to 50 potential routes (for each start/stop point set) that came closest to, or most satisfied, engineering factors, and minimized or avoided conflicts with environmental and land-use features at the lowest cost to construct. Based on this information, DOE selected one route, known as the Caliente rail alignment, for further evaluation (DIRS 176584-Nevada Rail Partners 2006, all). This rail alignment consists of alternative segments and common segments.

For each alternative segment and common segment, the computer modeling system provided information and data in a number of ways, including plan and profile, horizontal and vertical curvatures, and grade profiles. DOE used this information and data to estimate construction-related items such as earthworks (***cuts***, ***fills***, and haulage) and rail roadbeds (***subballast***, ***ballast***, track, and ties), and to identify design features such as bridges, overpasses, and underpasses. DOE also used the computer modeling system to develop preliminary construction-cost estimates by considering cost factors for construction-related items and design features. In general, the avoidance of environmental and land-use features typically resulted in alternative segments and common that were longer, which tended to increase earthworks, length of rail roadbeds, the number of structures, and, thus, construction costs (DIRS 176584-Nevada Rail Partners 2006, all).

Figure C-4 shows the full suite of common segments and potential alternative segments DOE produced for the Caliente rail corridor as a result of its analyses and public scoping comments.

C.3.2 MINA RAIL CORRIDOR ALIGNMENT IDENTIFICATION AND ANALYSIS

DOE developed the *Mina Rail Route Feasibility Study* (DIRS 180222-BSC 2006, all) to determine the feasibility of identifying a 0.4-kilometer (0.25-mile)-wide corridor in which to engineer a rail alignment that meets specific engineering criteria. As with the Caliente rail alignment, DOE employed software (using data from the feasibility study) to determine the feasibility of new alternative segments and common segments and realign existing alternative segments and common segments based on comments received during the scoping period. The software computes each segment's horizontal and vertical geometry and the cut and fill (earthwork) needed to construct each. The software then computes the segment geometries, incorporating topographic information, location-specific information, cross-section templates, and engineering criteria (as listed in Table C-1). Also addressed within the system were environmental and land-use features to be considered including:

- Springs
- Wilderness Areas, Wilderness Study Areas and wildlife preserves
- Locations of sensitive biological species
- Cultural resources
- Private lands, including patented mining claims
- American Indian Trust Lands
- Federally managed lands, including the Hawthorne Army Depot, U.S. Forest Service Lands, and national parks

The modeling software derived alternative segments and common segments that met the applicable design criteria while addressing the need to minimize or avoid potentially adverse environmental impacts.

For each alternative segment and common segment, the software provided information and data in a number of ways, including plan and profile, horizontal and vertical curvatures, and grade profiles. DOE used this information and data for each alternative segment and common segment to estimate construction-related items such as earthworks (cuts, fills, and haulage) and rail roadbeds (subballast, ballast, track, and ties), and to identify design features such as bridges, overpasses, and underpasses.

DOE also used the software to develop preliminary construction cost estimates by considering cost factors for construction-related items and design features. In general, the avoidance of environmental features typically resulted in longer common segments and alternative segments, which tended to increase earthworks, length of rail roadbeds, and the number of structures, and thus construction costs (DIRS 176584-Nevada Rail Partners 2006, all).

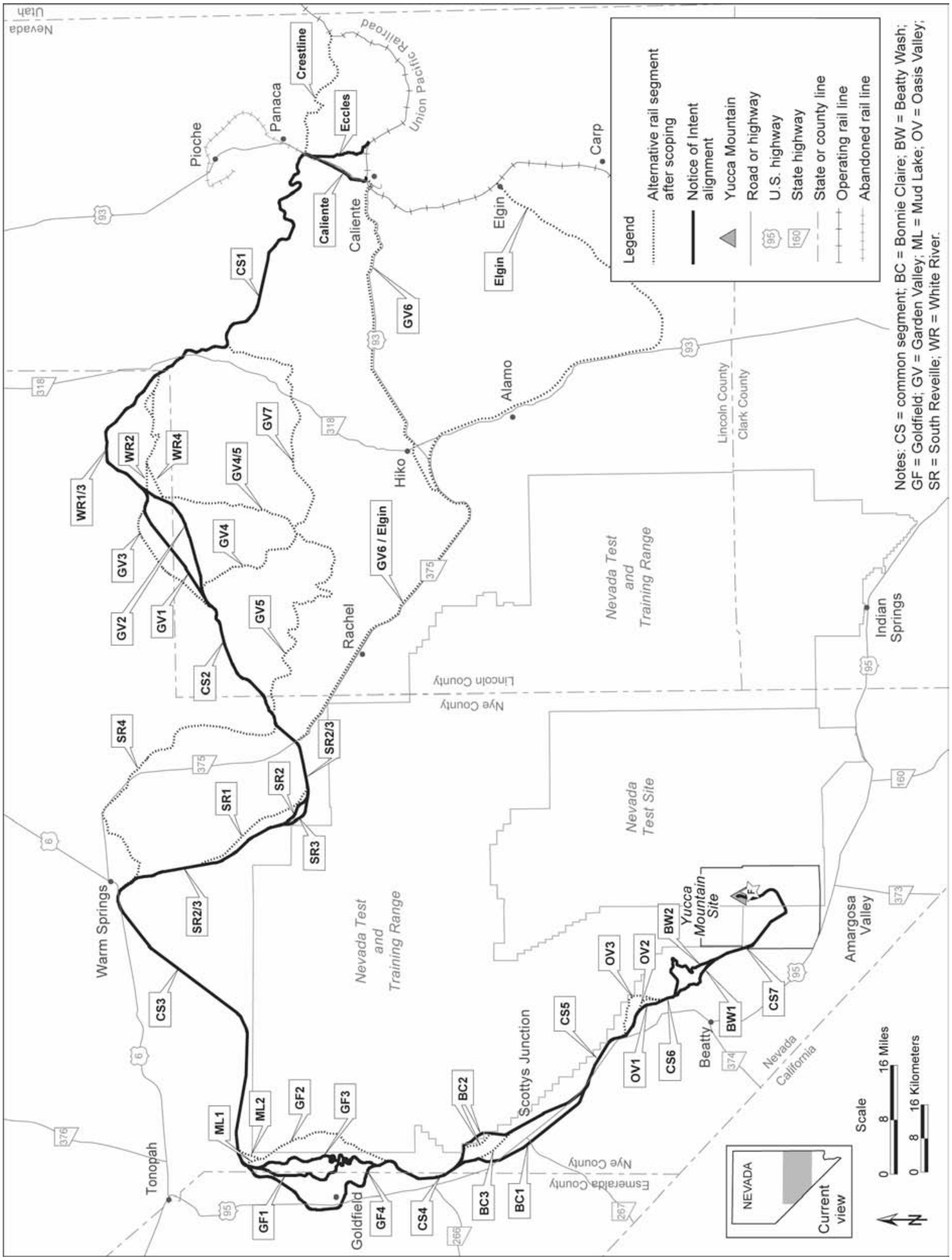

Figure C-4. Suite of potential alternative segments for the Caliente rail corridor.

As a result of the scoping process and subsequent analyses, DOE made several changes to the Mina rail alignment, as follows:

- At the request of the Walker River Paiute Tribe, eliminated two of the initial Schurz alternative segments and added three others.
- Made a slight modification to Mina common segment 1 in the Redlich area.
- Added a new alternative segment called Montezuma 3, which combined the northern section of Montezuma 2 and the southern section of Montezuma 1 with a crossover along the alluvial fans north of the Montezuma Range. The result was a new alignment that would avoid the communities of Goldfield and Silver Peak.

Figure C-5 shows the full suite of alternative segments and common segments DOE produced for the Mina rail corridor as a result of its analyses and public scoping comments.

C.4 Alternative Segments Eliminated from Detailed Analysis

Council on Environmental Quality regulations that implement the procedural requirements of NEPA (40 CFR 1502.14) and DOE regulations (10 CFR Part 1021) require the identification and evaluation of a range of alternatives that might accomplish the objectives of the Proposed Action. In accordance with these regulations, this section briefly describes the alternative segments DOE eliminated from detailed study and the reasons for their elimination. Alternative segments and common segments DOE did not eliminate are those that are practical or feasible from a technical, environmental, and economic standpoint.

DOE adjusted alternative segments and common segments described in Section 2.2 of the Rail Alignment EIS from those identified in the Notice of Intent and the Amended Notice of Intent. In some cases, the lengths of the common segments have changed as alternative segments have been eliminated. The primary reasons for eliminating or adjusting an alternative segment include:

- Environmental constraints, such as impacts to Wilderness Areas or wildlife preserves
- Avoidance of private lands, mineral resources, or oil resources
- Engineering considerations, such as steep, heavy grades; tight curvature; tunneling; or excessive excavation or placement of fill materials
- Public safety and national security issues associated with the Nevada Test and Training Range

C.4.1 CALIENTE RAIL ALIGNMENT ALTERNATIVE SEGMENTS ELIMINATED FROM DETAILED ANALYSIS

Figure C-6 shows the Caliente rail alignment alternative segments DOE eliminated from detailed analysis. Table C-2 lists the alternative segments DOE identified in its Notice of Intent (69 *FR* 18565, April 8, 2004) and added for consideration based on public comments received during the EIS scoping process. The table also summarizes the reasons DOE eliminated certain of these alternative segments from detailed analysis in the Rail Alignment EIS.

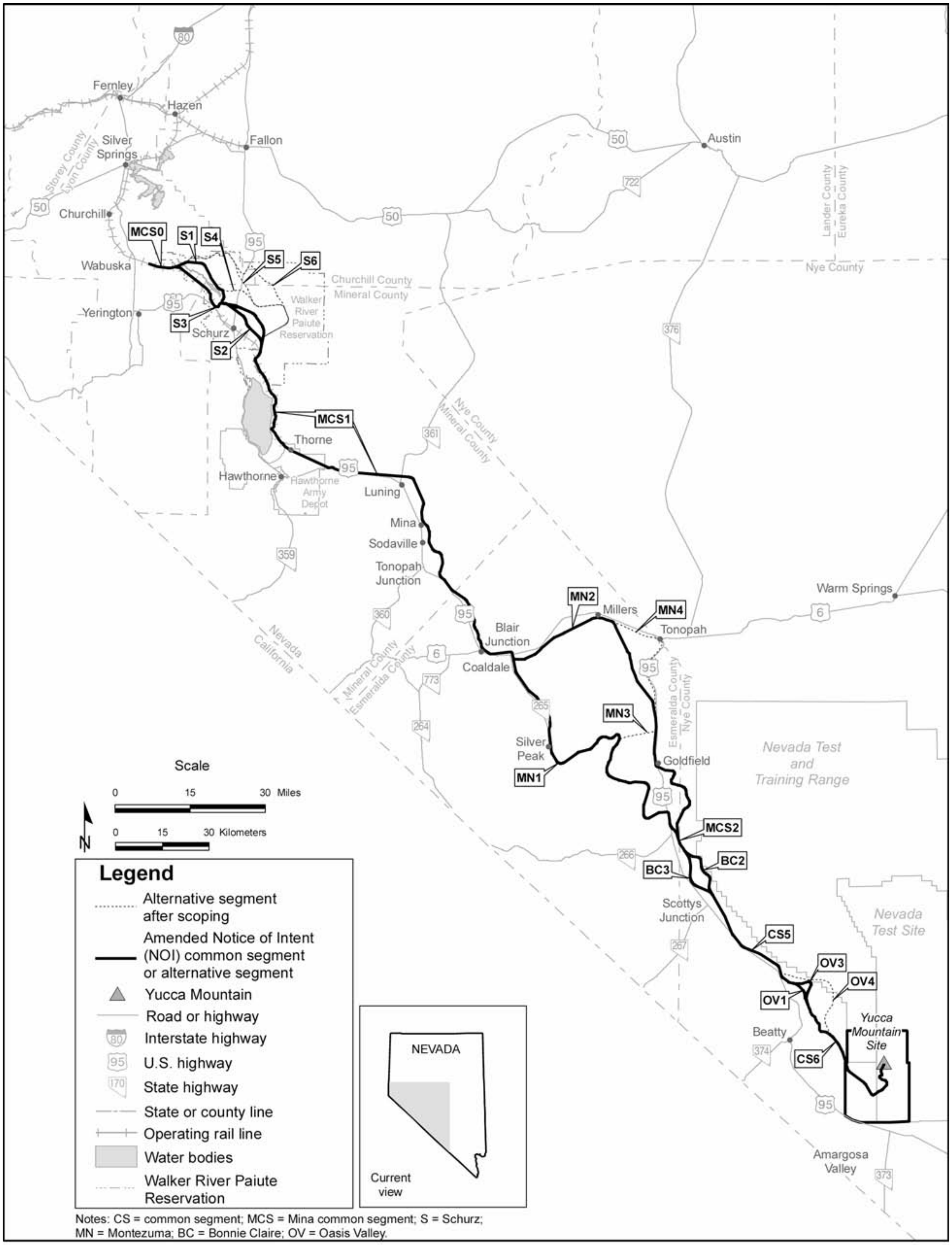

Figure C-5. Suite of potential alternative segments for the Mina rail corridor.

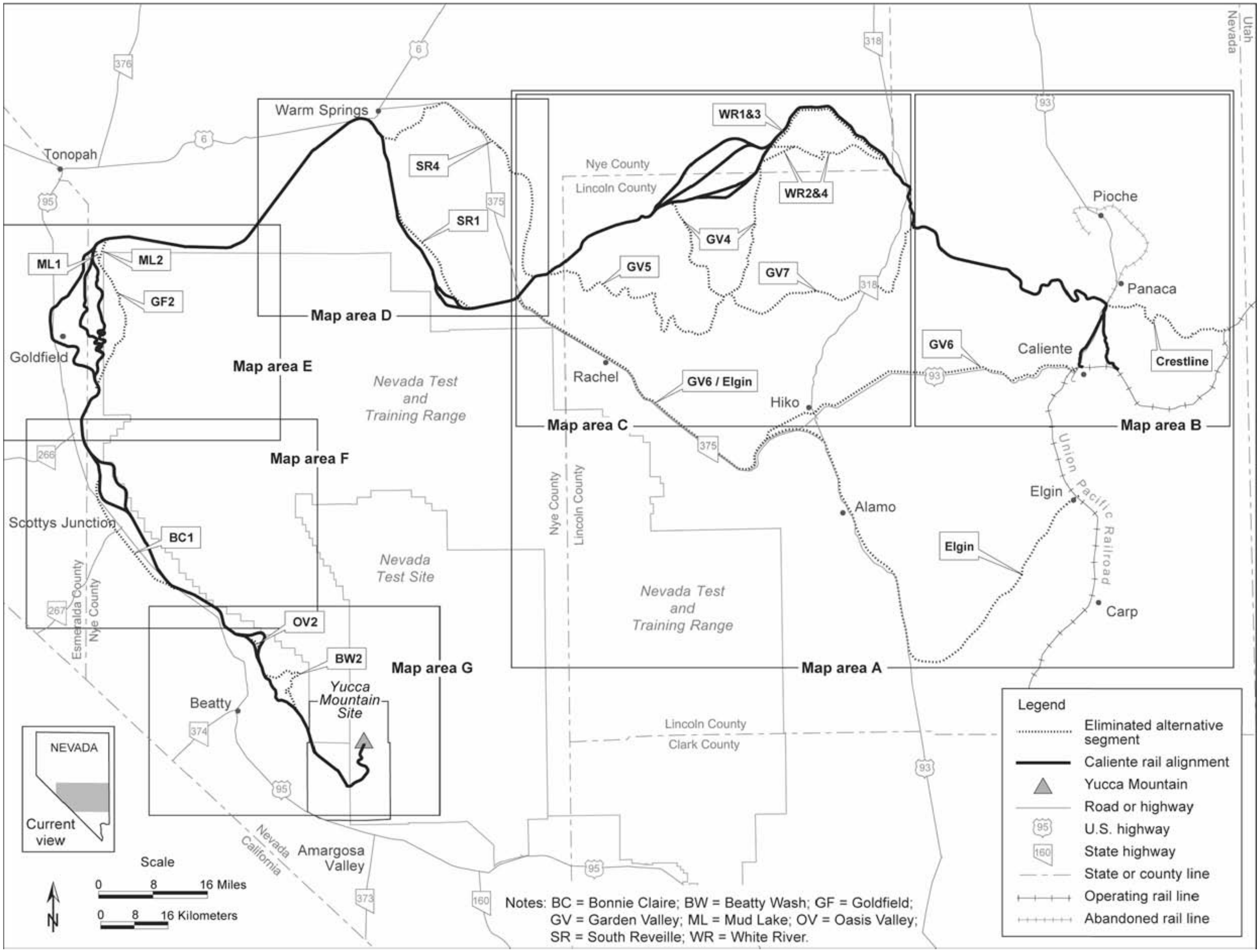

Figure C-6. Caliente rail alignment alternative segments DOE eliminated from detailed analysis.

Table C-2. Caliente rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 1 of 3).

Map area	Alternative segment	Notice of Intent	Scoping	Analyzed in detail or eliminated
Interface with the Union Pacific Railroad Mainline	Caliente	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Eccles	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Crestline	Alternative segment identified		Eliminated because engineering criteria not met.
	Elgin		Alternative segment identified	Eliminated because it would exceed maximum allowable grade.
White River Valley Area	White River 1	Alternative segment identified		With the elimination of White River 2 and 3, White River 1 became part of common segment 1.
	White River 2	Alternative segment identified		Eliminated because engineering criteria not met and possible requirement for tunnel through Timber Mountains.
	White River 3		Alternative segment identified	When White River 2 and 3 were eliminated, White River 3 became part of common segment 1.
	White River 4		Alternative segment identified	Eliminated because engineering criteria not met and possible requirement for tunnel through Timber Mountains.
Garden Valley Area	Garden Valley 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Garden Valley 2	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Garden Valley 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Garden Valley 4		Alternative segment identified	Eliminated because of operational issues.
	Garden Valley 5		Alternative segment identified	Eliminated because engineering criteria not met.
	Garden Valley 6		Alternative segment identified	Eliminated because engineering criteria not met.
	Garden Valley 7		Alternative segment identified	Eliminated because engineering criteria not met.
	Garden Valley 8		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.

Table C-2. Caliente rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 2 of 3).

Map area	Alternative segment	Notice of Intent	Scoping	Analyzed in detail or eliminated
South Reveille Area	South Reveille 1	Alternative segment identified		Eliminated because it would cross into the South Reveille Wilderness Study Area.
	South Reveille 2		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	South Reveille 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	South Reveille 4		Alternative segment identified	Eliminated because engineering criteria not met.
Mud Lake Area	Mud Lake 1	Alternative segment identified		Eliminated because it links to Goldfield 2, which was also eliminated.
	Mud Lake 2	Alternative segment identified		Eliminated because it links to Goldfield 2, which was also eliminated.
Goldfield Area	Goldfield 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Goldfield 2	Alternative segment identified		Eliminated because it would enter the Nevada Test and Training Range.
	Goldfield 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Goldfield 4		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
Bonnie Claire Area	Bonnie Claire 1	Alternative segment identified		Eliminated because it would enter Timbisha Shoshone Trust Lands.
	Bonnie Claire 2	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Bonnie Claire 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
Oasis Valley Area	Oasis Valley 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Oasis Valley 2	Alternative segment identified		Eliminated during the public scoping process because engineering factors and land use features are similar to Oasis Valley 1.
	Oasis Valley 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.

Table C-2. Caliente rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 3 of 3).

Map area	Alternative segment	Notice of Intent	Scoping	Analyzed in detail or eliminated
Beatty Wash Area	Beatty Wash 1	Alternative segment identified		When Beatty Wash 2 was eliminated, Beatty Wash 1 became part of common segment 6.
	Beatty Wash 2	Alternative segment identified		Eliminated because engineering criteria not met.

C.4.1.1 Alternative Segments at the Interface with the Union Pacific Railroad Mainline

DOE identified four alternative segments to connect the rail line to the existing mainline railroad in eastern Nevada (Figures C-7 and C-8). The Notice of Intent identified Caliente, Eccles, and Crestline as possible interface locations near Caliente, Nevada. In response to public scoping comments suggesting an interface location near the town of Elgin, Nevada, DOE identified Elgin as a fourth alternative segment. The Department then evaluated whether these four alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. The terrain around Crestline rendered it technically infeasible and Elgin would exceed the maximum allowable grade. Based on this analysis, DOE eliminated Crestline and Elgin from detailed analysis in the Rail Alignment EIS. The Department found the Caliente and Eccles alternative segments to be feasible from a technical and economic standpoint. Table C-3 provides a comparison of the key factors the Department used in this determination.

Table C-3. Comparison of possible alternative segments for the Interface with the Union Pacific Railroad Mainline.[a]

Attribute	**Crestline**	Eccles	Caliente	**Elgin**
Length (kilometers)[b]	39	18	18	225[c]
Construction cost ($ millions)	140	148	71.6	1,500[c]
Engineering factors	Rugged terrain and insufficient flat land to accommodate rail yard and associated facilities at the interchange with the Union Pacific Railroad mainline	Meets engineering design criteria	Meets engineering design criteria	Would exceed maximum allowable grade
Key environmental and land-use features	No notable environmental or land-use constraints	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	No notable environmental or land-use constraints

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.
c. Elgin interface does not share a common end point with the other interface alternative segments.

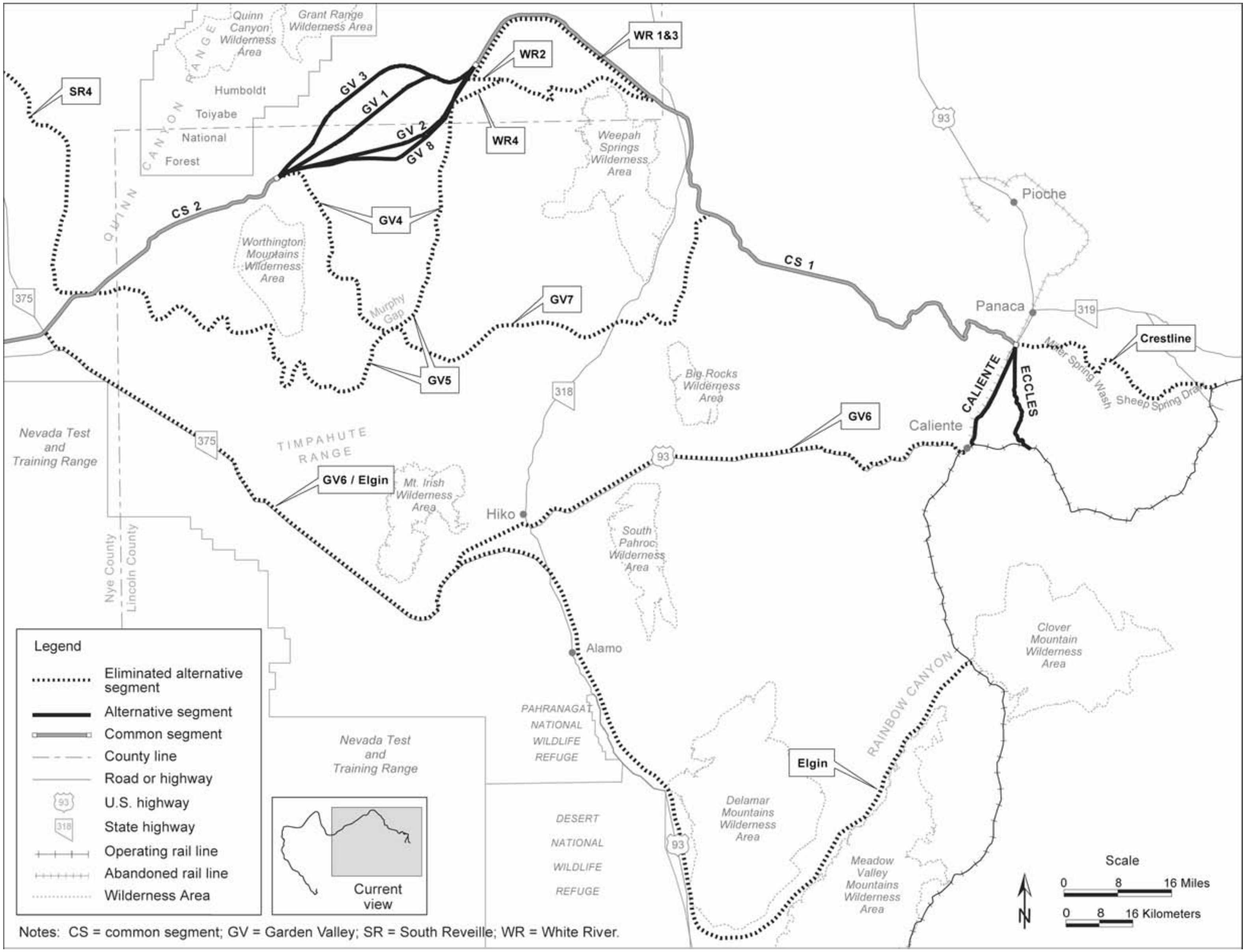

Figure C-7. Eliminated segments within Caliente map area A.

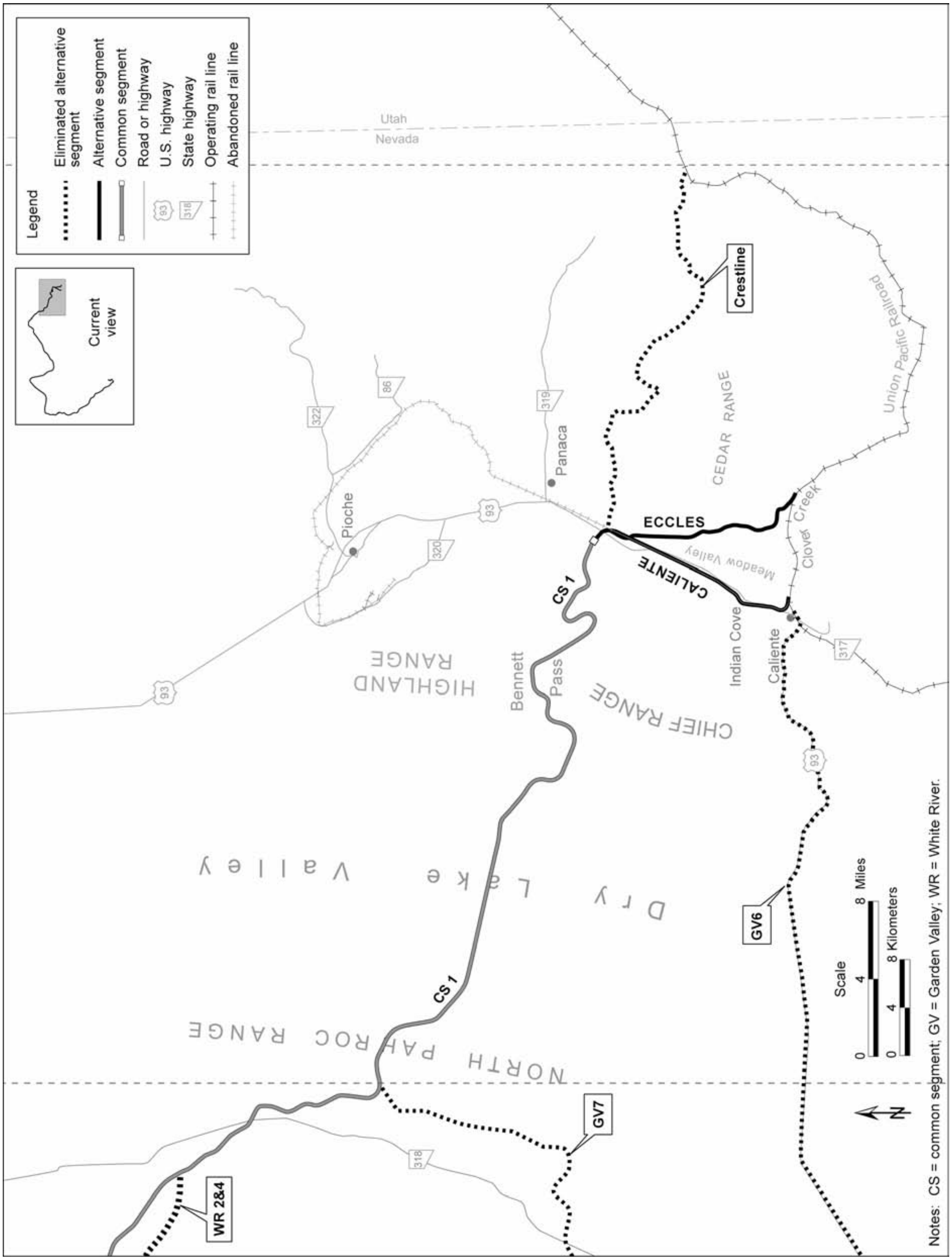

Figure C-8. Eliminated segments within Caliente map area B.

C.4.1.2 White River Valley Alternative Segments

DOE identified four possible alternative segments in the White River Valley area (Figures C-7 and C-9). The Notice of Intent identified White River 1 and White River 2. Later, DOE identified alternative segments White River 3 and White River 4 to avoid the Weepah Springs Wilderness. The Department then evaluated whether these four alternative segments would be technically feasible according to the engineering design criteria, estimated the cost to construct each alternative segment, and considered the environmental and land-use features associated with each. White River 2 and White River 4 would have required long stretches at the maximum allowable grade, might have required a tunnel through the Timber Mountains, and would be three times as costly as White River 1 and White River 3. Based on this analysis, DOE eliminated White River 2 and White River 4 from detailed analysis in the Rail Alignment EIS. DOE found White River 1 and 3 to be feasible from a technical and economic standpoint. Table C-4 provides a comparison of the key factors used in this determination.

Because DOE eliminated White River 2 and White River 4 from consideration, it was no longer necessary to maintain a distinction between White River 1 and White River 3. Although White River 3 was slightly longer than White River 1, elimination of White River 2 and White River 4 allowed DOE to establish a common end for White River 1 and White River 3, and then made the two alternative segments part of Caliente common segment 1.

Table C-4. Comparison of possible alternative segments in the White River Valley area.[a]

Attribute	White River 1	**White River 2**	White River 3	**White River 4**
Length (kilometers)[b]	47	42	48	42
Construction cost ($ millions)	46	160	46	140
Engineering factors	Would include a short stretch at maximum allowable grade	Would require long stretches at maximum allowable grade and/or a potential tunnel through the Timber Mountains	Would include a short stretch at maximum allowable grade	Would require long stretches at maximum allowable grade and/or a potential tunnel through the Timber Mountains
Key environmental and land-use features	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints

a. Eliminated alternative segments are shown in bold.
b. To convert kilometers to miles, multiply by 0.62137.

C.4.1.3 Garden Valley Alternative Segments

DOE identified eight alternative segments in the Garden Valley area (Figures C-7 and C-9). The Notice of Intent identified Garden Valley 1 and Garden Valley 2. In response to public scoping comments regarding Garden Valley and perceived noise and visual impacts to an earthworks sculpture, *City*, DOE identified six additional alternative segments in the area (Garden Valley 3 through Garden Valley 8). The Department then evaluated whether the eight alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Garden Valley 4, 5, 6, and 7 would either exceed maximum allowable grade or require significant earthwork or construction of tunnels. Also, these alternative segments would have been longer than other available alternative segments in Garden Valley. For these reasons, construction costs for Garden Valley 4, 5, 6, and 7 would have been significantly greater than for any of the other Garden Valley alternative segments. Therefore, DOE eliminated Garden Valley 4, 5, 6, and 7 from detailed analysis in the Rail Alignment EIS. Garden Valley 1, 2, 3, and 8 would be feasible from a technical, environmental, land-use, and economic standpoint. Table C-5 provides a comparison of the key factors DOE used in this determination.

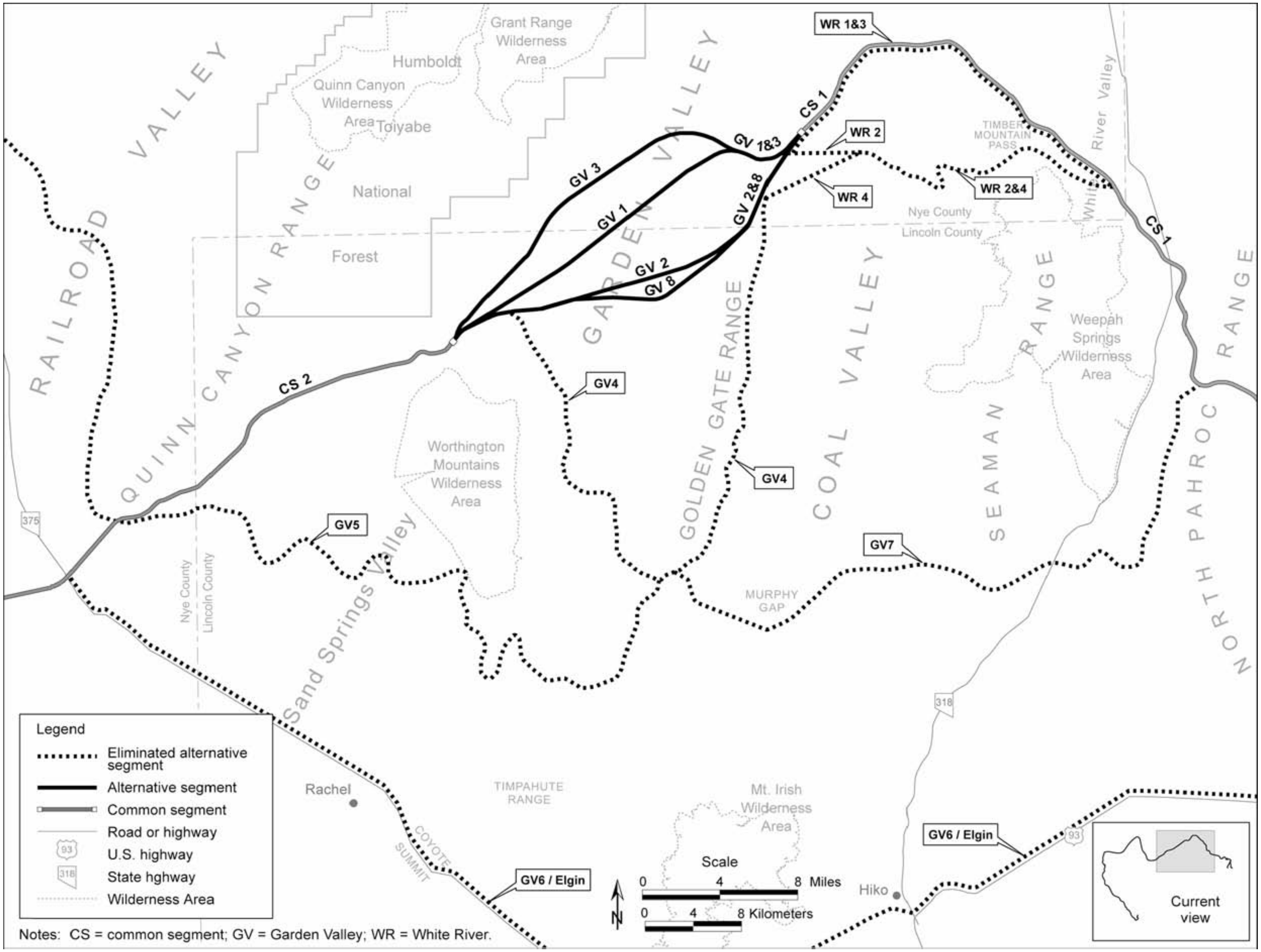

Figure C-9. Eliminated segments within Caliente map area C.

Table C-5. Comparison of possible alternative segments in Garden Valley.[a]

Attribute	Garden Valley 1	Garden Valley 2	Garden Valley 3	**Garden Valley 4**	**Garden Valley 5**	**Garden Valley 6**	**Garden Valley 7**	Garden Valley 8
Length (kilometers)[b]	35	36	38	68[c]	100[c]	160[c]	100[c]	37
Construction cost ($ millions)	126	120	109	170	160[d]	1,600[d]	380[d]	154
Engineering factors	Meets engineering design criteria	Meets engineering design criteria	Meets engineering design criteria	Would require more than 10 miles of continuous maximum allowable grade through Murphy Gap	Would exceed maximum allowable grade and there would be more than 10 miles of continuous maximum grade	Would require extensive tunneling to exit Caliente and then through each of the three passes to the west	Would require more than 10 miles of continuous maximum allowable grade through Murphy Gap	Meets engineering design criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints	No notable environmental or land-use constraints

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.
c. Garden Valley 4, 5, 6, and 7 do not share common starting and ending points with the other Garden Valley alternative segments.
d. Cost is approximate because the computer-based modeling system could not identify a feasible alignment for which construction costs could be estimated.

C.4.1.4 South Reveille Alternative Segments

DOE identified four alternative segments in the South Reveille area, South Reveille 1 through South Reveille 4 (Figure C-10). South Reveille 1 was originally considered a common segment in the Notice of Intent, but became an alternative segment with the addition of South Reveille 2, South Reveille 3, and South Reveille 4. DOE developed these alternative segments in response to public scoping comments to avoid the South Reveille Wilderness Study Area, which the original common segment (South Reveille 1) would intersect. The Department then evaluated whether these four alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the potential environmental and land-use features associated with each. DOE concluded that South Reveille 1 would be incompatible with the current uses of the South Reveille Wilderness Study Area, and that South Reveille 4 would exceed the maximum allowable grade. Based on this analysis, the Department eliminated South Reveille 1 and South Reveille 4 from detailed analysis in the Rail Alignment EIS. Though there could be impacts to cultural resources along South Reveille 2 and land-uses along South Reveille 2 and 3 might be affected in the absence of mitigation, these constraints did not warrant elimination of South Reveille 2 and South Reveille 3. The DOE analysis found that South Reveille alternative segments 1 and 3 appear to be feasible from a technical and economic standpoint. Table C-6 provides a comparison of the key factors DOE used in this determination.

Table C-6. Comparison of possible alternative segments in Reveille Valley.[a]

Attribute	**South Reveille 1**	South Reveille 2	South Reveille 3	**South Reveille 4**
Length (kilometers)[b]	Alternative segment not evaluated because it would cross into the South Reveille Wilderness Study Area	19	20	84
Construction cost ($ millions)		82.6	80.3	126
Engineering factors		Meets engineering design criteria	Meets engineering design criteria	Would exceed maximum allowable grade
Key environmental and land-use features		Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

C.4.1.5 Mud Lake Alternative Segments

The Notice of Intent identified two alternative segments in the Mud Lake area, Mud Lake 1 and Mud Lake 2 (Figure C-11). Mud Lake alternative segments 1 and 2 would begin near the northwest corner of the Nevada Test and Training Range. Mud Lake 1 would pass about 2 kilometers (1 mile) northwest of Mud Lake, avoiding its western shore, and would extend south to connect with Goldfield alternative segment 2. Mud Lake 2 would depart Caliente common segment 3 and run farther to the east before connecting with Goldfield alternative segment 2. Due to this arrangement, both Mud Lake alternative segments were dependent on Goldfield 2 as a viable alternative segment. Therefore, when DOE eliminated Goldfield 2 from further analysis, as described below, both Mud Lake 1 and Mud Lake 2 were also eliminated.

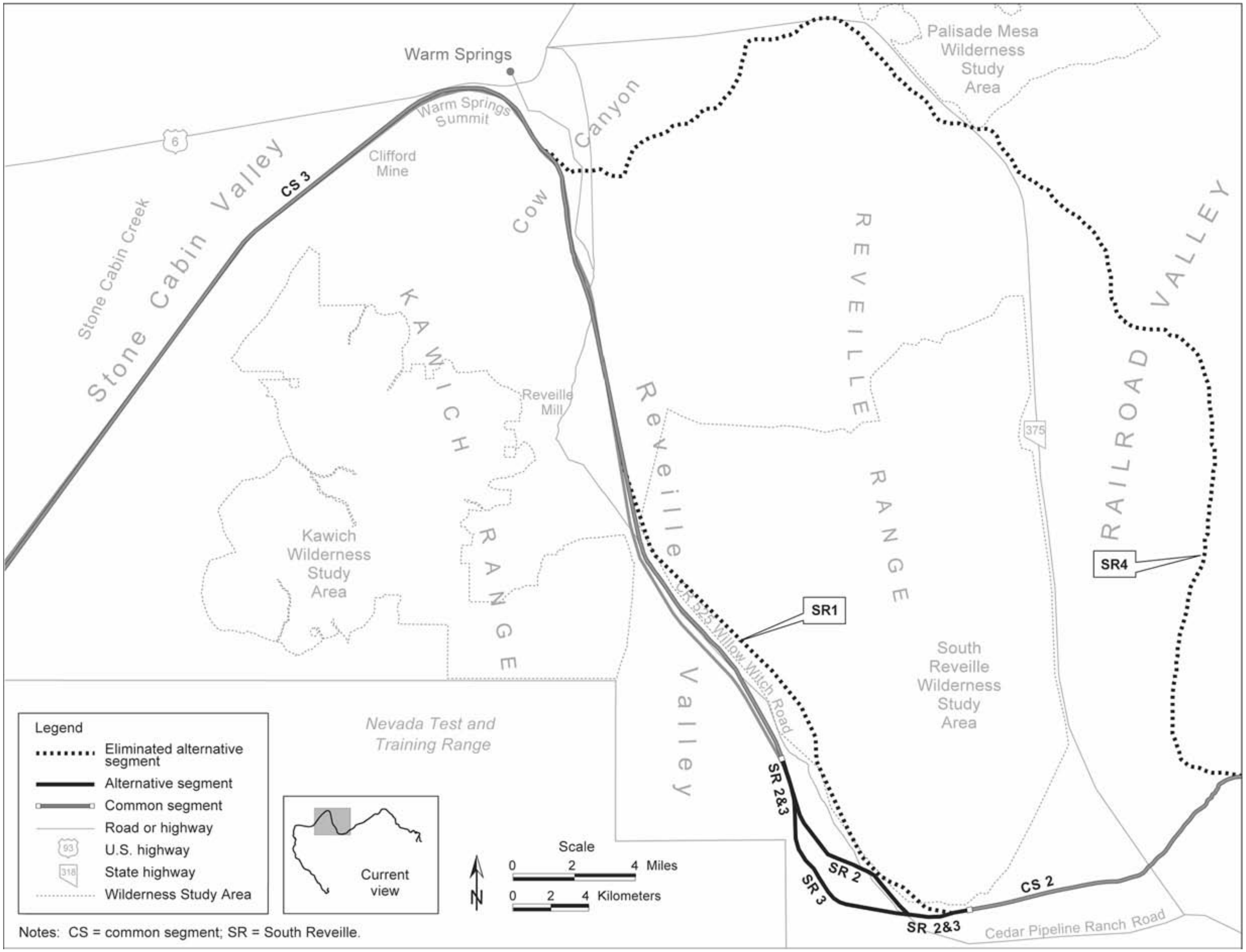

Figure C-10. Eliminated segments within Caliente map area D.

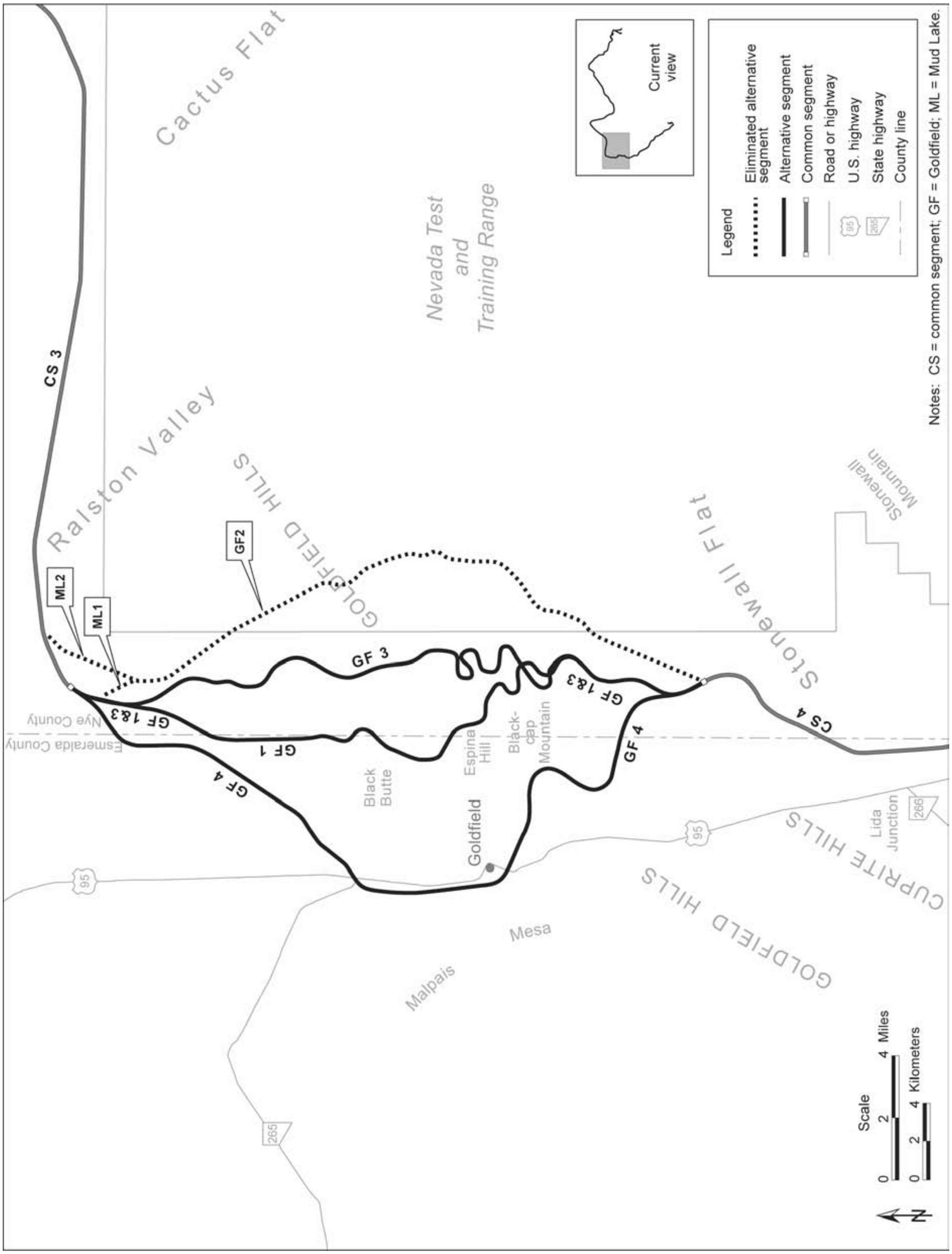

Figure C-11. Eliminated segments within Caliente map area E.

C.4.1.6 Goldfield Alternative Segments

DOE identified four alternative segments in the Goldfield area, Goldfield 1 through Goldfield 4 (Figure C-11). The Notice of Intent identified Goldfield 1 and Goldfield 2. DOE added Goldfield 3 and Goldfield 4 as a result of public scoping comments to avoid mineral resource areas to the north and east of Goldfield. The U.S. Air Force stated that a rail line would be incompatible with current uses of the Nevada Test and Training Range. Therefore, DOE eliminated Goldfield 2, which would enter the Nevada Test and Training Range, from detailed analysis. DOE then evaluated whether the remaining three Goldfield alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Table C-7 provides a comparison of the key factors DOE used in this determination.

Table C-7. Comparison of possible alternative segments in the Goldfield area.[a]

Attribute	Goldfield 1	**Goldfield 2**	Goldfield 3	Goldfield 4
Length (kilometers)[b]	47	Alternative segment not evaluated because it would enter the Nevada Test and Training Range	50	53
Construction cost ($ millions)	203		231	249
Engineering factors	Would cut through complex, steep terrain. Meets engineering design criteria.		Would cut through complex, steep terrain. Meets engineering design criteria.	Would require short stretch at maximum allowable grade. Meets engineering design criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination		Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

DOE found Goldfield alternative segments 1, 3, and 4 to have various construction and design complexities, such as grade-separated crossings, that would increase construction costs. Absent consideration of mitigation measures, each Goldfield alternative segment could also have the potential to impact mining interests and cultural resources. However, each alternative segment is feasible from a technical and economic standpoint and the environmental and land-use constraints do not warrant elimination of Goldfield 1, Goldfield 3, and Goldfield 4 from detailed analysis in the Rail Alignment EIS.

C.4.1.7 Bonnie Claire Alternative Segments

DOE identified three alternative segments in the Bonnie Claire area, Bonnie Claire 1 through Bonnie Claire 3 (Figure C-12). The Notice of Intent identified Bonnie Claire 1 and Bonnie Claire 2. As a result of public scoping comments that suggested avoiding the Nevada Test and Training Range and the Timbisha Shoshone Trust Lands near Scottys Junction, the Department modified Bonnie Claire 2 and identified a new alternative segment, Bonnie Claire 3. Additionally, based on comments from the Timbisha Shoshone Tribe that the rail line crossing their lands would be incompatible with their current and planned land uses, the Department eliminated Bonnie Claire 1 from detailed analysis in the Rail Alignment EIS. DOE then determined whether Bonnie Claire 2 and Bonnie Claire 3 would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and

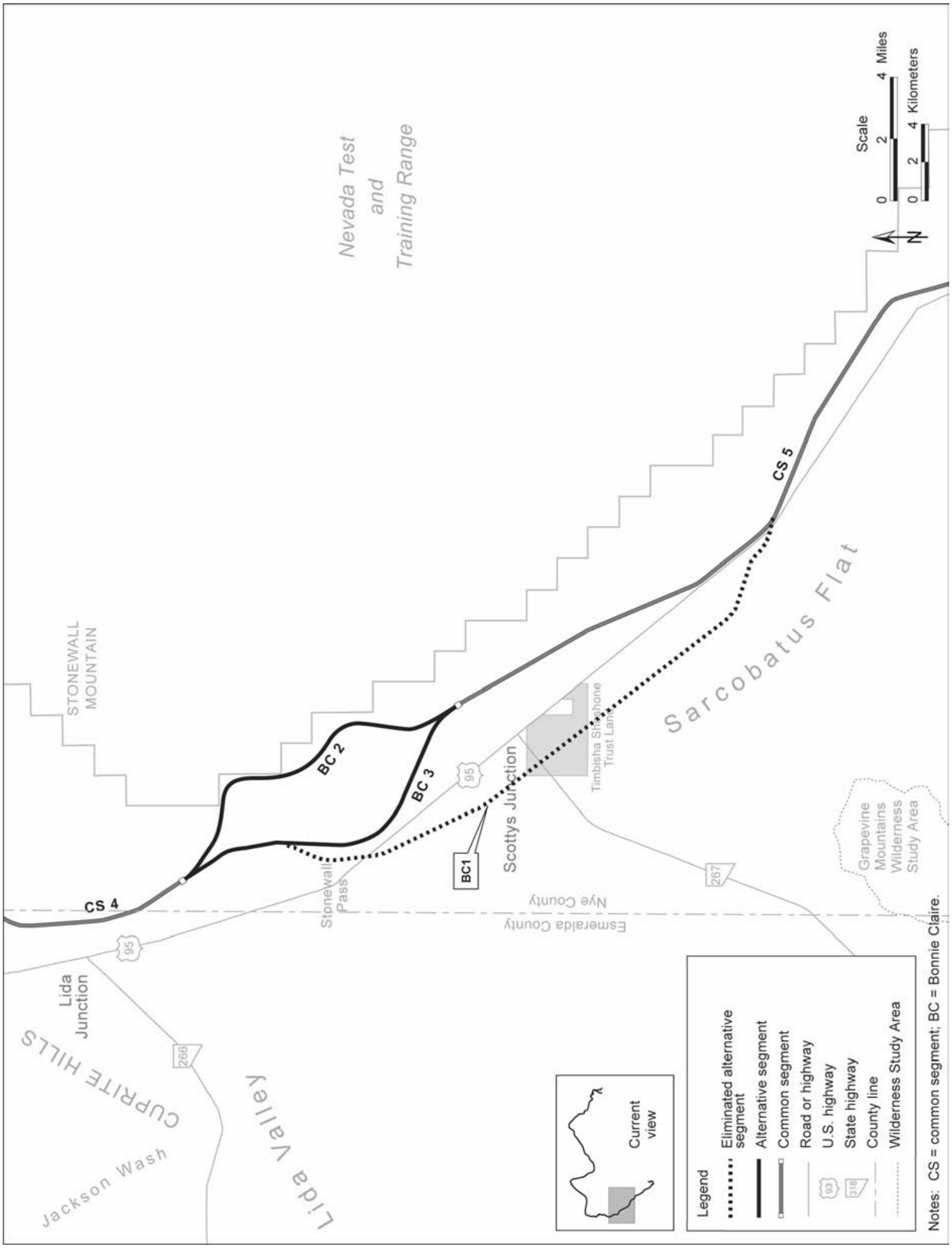

Figure C-12. Eliminated segments within Caliente map area F.

considered the environmental and land-use features associated with each. Based on this analysis, neither alternative segment was eliminated from detailed analysis in the Rail Alignment EIS. Table C-8 provides a comparison of the key factors DOE used in this determination.

Table C-8. Comparison of possible alternative segments in the Bonnie Claire area.a

Attribute	**Bonnie Claire 1**	Bonnie Claire 2	Bonnie Claire 3
Length (kilometers)[b]	Alternative segment not evaluated because it would cross Timbisha Shoshone Trust Lands.	20	20
Construction cost ($ millions)		96.9	74.9
Engineering factors		Meets engineering design criteria	Meets engineering design criteria
Key environmental and land-use features		Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

Bonnie Claire alternative segments 2 and 3 would have various construction and design complexities. Both alternative segments would require bridges and near maximum allowable grade that would increase construction costs. In addition, absent consideration of mitigation, both alternative segments would have the potential to impact various environmental resources, such as access to mining operations. However, each alternative segment appears to be feasible from a technical and economic standpoint.

C.4.1.8 Oasis Valley Alternative Segments

DOE identified three alternative segments in the Oasis Valley area, Oasis Valley 1, Oasis Valley 2, and Oasis Valley 3 (Figure C-13). The Notice of Intent identified Oasis Valley 1 and Oasis Valley 2. Oasis Valley 1 would cross less private land, but Oasis Valley 2 would be further from springs in the vicinity. In response to public scoping comments to avoid or minimize intrusion on certain parcels of land, DOE added Oasis Valley 3 for consideration. The Department then determined whether these three alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Oasis Valley alternative segments 1, 2, and 3 appear to be feasible from a technical and economic standpoint. Oasis Valley 1 and 2 are immediately adjacent to one another and their engineering and construction factors would be similar. Both have similar land-use constraints, which do not warrant elimination of the alternative segments from detailed analysis. Because Oasis Valley 1 and Oasis Valley 2 have such similarities, DOE eliminated Oasis Valley 2 from detailed analysis. Table C-9 provides a comparison of the key factors DOE used in this determination.

Table C-9. Comparison of possible alternative segments in the Oasis Valley area.[a]

Attribute	Oasis Valley 1	**Oasis Valley 2**	Oasis Valley 3
Length (kilometers)[b]	10	Alternative segment not evaluated because engineering factors and environmental and land-use features similar to Oasis Valley 1	14
Construction cost ($ millions)	43.2		58.6
Engineering factors	Meets engineering design criteria		Meets engineering design criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination		Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

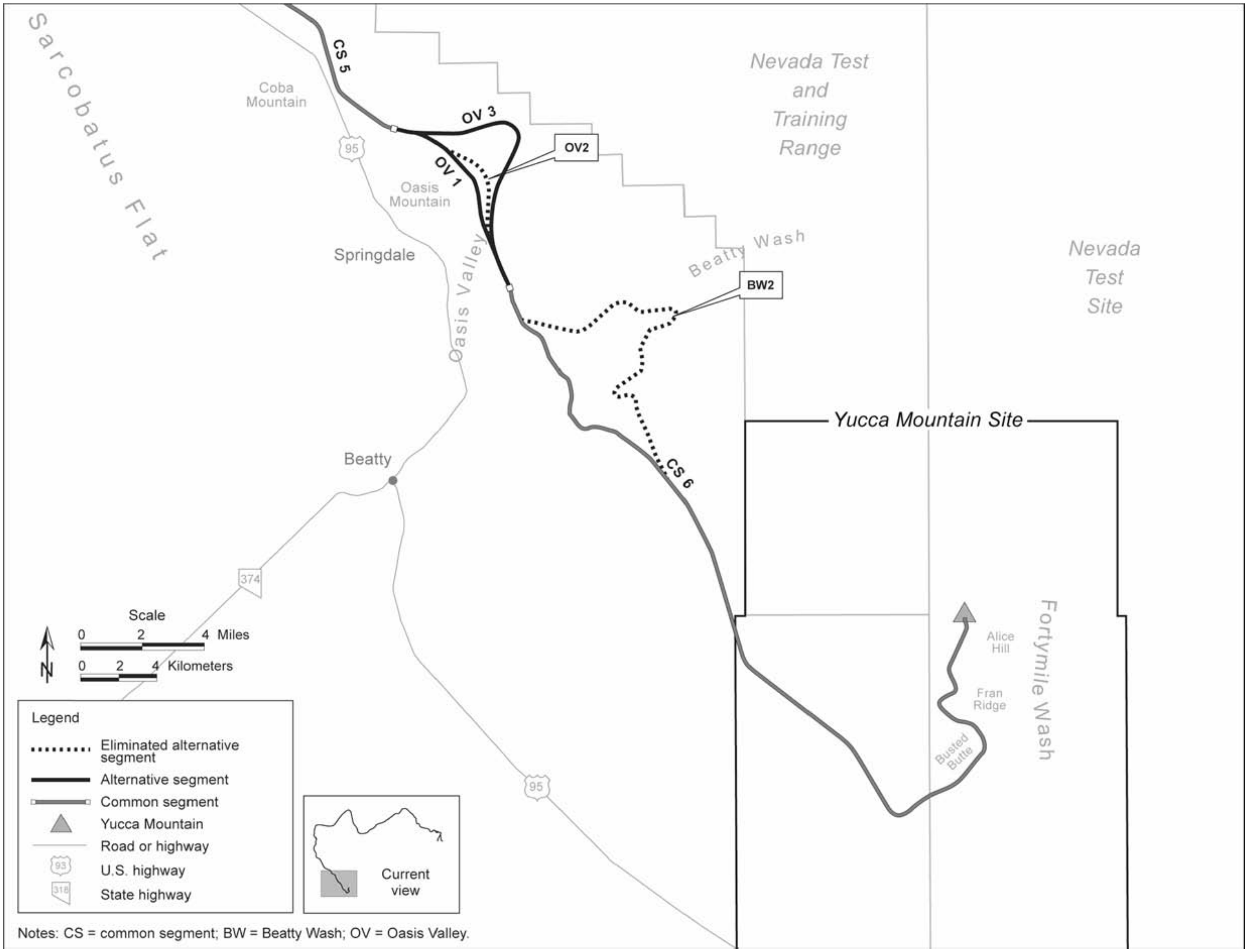

Figure C-13. Eliminated segments within Caliente map area G.

C.4.1.9 Beatty Wash Alternative Segments

In the Notice of Intent to prepare the Rail Alignment EIS (69 *FR* 18565, April 8, 2004), DOE identified two alternative segments in the Beatty Wash area, Beatty Wash 1 and Beatty Wash 2 (Figure C-13). DOE determined whether these two alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. Beatty Wash 2 would exceed design criteria for horizontal and vertical curvature. Therefore, DOE eliminated Beatty Wash 2 from detailed analysis in the Rail Alignment EIS. Table C-10 provides a comparison of the key factors DOE used in this determination. Eliminating Beatty Wash 2 resulted in only one Beatty Wash alternative segment for detailed analysis; thus, Beatty Wash 1 became an addition to common segment 6.

Table C-10. Comparison of possible alternative segments in the Beatty Wash area.[a]

Attribute	Beatty Wash 1	**Beatty Wash 2**
Length (kilometers)[b]	13	21
Construction cost ($ millions)	36	More than 60[c]
Engineering factors	Meets engineering design criteria	Exceeds design criteria for horizontal and vertical curvature
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.
c. Cost is listed as approximate because the computer based modeling system could not identify a viable alignment for construction estimating.

C.4.2 MINA RAIL ALIGNMENT ALTERNATIVE SEGMENTS ELIMINATED FROM DETAILED ANALYSIS

Figure C-14 shows the alternative segments DOE eliminated from consideration for the Mina rail corridor. Table C-11 identifies the alternative segments DOE identified in its Amended Notice of Intent (71 *FR* 60484, October 13, 2006) and alternative segments the Department added for consideration based on public comments. The table also summarizes the reasons DOE eliminated certain alternative segments from detailed analysis in the Rail Alignment EIS.

Table C-11. Mina rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 1 of 2).

Map area	Alternative segments	Amended Notice of Intent	Scoping	Analyzed in detail or eliminated
Walker River Paiute Reservation area	Schurz 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Schurz 2	Alternative segment identified		Eliminated based on input from the Walker River Paiute Tribe.
	Schurz 3	Alternative segment identified		Eliminated based on input from the Walker River Paiute Tribe.

Table C-11. Mina rail alignment alternative segments identified and analyzed or eliminated from detailed analysis (page 2 of 2)

Map area	Alternative segments	Amended Notice of Intent	Scoping	Analyzed in detail or eliminated
Walker River Paiute Reservation area (continued)	Schurz 4		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Schurz 5		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Schurz 6		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
Montezuma Range area	Montezuma 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Montezuma 2	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Montezuma 3		Alternative segment identified	Analyzed in detail in the Rail Alignment EIS.
	Montezuma 4		Alternative segment identified	Eliminated because engineering criteria not met.
Bonnie Claire	Alternative segments and all factors are unchanged from Caliente analysis.			
Oasis Valley area	Oasis Valley 1	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Oasis Valley 3	Alternative segment identified		Analyzed in detail in the Rail Alignment EIS.
	Oasis Valley 4		Alternative segment identified	Eliminated because of land-use constraints and because engineering criteria not met.

C.4.2.1 Schurz Alternative Segments

The Amended Notice of Intent identified three alternative segments near Schurz, Schurz 1, Schurz 2, and Schurz 3 (Figure C-15). Feedback from the Walker River Paiute Tribe suggested that Schurz 2 and Schurz 3 not be considered viable alternatives to provide a bypass around Schurz, and DOE eliminated those alternative segments from detailed analysis in the Rail Alignment EIS. The Walker River Paiute Tribe identified several additional alternative segments where the rail line would cross Walker River Paiute Reservation lands. DOE determined whether the alternative segments would be technically feasible according to the design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. The results of these analyses indicated

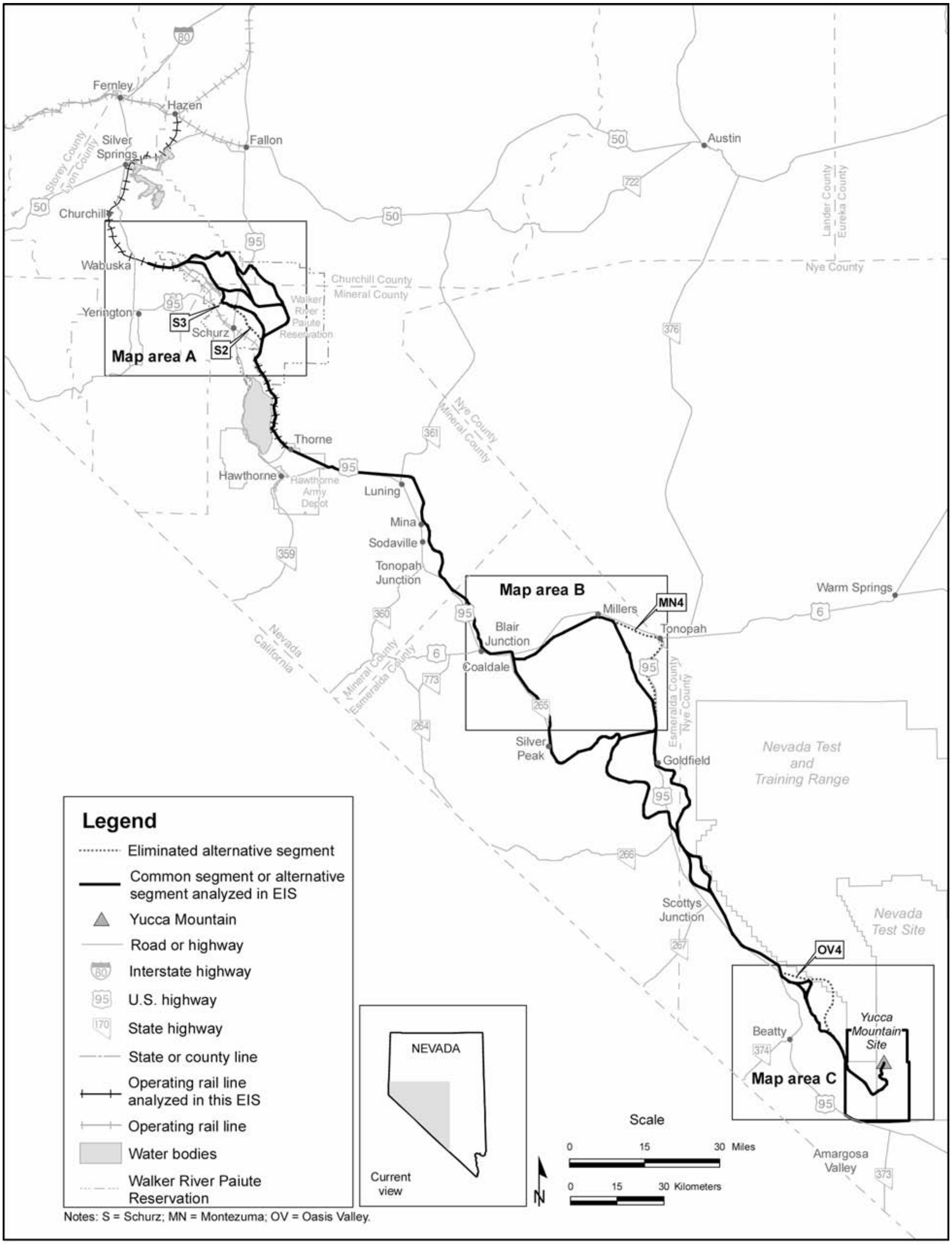

Figure C-14. Mina map key.

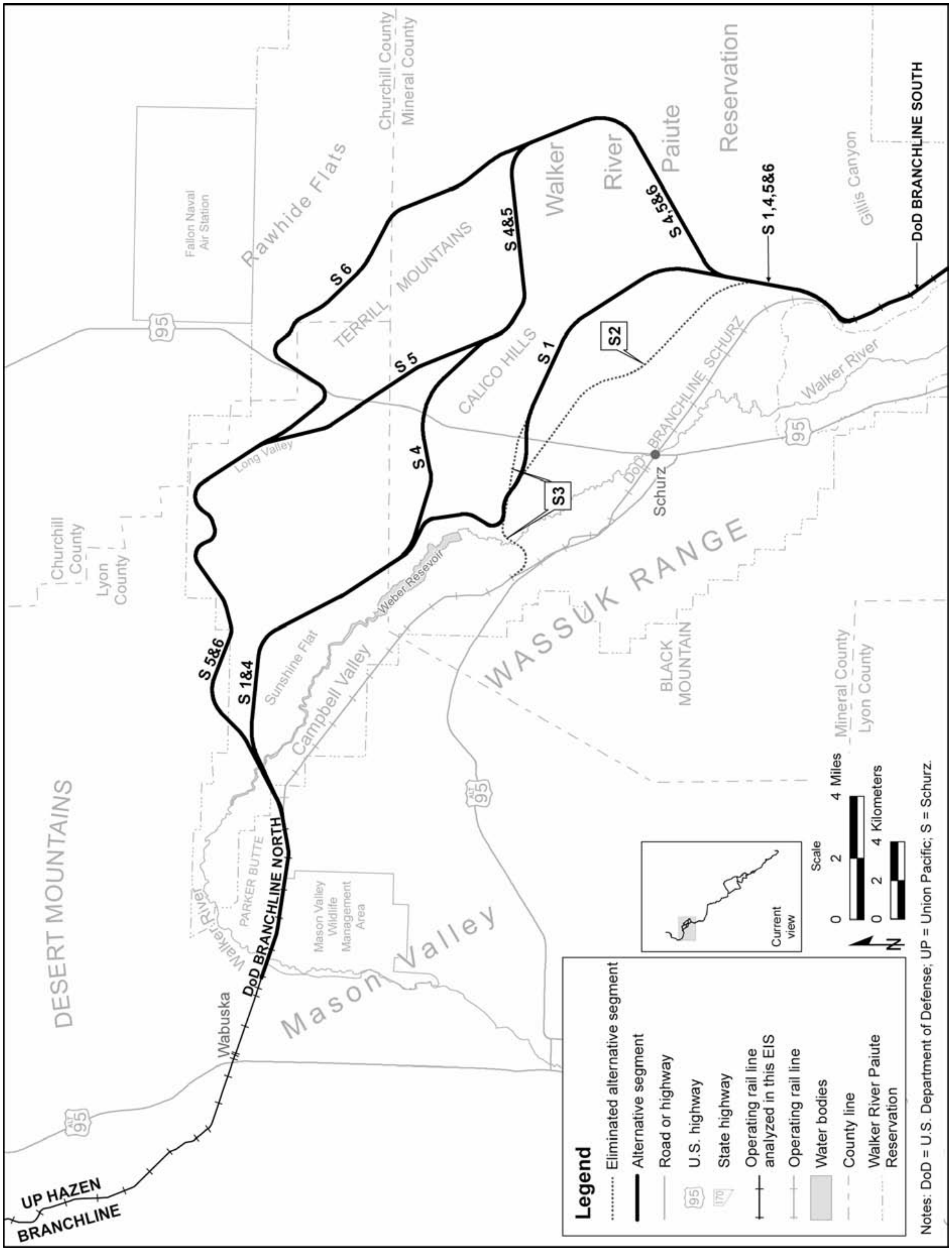

Figure C-15. Eliminated segments within Mina map area A.

that, while Schurz 4, Schurz 5, and Schurz 6 would each add additional length to the overall route and would present engineering challenges in several areas, each would meet engineering design criteria and present a viable alternative segment. Therefore, DOE added Schurz 4, 5, and 6 to the suite of alternative segments to be considered for detailed analysis in the EIS. Table C-12 lists the alternative segments considered.

Table C-12. Comparison of possible alternative segments in the Schurz area.[a]

Attribute	Schurz 1	**Schurz 2**	**Schurz 3**	Schurz 4	Schurz 5	Schurz 6
Length (kilometers)[b]	51.8	48.4	49.7	63.6	69	70.5
Construction cost (millions of $)	168	137	168	238	335	347
Engineering factors	Meets engineering design criteria	Eliminated due to input from the Walker River Paiute Tribe		Meets engineering design criteria	Meets engineering design criteria	Meets engineering design criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination			No notable environmental or land-use constraints	No notable environmental or land-use constraints	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segments are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

C.4.2.2 Montezuma Alternative Segments

DOE considered four alternative segments in the Montezuma area (Figure C-16). The Amended Notice of Intent identified two alternative segments in the Montezuma Range area, Montezuma 1 and 2. Based on a public scoping comment to avoid communities along the Mina rail alignment, DOE added Montezuma alternative segment 3, which would avoid the communities of Goldfield and Silver Peak. Additionally, based on a comment received during public scoping, DOE examined Montezuma 4 as an alternative to constructing Montezuma 2. DOE determined whether the alternative segments would be technically feasible according to the engineering design criteria, estimated the cost of each alternative segment, and considered the environmental and land-use features associated with each. DOE determined that Montezuma 4 would impact private lands and that an alternative segment that meets the intent of the public scoping comment while meeting engineering and environmental criteria could not be derived. Therefore, DOE eliminated Montezuma 4 from detailed analysis in the Rail Alignment EIS. Table C-13 displays a comparison of the alternative segments considered.

Table C-13. Comparison of possible alternative segments in the Montezuma area.[a]

Attribute	Montezuma 1	Montezuma 2	Montezuma 3	**Montezuma 4**
Length (kilometers)[b]	118	119	140	145
Construction cost (in millions of $)	485	383	475	Not calculated because eliminated from consideration
Engineering factors	Meets engineering design criteria	Meets engineering design criteria, utilizes existing rail roadbed	Meets engineering design criteria, utilizes existing rail roadbed	Exceeds grade criteria
Key environmental and land-use features	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination	Environmental and land-use constraints do not warrant elimination

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

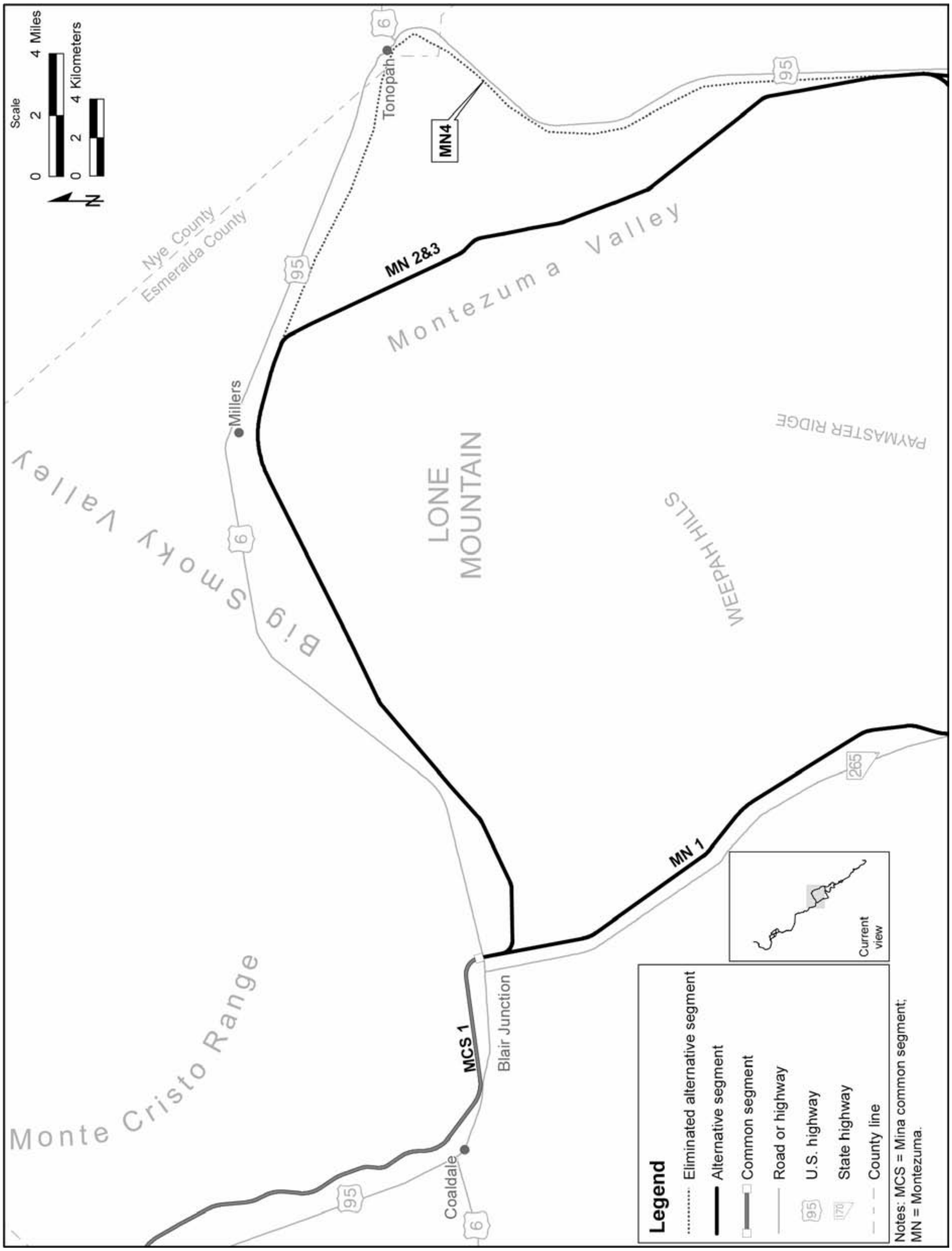

Figure C-16. Eliminated segments within Mina map area B.

C.4.2.3 Oasis Valley Alternative Segments

In total, DOE considered four alternative segments in Oasis Valley (Figure C-17). DOE identified Oasis Valley 1 and Oasis Valley 2 in its Notice of Intent. As discussed in Section C.5.1.8, during the Caliente rail alignment scoping process, DOE added Oasis Valley 3 to and eliminated Oasis Valley 2 from detailed analysis in the Rail Alignment EIS. The Amended Notice of Intent incorporated Oasis Valley 1 and Oasis Valley 3 by reference. Then, during scoping for the Mina rail alignment, one commenter suggested that DOE create an alternative segment in Oasis Valley to avoid private lands and eliminate perceived noise and vibration impacts. Based on this comment, DOE attempted to identify a feasible alternative segment, but could not without crossing onto the Nevada Test and Training Range. Table C-14 compares the Oasis Valley alternative segments DOE considered.

Table C-14. Comparison of possible alternative segments in the Oasis Valley area.[a]

<table>
<tr><th>Alternative segment</th><th>Oasis Valley 1</th><th>Oasis Valley 3</th><th>Oasis Valley 4</th></tr>
<tr><td>Length (kilometers)[b]</td><td>17.4</td><td>20.9</td><td rowspan="4">Alternative segment not included in the Rail Alignment EIS as it would enter the Nevada Test and Training Range</td></tr>
<tr><td>Construction cost (millions of $)</td><td>43.2</td><td>58.6</td></tr>
<tr><td>Engineering factors</td><td>Meets engineering design criteria</td><td>Meets engineering design criteria</td></tr>
<tr><td>Key environmental and land-use features</td><td>Environmental and land-use constraints do not warrant elimination</td><td>Environmental and land-use constraints do not warrant elimination</td></tr>
</table>

a. Eliminated alternative segment are shown in **bold**.
b. To convert kilometers to miles, multiply by 0.62137.

C.5 Rail Alignment Refinement Process

DOE continued with development of alternative segments and common segments that were identified for detailed analysis, as described above. DOE used Caliente- and Mina-specific information from the computer models to refine and adjust common segment and alternative segment geometry to reflect rail design and engineering criteria. The Department transferred the information developed by the computer modeling system to a computer-aided-design (commonly called CAD) platform, and to alignment-specialty software. DOE used the CAD platform to create engineered drawings and used the software to develop each segment's horizontal and vertical geometry and estimate earthwork volumes such as cuts and fills. In developing this geometry, DOE considered U.S. Geological Survey topographic information, specific location information, cross-section templates, and engineering criteria (DIRS 176584-Nevada Rail Partners 2006, all).

DOE reviewed the alternative segments and common segments generated by software to identify the potential for further refinements. Further refinements were undertaken to improve operational functionality using industry standard practices recommended by the American Railway Engineering and Maintenance-of-Way Association and the Association of American Railroads.

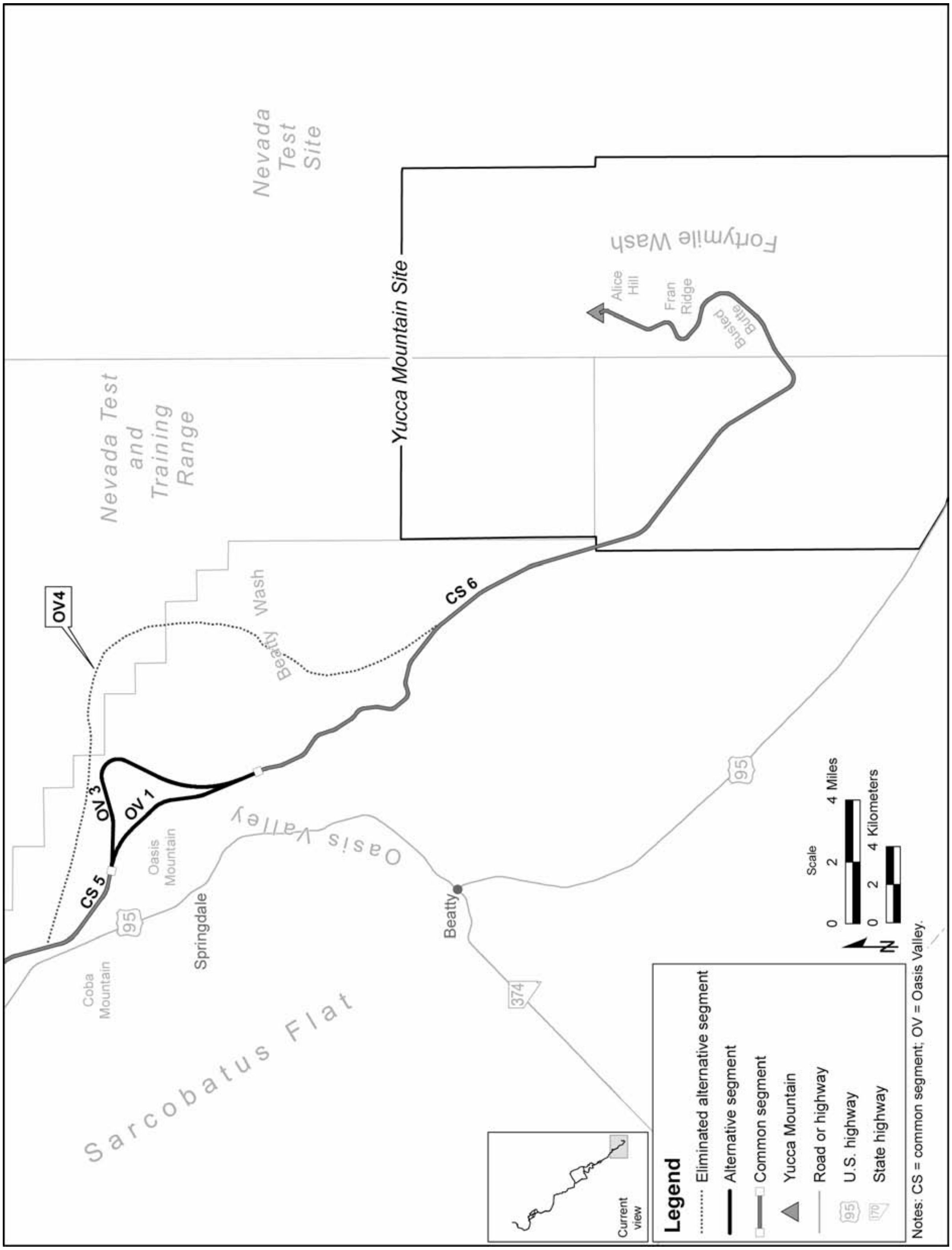

Figure C-17. Eliminated segments within Mina map area C.

C.5.1 CALIENTE RAIL ALIGNMENT REFINEMENT PROCESS

Caliente rail alignment refinements were limited in geographic extent and mostly consisted of shifting the track centerline. Figures C-18 and C-19 illustrate the alternative segment DOE refined the most, Oasis Valley 3. Figure C-18 illustrates the alternative segment before the conceptual design process, and Figure C-19 illustrates the results of this initial process. Figure C-20 shows the resulting conceptual alternative segments and common segments.

Following receipt of new aerial mapping and terrain models for the Caliente rail alignment, DOE again used computer-based modeling software to evaluate and refine the alternative segments and common segments in light of the new topographic data. The second refinement, called the Revision 1 alignment, typically altered the centerline location (compare to Revision 0) by several hundred feet, and occasionally a greater distance if environmental impacts would be reduced, thereby improving the feasibility of the rail alignment.

Water availability is the major issue determining the location and design of the rail alignment. It simultaneously affects engineering design, environmental effects, permitting constraints, and project costs. The principal factor affecting water demand is earthwork. Ninety percent of the water DOE would need for the project would be used to provide for compaction of embankment fill materials, and to control dust during excavation and other earth-moving activities. In the first refinement (Revision 0), DOE prepared the track profile with the objective of trying to balance earthwork quantities (that is, keeping the total excavation [cut] approximately equal to the placement of embankment [fill]). However, the conceptual design approach used during Revision 1 was to adjust the profile so that cut and fill would be reduced. By reducing fill, the water demand for embankment compaction would also be reduced (DIRS 176584-Nevada Rail Partners 2006, all).

DOE considered additional environmental and land-use factors in deriving the alternative segments and common segments that make up the Caliente rail alignment. This information included the identification of known areas of potential cultural resources impacts based on cultural resources surveys, and DOE adjusted the alternative segments and common segments to decrease or eliminate impacts in these areas.

C.5.2 MINA RAIL ALIGNMENT REFINEMENT PROCESS

DOE developed a conceptual Mina rail alignment and refined it using the modeling program and the process described in Section C.5. Figure C-21 shows the resulting conceptual alternative segments and common segments that make up the Mina rail alignment.

Following the receipt of new aerial mapping and terrain models, DOE again used software to evaluate the Mina alternative segments and common segments in light of the new topographic data, utilizing the same process and factors described for the Caliente rail alignment refinement process in C.5.1.

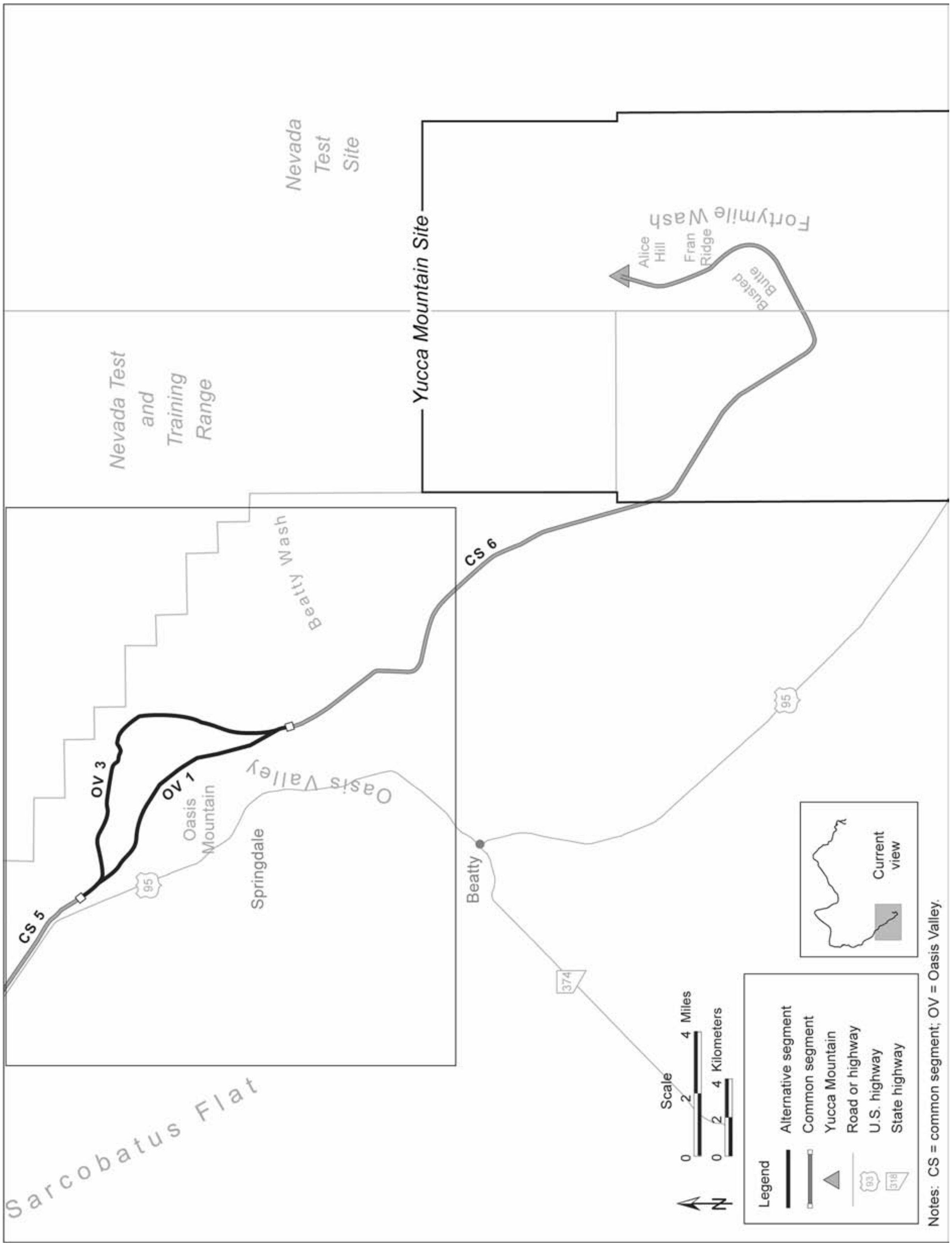

Figure C-18. The Oasis Valley alternative segments before the conceptual design process.

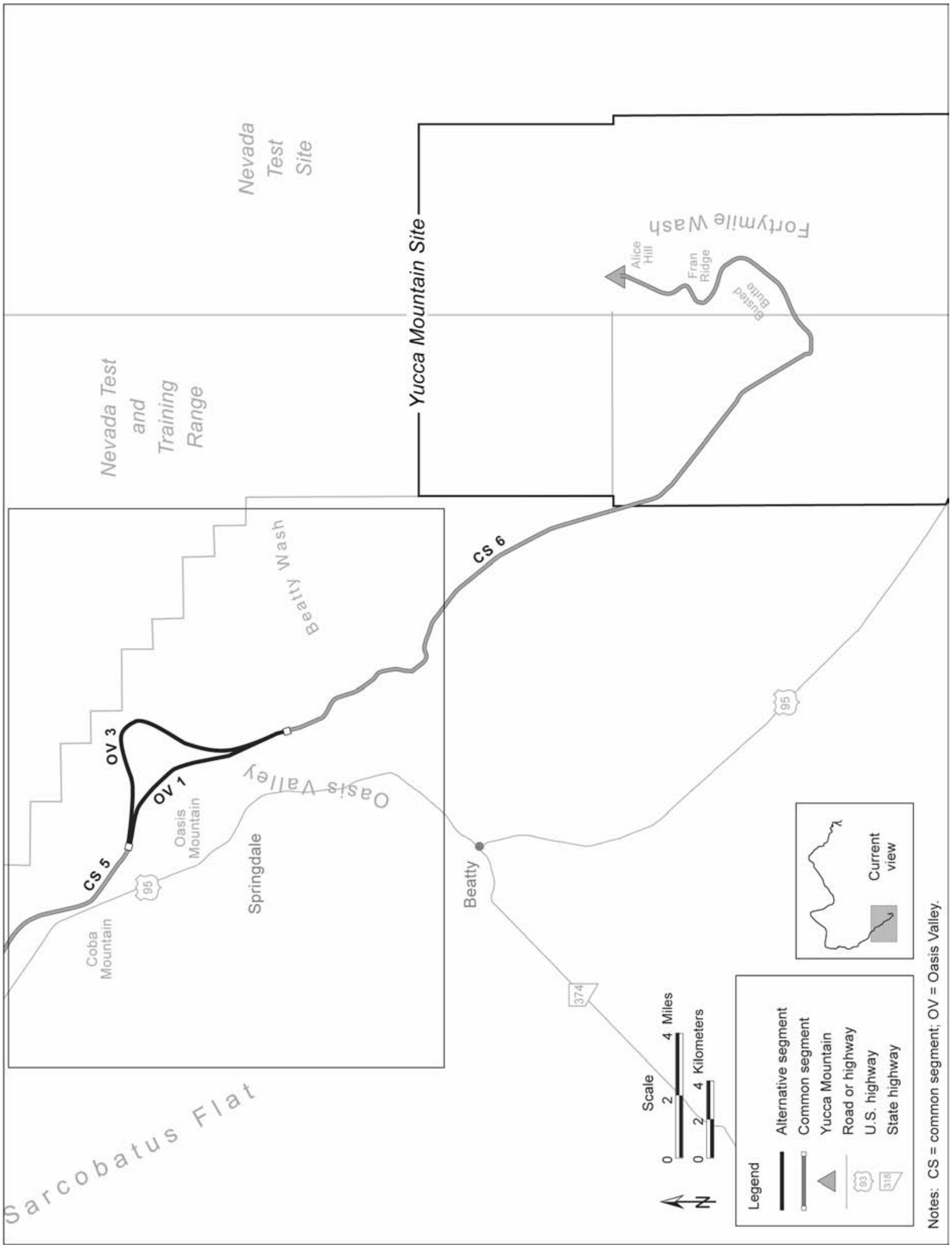

Figure C-19. The Oasis Valley alternative segments refined as a result of the conceptual design process.

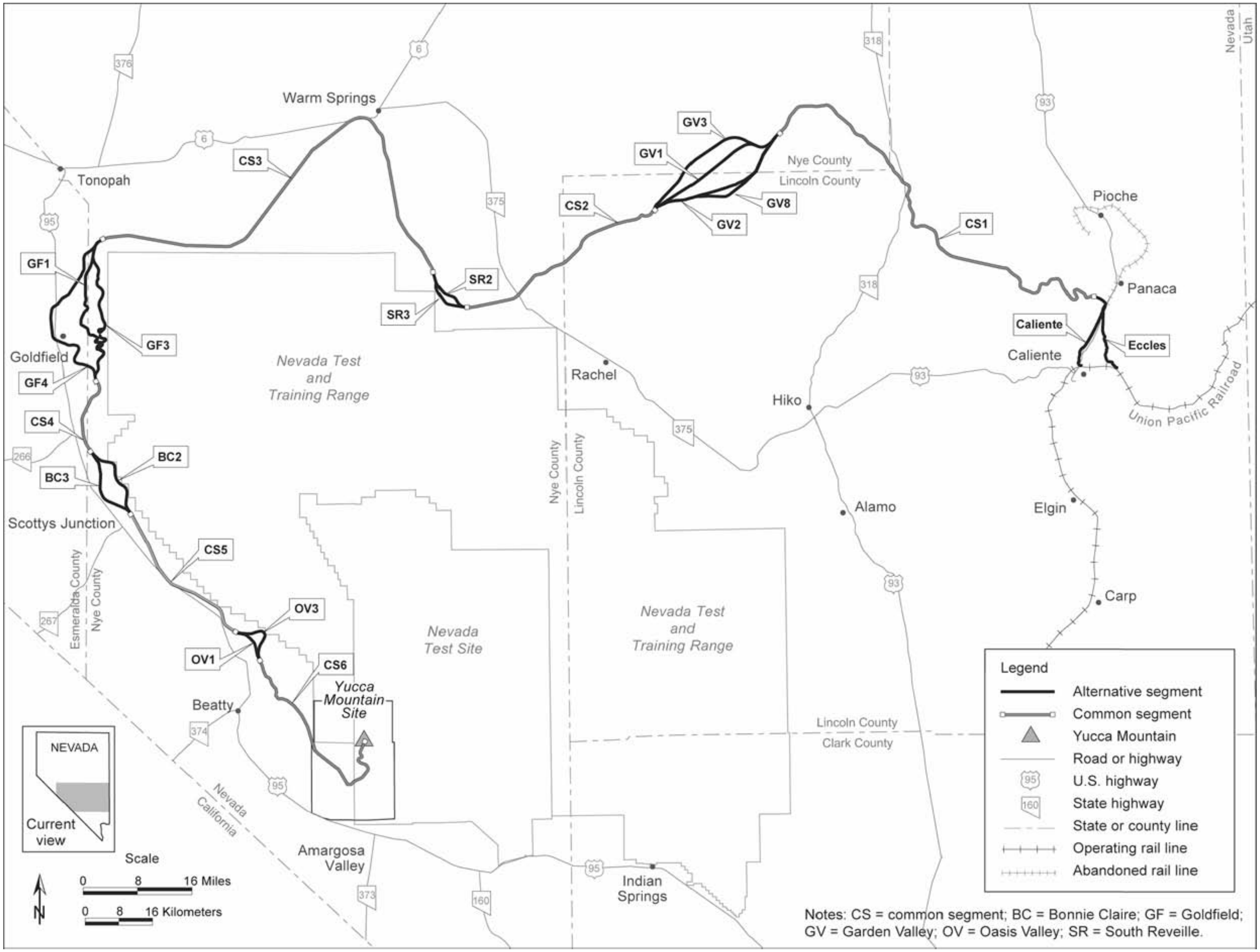

Figure C-20. Final alternative segments and common segments for analysis in the Rail Alignment EIS – Caliente rail alignment.

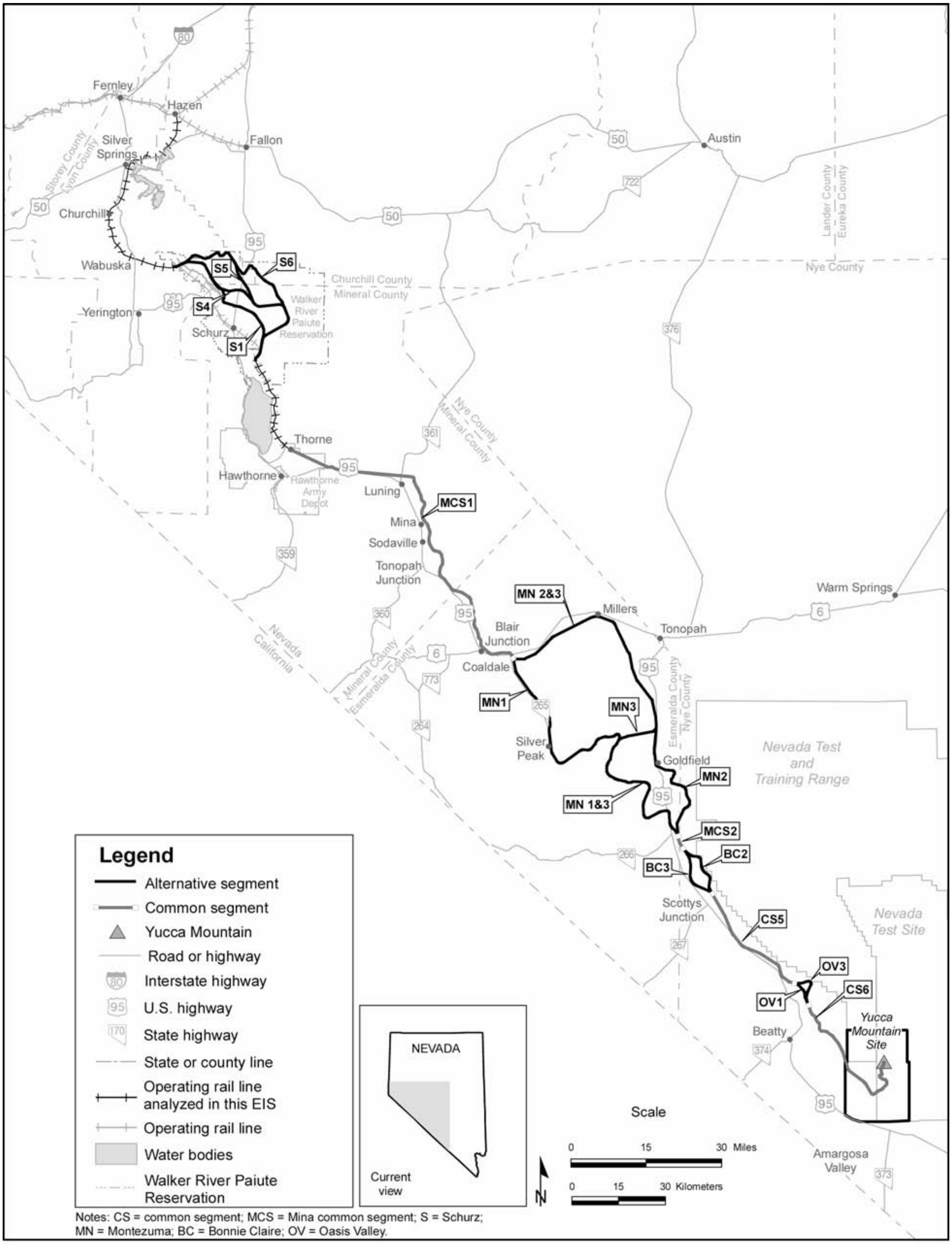

Figure C-21. Final alternative segments and common segments for analysis in the Rail Alignment EIS – Mina rail alignment.

C.6 Glossary

accessible environment	For this ***environmental impact statement*** (EIS), all points on Earth outside the surface and subsurface area controlled over the long term for the ***repository***, including the atmosphere above the controlled area.
accident	An unplanned sequence of events that results in undesirable consequences. Examples in this Rail Alignment EIS include an inadvertent release of radiation from the casks or hazardous materials from their containers; train derailments; vehicular accidents; and construction-related accidents that could affect workers.
air quality	A measure of the concentrations of pollutants, measured individually in the air.
alpha particle	A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium nucleus and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***
alternative	One of two or more actions, processes, or propositions, from which a decisionmaker will determine the course to be followed. The National Environmental Policy Act, as amended, states that in preparing an EIS, an agency "shall … (s)tudy, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" [42 U.S.C. 4321, Title I, Section 102(E)]. The regulations of the Council on Environmental Quality that implement the National Environmental Policy Act indicate that the alternatives section is "the heart of the environmental impact statement (40 CFR 1502.14), and include rules for presentation of the alternatives, including no action, and their estimated impacts. The Rail Alignment EIS analyzes one alternative to the ***Proposed Action*** – the ***No-Action Alternative*** – and two implementing alternatives under the Proposed Action – the Caliente Implementing Alternative and the Mina Implementing Alternative – for constructing, operating, and possibly abandoning a ***railroad*** for the shipment of ***spent nuclear fuel*** and ***high-level radioactive waste*** for long-term ***disposal*** in a ***geologic repository*** at Yucca Mountain. Under the No-Action Alternative, the DOE would not construct the proposed railroad along the Caliente ***rail alignment*** or the Mina rail alignment.
alternative segment	Geographic region of the ***rail alignment*** for which multiple routes for the ***rail line*** have been identified. In the Rail Alignment EIS, there are different alignments identified within the Caliente ***rail corridor*** and the Mina rail corridor that could minimize or avoid environmental ***impacts*** and reduce construction complexities.

atomic mass	The mass of a neutral atom, based on a relative scale, usually expressed in atomic mass units. See ***atomic weight.***
atomic nucleus	See ***nucleus***.
atomic number	The number of ***protons*** in an atom's ***nucleus***.
atomic weight	The relative mass of an atom based on a scale in which a specific carbon atom (carbon-12) is assigned a mass value of 12. Also known as relative ***atomic mass***.
ballast	The coarse rock that is placed under the ***railroad*** tracks to support the railroad ties and improve drainage along the ***rail line***.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a radioactive transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
boiling-water reactor (BWR)	A ***nuclear reactor*** that uses boiling water to produce steam to drive a turbine.
common segment	Geographic region of the ***rail alignments*** for which a single route for the ***rail line*** has been identified.
cut	Cutting away from the top of a slope to fill in at the bottom, thereby providing a suitable grade for the rail ***roadbed***. See ***fill***.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called decay products.
disposal (of spent nuclear fuel and high-level radioactive waste)	The ***emplacement*** in a ***repository*** of ***spent nuclear fuel***, ***high-level radioactive waste***, or other highly ***radioactive*** material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the ***isolation*** of such waste from the ***accessible environment***.
dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.
emplacement	The placement and positioning of ***waste packages*** in the ***repository***.

environment	(1) Includes water, air, and land and all plants and humans and other animals living therein, and the interrelationship existing among these. (2) The sum of all external conditions affecting the life, development, and survival of an organism.
environmental impact statement (EIS)	A detailed written statement that describes: "...the environmental impact of the ***proposed action***; any adverse environmental effects which cannot be avoided should the proposal be implemented; ***alternatives*** to the proposed action; the relationship between local short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Preparation of an EIS requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments.
exposure (to radiation)	The condition of being subject to the effects of or potentially acquiring a ***dose*** of ***radiation***. The incidence of radiation on living or inanimate material by ***accident*** or intent. Background exposure is the exposure to natural ionizing radiation. Occupational exposure is the exposure to ionizing radiation that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.
fill	The material used to fill the bottom of a slope with material cut away from the top of a slope, thereby providing a suitable grade for the rail ***roadbed***. (See ***cut***.)
fission products	***Radioactive*** or nonradioactive atoms produced by the ***fission*** of heavy atoms, such as uranium.
fuel assembly	A number of fuel elements held together by structural materials, used in a ***nuclear reactor***; sometimes called a fuel bundle.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
geologic repository	A system for the ***disposal*** of ***radioactive*** waste in excavated geologic media, including surface and subsurface areas of operation, and the adjacent part of the geologic setting that provides ***isolation*** of the radioactive waste in a controlled area.
high-level radioactive waste	The highly ***radioactive*** material that resulted from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains ***fission products*** in sufficient concentrations.

impact	For an EIS, the positive or negative effect of an action (past, present, or future) on the natural ***environment*** (land use, ***air quality***, water resources, geological resources, ecological resources, aesthetic and scenic resources) and the human environment (***infrastructure***, economics, social, and cultural).
infrastructure	Basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication systems.
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
isolation	Inhibiting the transport of ***radioactive*** material so that the amounts and concentrations of this material entering the ***accessible environment*** stay within prescribed limits.
neutron	An atomic particle with no charge and an ***atomic mass*** of 1; a component of all atoms except hydrogen; frequently released as ***radiation***.
No-Action Alternative	Under the No-Action Alternative in the Rail Alignment EIS, DOE would not implement the ***Proposed Action*** in the Caliente rail corridor or the Mina rail corridor.
nuclear reactor	A device in which a nuclear fission chain reaction can be initiated, sustained, and controlled to generate heat or to produce useful ***radiation***.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
pressurized-water reactor (PWR)	A nuclear power ***reactor*** that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.
Proposed Action	The activity proposed to accomplish a federal agency's purpose and need. An EIS analyzes the environmental ***impacts*** of a proposed action, which includes the project and its related support activities. The Proposed Action in the Rail Alignment EIS, is to determine an alignment (within a corridor) and construct, operate, and potentially abandon a railroad in Nevada to transport spent nuclear fuel, high-level radioactive waste, and other Yucca Mountain project materials to a repository at Yucca Mountain.

proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all atomic ***nuclei***.
radiation	Energy traveling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. As used in this Rail Alignment EIS "radiation" refers to ***ionizing radiation***. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.
radioactive	Emitting ***radioactivity***.
radioactivity	(1) The spontaneous transformation of unstable atomic ***nuclei***, usually accompanied by the emission of ionizing ***radiation*** (e.g., such as ***alpha***, ***beta***, ***or gamma rays***). (2) The property of unstable nuclei in certain atoms (of elements such as uranium) to spontaneously emit ionizing radiation during nuclear transformations.
radionuclide	See ***nuclide***.
rail alignment	(1) A strip of land less than 400 meters (0.25 mile) wide through which the location of a rail line would be identified. (2) In this Rail Alignment EIS, the location of a ***rail line*** within a ***rail corridor***.
rail corridor	As used in this Rail Alignment EIS, a strip of land, 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at Yucca Mountain.
rail line	An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.
railroad	A transportation system incorporating the rail line, operations support facilities, railcars, locomotives, and other related property and infrastructure.
reactor	See ***nuclear reactor***.
repository	See ***geologic repository***.
roadbed	The earthwork foundation upon which the track, ties, ***ballast***, and ***subballast*** of a ***rail line*** are lain.

spent nuclear fuel	Fuel that has been withdrawn from a ***nuclear reactor*** following ***irradiation***, the component elements of which have not been separated by reprocessing. For this project, this refers to (1) intact, nondefective ***fuel assemblies***, (2) failed fuel assemblies in ***canisters***, (3) fuel assemblies in canisters, (4) consolidated fuel rods in canisters, (5) nonfuel assembly hardware inserted in ***pressurized-water reactor*** fuel assemblies, (6) fuel channels attached to ***boiling-water reactor*** fuel assemblies, and (7) nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters.
subballast	A layer of crushed gravel that is used to separate the ***ballast*** and ***roadbed*** for the purpose of load distribution and drainage.
waste packages	Two thick metal cylinders, one nested within the other. The inner cylinder would be made of stainless steel to provide structural strength. The outer cylinder would be made of a nickel alloy that is highly resistant to corrosion.
withdrawal	Related to land use: Withholding an area of federal land from settlement, sale, location, or surface entry, under some or all of the general land laws, for the purpose of limiting activities under those laws to maintain other public values in the area or reserving the area for a particular public purpose or program. Related to water resources: Water diverted from the ground or diverted from a surface-water source for use.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.

C.7 References

180222	BSC 2006	BSC (Bechtel SAIC Company) 2006. Mina Rail Route Feasibility Study. Rev. 01. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20070108.0027.
176584	Nevada Rail Partners 2006	Nevada Rail Partners 2006. Alignment Development Report Caliente Rail Corridor, Task 6: Route Alignment Definition, REV. 01A. Document No. NRP-R-SYSW-DA-0001-01A. Las Vegas, Nevada: Nevada Rail Partners. ACC: ENG.20060302.0017.

APPENDIX D

AESTHETIC RESOURCES

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APPENDIX D

AESTHETIC RESOURCES

This appendix supports the DOE analyses of potential impacts to aesthetic resources described in Sections 4.2.3 and 4.3.3 of *the* Rail Alignment EIS.

The U.S. Department of Energy (DOE) used U.S. Department of the Interior, Bureau of Land Management (BLM) methodologies to evaluate visual values along the Caliente and Mina rail alignments. The BLM considers visual resources when addressing aesthetic issues during BLM planning. These resources include natural or manmade physical features that give a landscape its character and value as an environmental factor. The BLM uses a visual resource management system to classify the aesthetic value of its lands and to set management objectives (DIRS 173052-BLM 1984, all).

Scenic quality is a measure of the visual appeal of a tract of land. Areas are rated based on key factors including landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications (DIRS 101505-BLM 1986, Section II).

Sensitivity levels are a measure of public concern for scenic quality. Areas are ranked high, medium, or low based on types of users, amount of use, public interest, adjacent land uses, and whether they are special areas (DIRS 101505-BLM 1986, Section III).

The BLM classification of visual resource value, the visual resource inventory, involves assessing visual resources and assigning them to one of four visual resource management classes based on three factors: ***scenic quality***, visual sensitivity (***sensitivity levels***), and distance from travel or observation points (DIRS 101505-BLM 1986, all). The BLM uses a combination of the ratings of these three factors to assign a visual resource inventory class to a piece of land, ranging from Class I to Class IV, with Class I representing the highest visual values. Each visual resource class is subsequently associated with a management objective, defining the way the land may be developed or used. Each BLM district assigns visual resource management classes to its lands during the resource management planning process. Table D-1 lists the BLM management objectives for visual resource classes.

The BLM uses visual resource contrast ratings to assess the visual impacts of proposed projects and activities on the existing landscape (DIRS 173053-BLM 1986, all). The Bureau looks at basic elements of design to determine levels of contrast created between a proposed project and the existing ***viewshed.*** Depending on the visual resource management objective for a particular location, varying levels of contrast are acceptable.

Contrast ratings are determined from locations called key observation points, which are usually along commonly traveled routes such as highways or frequently used county roads or in communities. To identify key observation points along the Caliente and Mina rail alignments, DOE considered the following factors: angle of observation, number of viewers, how long the project would be in view, relative project size, season of use, and light conditions. BLM guidance (DIRS 173053-BLM 1986, Section IIC) recommends that key observation points for linear projects, such as the proposed railroad, include the following:

- Most-critical viewpoints (for example, views from communities at road crossings)
- Typical views encountered in representative landscapes, if not covered by critical viewpoints
- Any special project or landscape features such as river crossings and substations

Table D-1. BLM visual resource management classes and objectives.[a]

Visual resource class	Objective	Acceptable changes to land
Class I	Preserve the existing character of the landscape.	Provides for natural ecological changes but does not preclude limited management activity. Changes to the land must be small and must not attract attention.
Class II	Retain the existing character of the landscape.	Management activities may be seen but should not attract the attention of the casual observer. Changes must repeat the basic elements of form, line, color, and texture of the predominant natural features of the characteristic landscape.
Class III	Partially retain the existing character of the landscape.	Management activities may attract attention but may not dominate the view of the casual observer. Changes should repeat the basic elements in the predominant natural features of the characteristic landscape.
Class IV	Provides for management activities that require major modifications of the existing character of the landscape.	Management activities may dominate the view and be the major focus of viewer attention. An attempt should be made to minimize the impact of activities through location, minimal disturbance, and repeating the basic elements.

a. Source: DIRS 101505-BLM 1986, Section V.B.

D.1 Caliente Rail Alignment

This section provides photographs taken from key observation points along the Caliente rail alignment. For some views, DOE has added simulations to the baseline photographs to show how track, trains, or facilities would appear. Figure D-1 shows the locations of the key observation points and the BLM visual resource management classifications of the lands in the viewsheds. Figures D-2 through D-83 are photographs along the Caliente rail alignment.

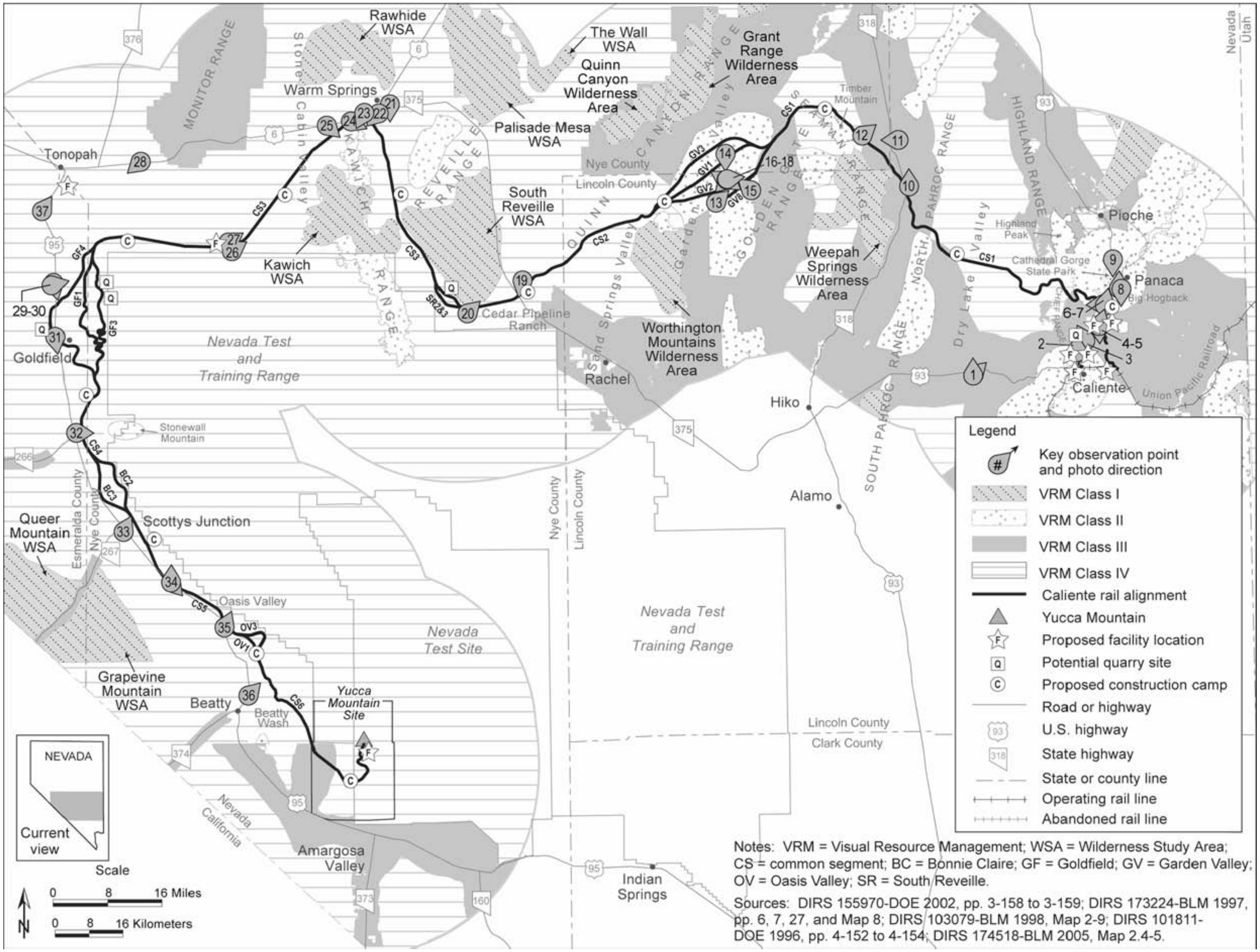


Figure D-1. Visual resource management classifications and key observation points along the Caliente rail alignment.

Figure D-2. View northeast from key observation point 1 at U.S. Highway 93 in Dry Lake Valley toward the Burnt Springs and Chief Ranges. Rail line would not be visible because it would be screened by Burnt Springs Range.

Figure D-3. View north from key observation point 1 on U.S. Highway 93 in Dry Lake Valley. Highland Range on right. Rail line would not be visible in valley because of distance.

Figure D-4. View north from key observation point 2 on U.S. Highway 93 toward location of Staging Yard Caliente-Indian Cove option.

Figure D-5. Simulation of Staging Yard Caliente-Indian Cove option in view north from key observation point 2. Office buildings would be visible in background.

Figure D-6. Simulation of train approaching Staging Yard Caliente-Indian Cove option in view north from key observation point 2.

Figure D-7. View north-northwest from key observation point 3 on U.S. Highway 93. Rock conveyor to deliver ballast to Staging Yard Caliente-Indian Cove option would cross over highway here. (See Figure D-9 for a simulation of conveyor appearance.)

Figure D-8. View south-southwest from key observation point 4 on U.S. Highway 93. Rock conveyor to deliver ballast to Staging Yard Caliente-Upland option would cross over highway here.

Figure D-9. Simulation of rock conveyor in view south-southwest from key observation point 4.

Figure D-10. View north-northeast from key observation point 5 on U.S. Highway 93 over location of Staging Yard Caliente-Upland option. Note existing buildings.

Figure D-11. Simulation of Staging Yard Caliente-Upland option in view north-northeast from key observation point 5.

Figure D-12. View north-northeast from key observation point 6 on U.S. Highway 93 at location where rail line would cross highway.

Figure D-13. Simulation of U.S. Highway 93 crossing over rail line in view north-northeast from key observation point 6.

Figure D-14. Simulation of train on rail line at U.S. Highway 93 crossing over rail line in view north-northeast from key observation point 6.

Figure D-15. View west from key observation point 7 on U.S. Highway 93 just north of rail line crossing, toward Highland Range and Bennett Pass.

Figure D-16. Simulation of track in view west from key observation point 7.

Figure D-17. Simulation of train close to U.S. Highway 93 in view west from key observation point 7.

Figure D-18. View south from key observation point 8 along U.S. Highway 93 at intersection with State Route 319, toward Big Hogback. Rail line would not be visible in this view.

Figure D-19. View north from key observation point 8 along U.S. Highway 93 at intersection with State Route 319. Photograph taken to show that Cathedral Gorge is not visible from highway here.

Figure D-20. View south from key observation point 9 at Miller Point in Cathedral Gorge Park toward rail alignment location. Rail line would be barely discernible, if visible at all.

Figure D-21. Panorama from northwest to northeast from key observation point 10 on State Route 318, toward location of rail line crossing.

Figure D-22. Simulation of crossing structure and train on rail line in view northwest to northeast from key observation point 10.

Figure D-23. View west toward Timber Mountain and northern Seaman Range from key observation point 11 off county road west of State Route 318 north of rail line crossing. White River visible in foreground.

Figure D-24. Simulation of track in view west from key observation point 11.

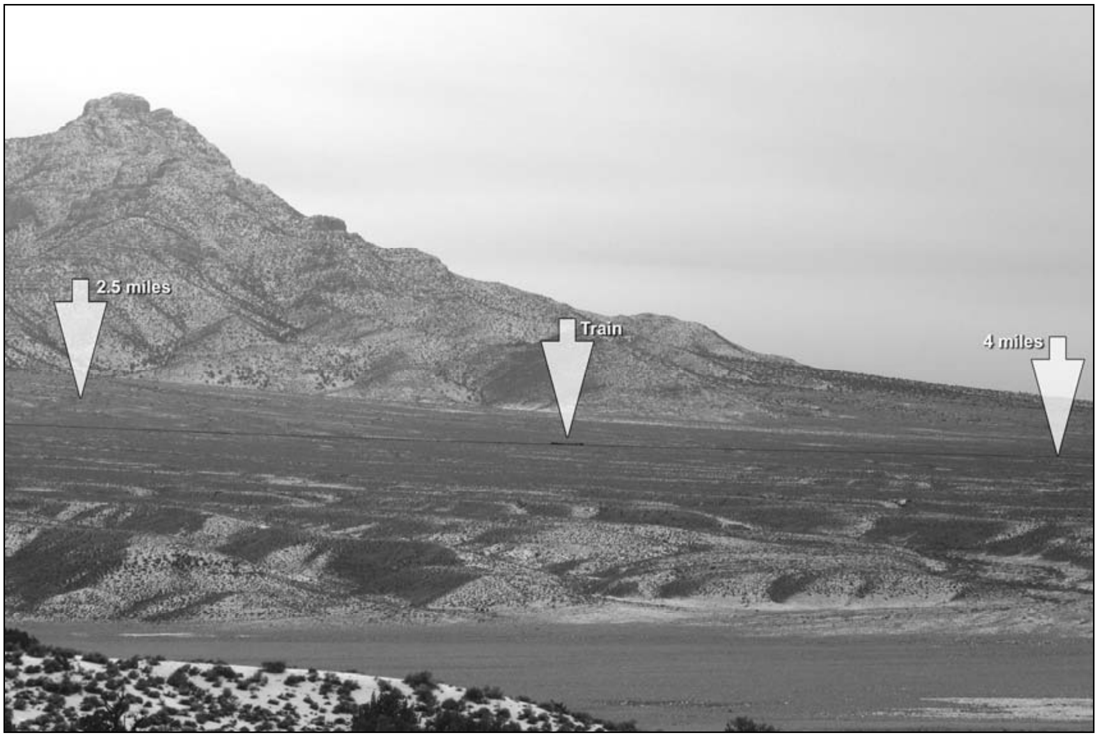


Figure D-25. Simulation of track and train in view west from key observation point 11.

Figure D-26. View east-northeast from key observation point 12 on Timber Mountain Pass Road toward location of rail line crossing. White River visible in right midground.

Figure D-27. Simulation of track and signals at rail line crossing of Timber Mountain Pass Road in view east-northeast from key observation point 12.

Figure D-28. Simulation of train at rail line crossing of Timber Mountain Pass Road in view east-northeast from key observation point 12.

Figure D-29. View northeast from key observation point 13 on a county road in south Garden Valley. Modifications associated with *City* sculpture visible as light band across midground, with trees on a ranch at right.

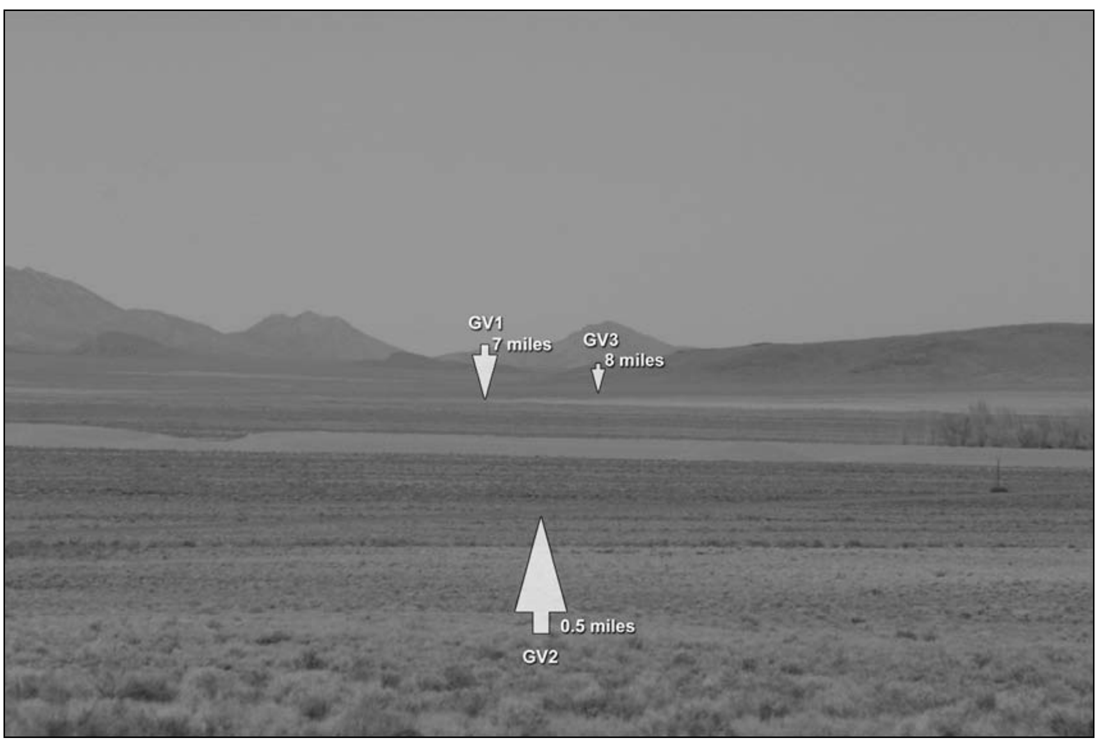


Figure D-30. Simulation from key observation point 13 of track on Garden Valley alternative segment 2 in foreground, Garden Valley alternative segments 1 and 3 in background, coming from east entry to valley. Note simulation of communications tower in right midground along Garden Valley alternative segment 2. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley alternative segment 2.

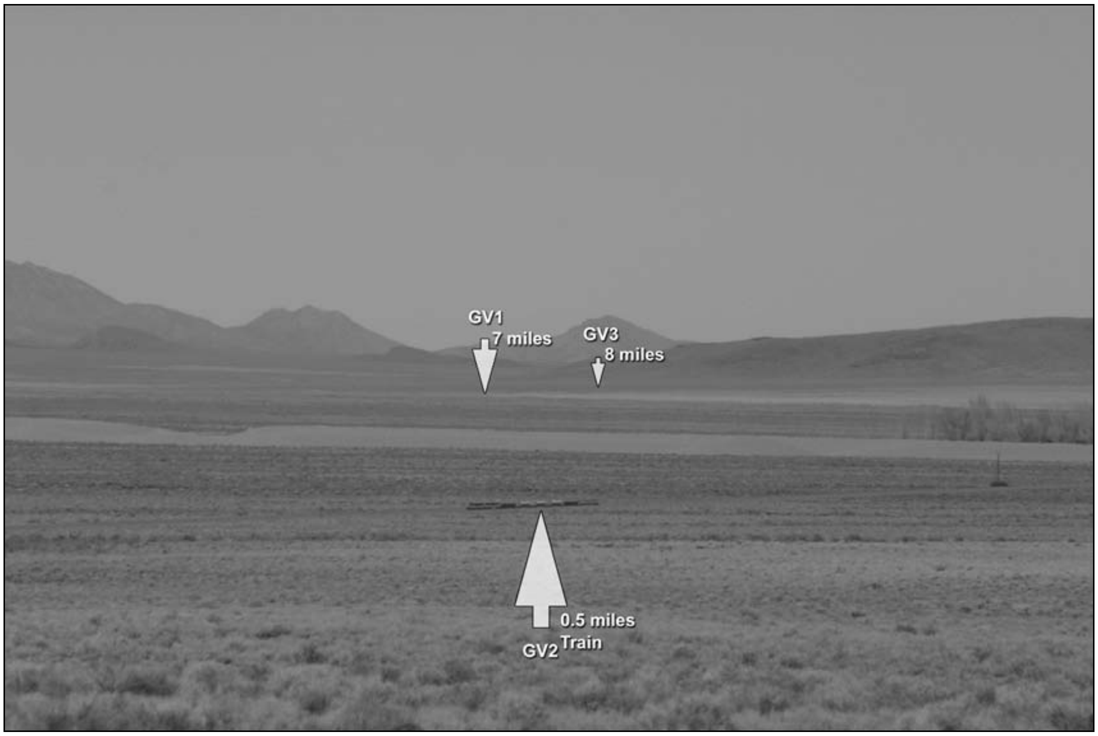


Figure D-31. Simulation of train on Garden Valley alternative segment 2 in view northeast from key observation point 13. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley alternative segment 2.

Figure D-32. View south from key observation point 14 on county road in middle of Garden Valley toward south end of the Golden Gate Range. Tops of some *City* sculpture mounds and ranch visible at left midground.

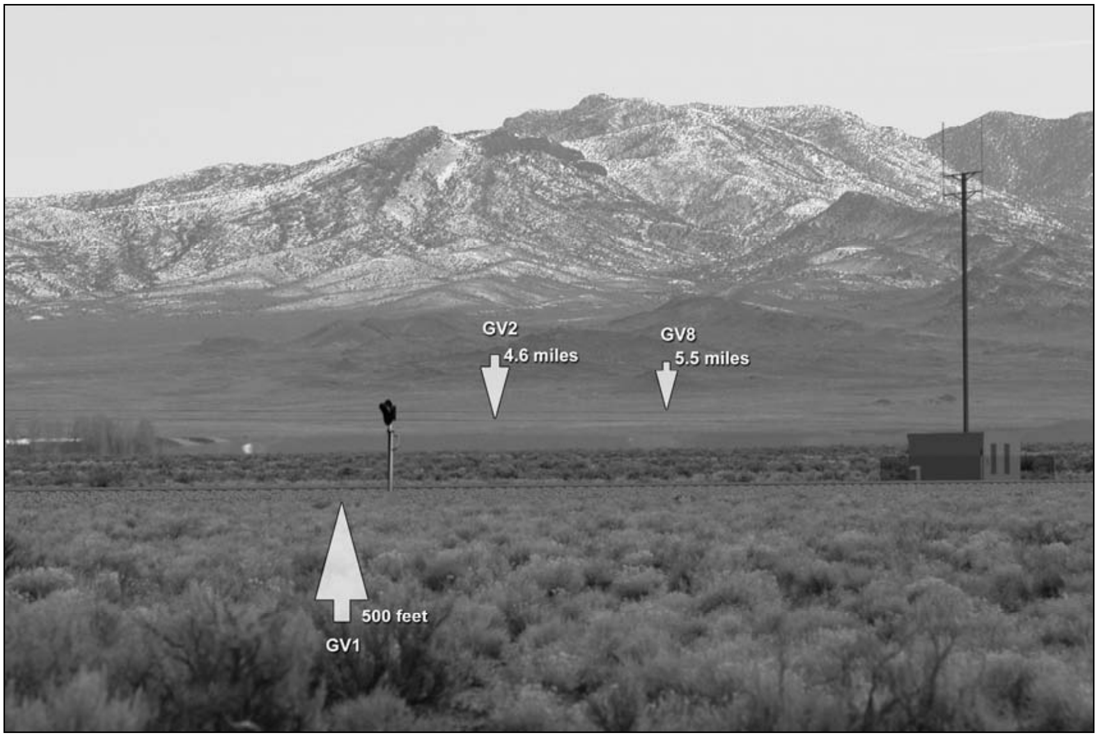


Figure D-33. Simulation from key observation point 14 of track on nearby Garden Valley alternative segment 1, distant Garden Valley alternative segment 2, and more distant Garden Valley alternative segment 8. Note simulation of signal and communication tower along Garden Valley alternative segment 1. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 1.

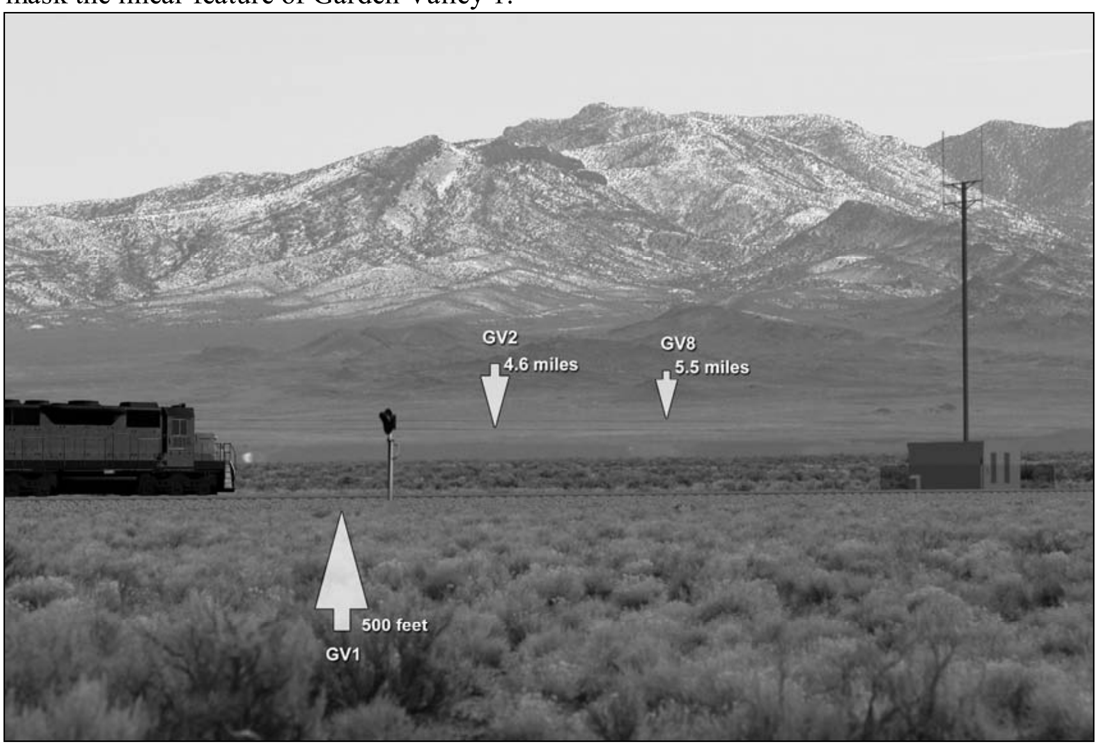


Figure D-34. Simulation of train on Garden Valley alternative segment 1 in view south from key observation point 14. Garden Valley alternative segment 2 and Garden Valley alternative segment 8 in distant midground. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 1.

Figure D-35. View northwest toward Quinn Canyon Range from key observation point 15 on county road south of Garden Valley. Tops of some *City* sculpture mounds visible in midground, ranch in right midground.

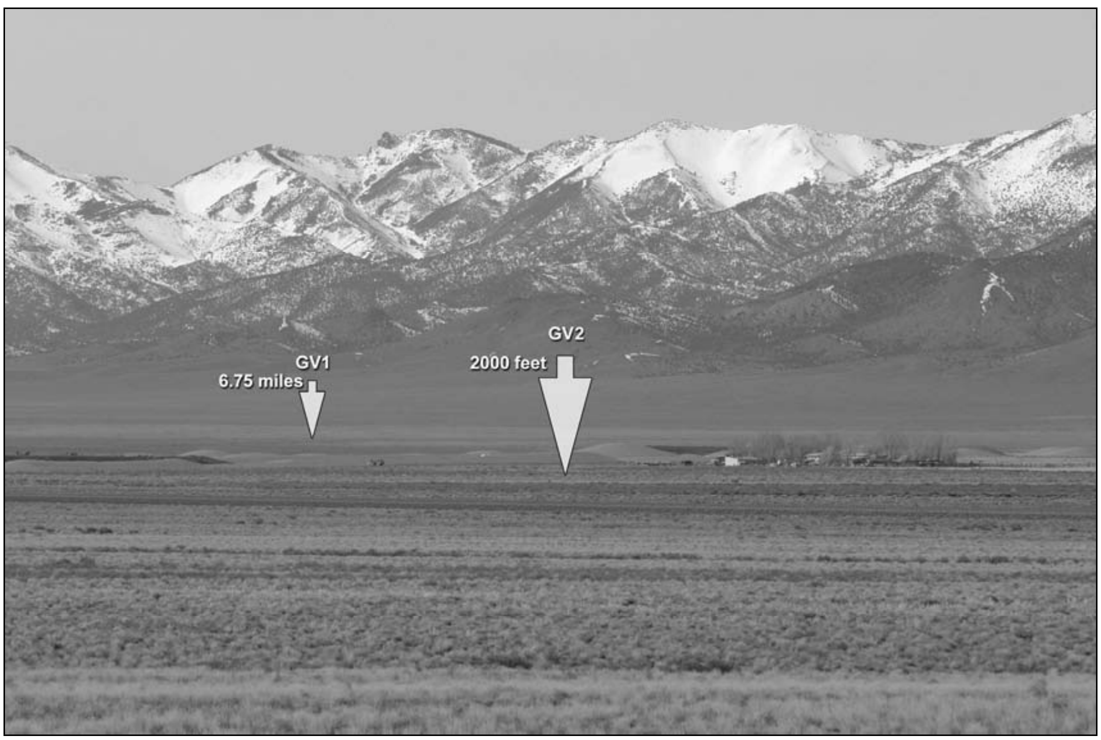


Figure D-36. Simulation of track on Garden Valley alternative segment 1 (background) and Garden Valley alternative segment 2 in view northwest from key observation point 15. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 2.

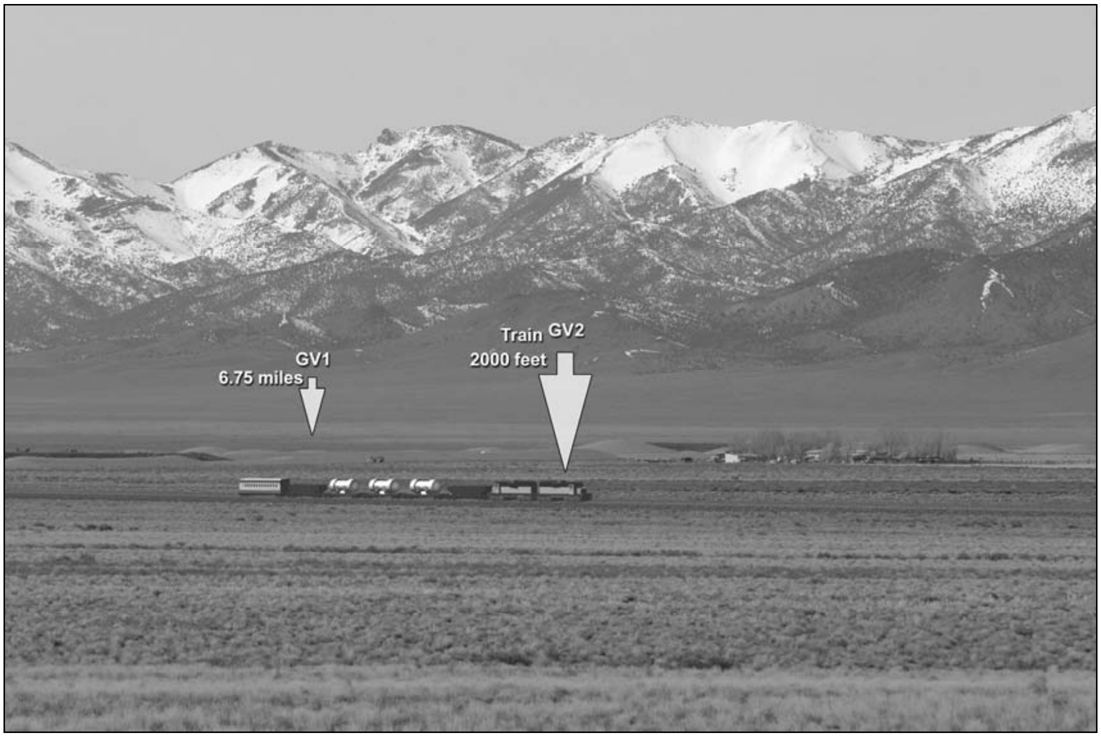


Figure D-37. Simulation of trains on Garden Valley alternative segment 2 (closest to viewer) and Garden Valley alternative segment 1 in view northwest from key observation point 15. Not in picture is an earthwork berm that would mask the linear feature of Garden Valley 2.

Figure D-38. View northwest toward the Quinn Canyon Range from key observation point 16 on top of a *City* mound.

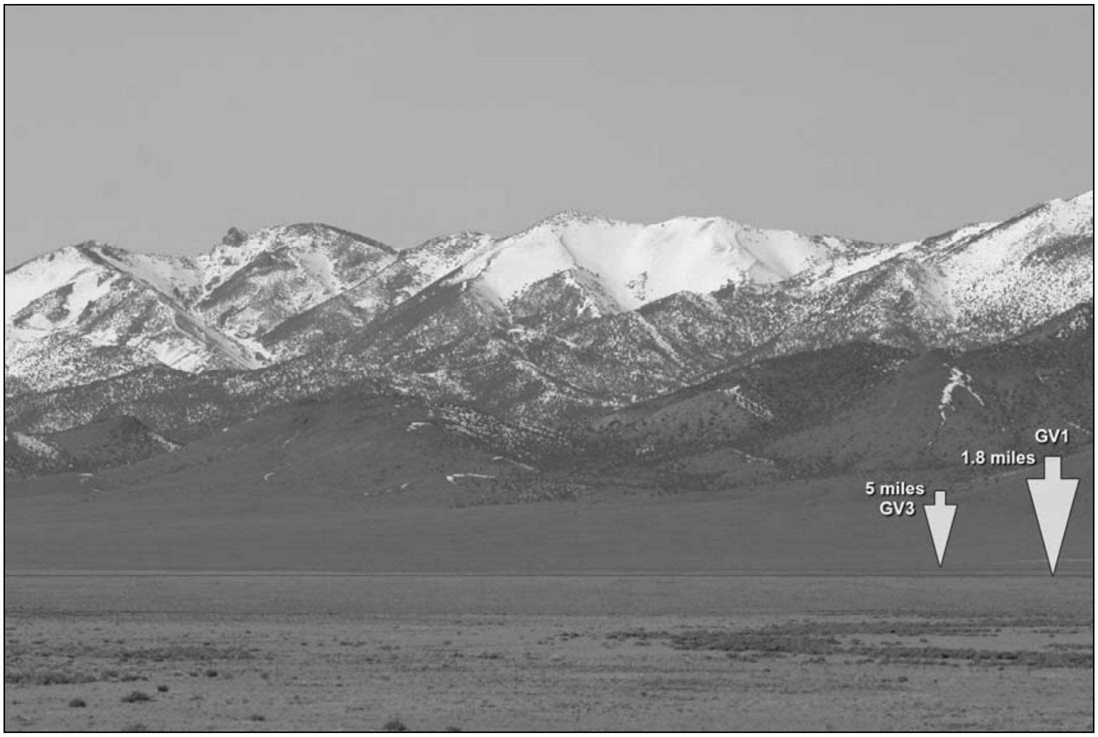


Figure D-39. Simulation of track on Garden Valley alternative segment 1 (midground) and Garden Valley alternative segment 3 (background) in view northwest from key observation point 16.

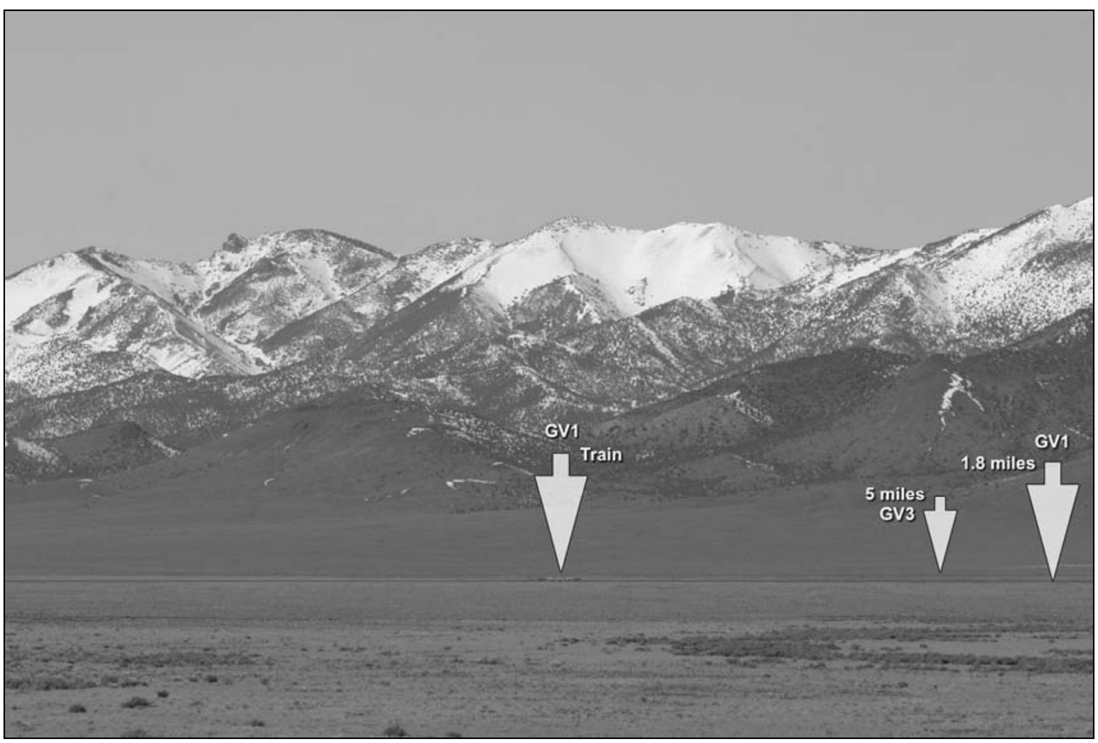


Figure D-40. Simulation of trains on Garden Valley alternative segment 1 and Garden Valley alternative segment 3 in view northwest from key observation point 16.

Figure D-41. View west-southwest from key observation point 16 on top of a *City* mound over Garden Valley between the Worthington and Quinn Canyon Ranges.

Figure D-42. Simulation of track on Garden Valley alternative segment 1 across midground of view, Garden Valley alternative segment 3 more distant, in view west-southwest from key observation point 16. Construction camp would be at greater distance from viewer, off photo on left.

Figure D-43. View southwest toward the Worthington Range from key observation point 17 on top of a *City* mound.

Figure D-44. Simulation of track on Garden Valley alternative segments 2 and 8 in view southwest from key observation point 17. On west side Garden Valley alternative segments 2 and 8 are approximately 1 mile apart; the two simulated tracks are not visible as distinct lines because of the distance and local topography. Instead, the visible line is slightly thicker than it would be if only one alternative segment were shown. The alternative segments merge into a single segment at about the center of the picture.

Figure D-45. View southeast from key observation point 18 on top of a *City* mound toward the Golden Gate Range.

Figure D-46. Simulation of track on Garden Valley alternative segment 2 and Garden Valley alternative segment 8 (more distant) in view southeast from key observation point 18.

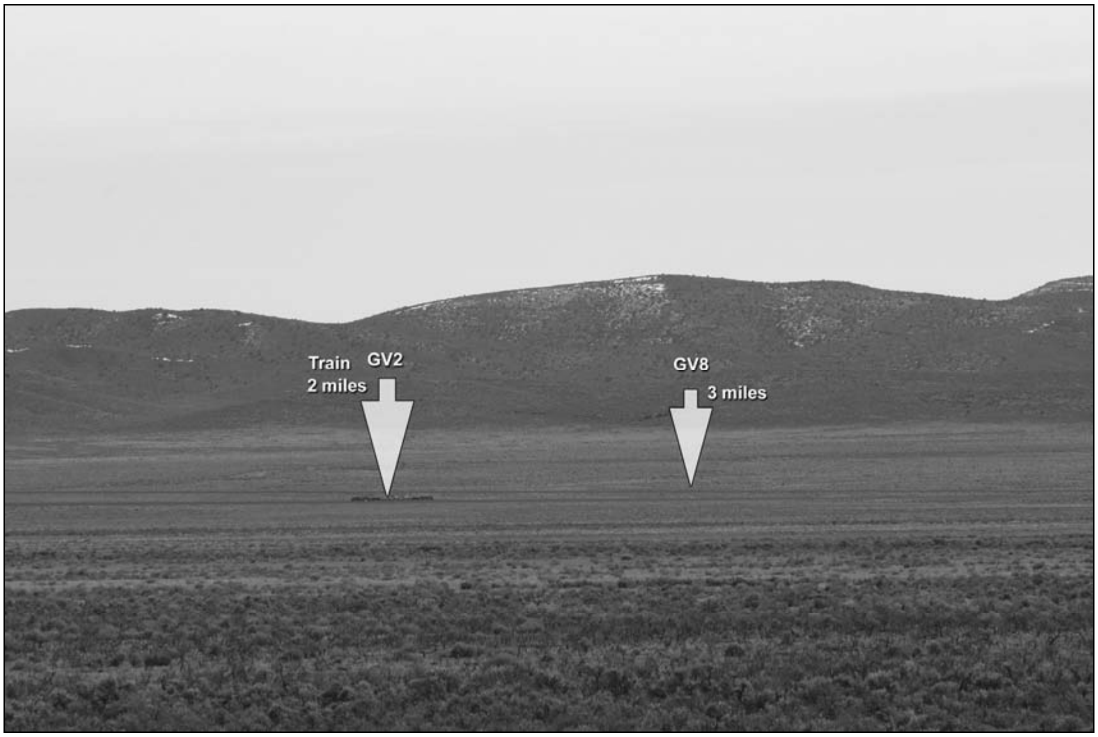


Figure D-47. Simulation of train on Garden Valley alternative segment 2 and track on Garden Valley alternative segment 8 (more distant), in view southeast from key observation point 18.

Figure D-48. View slightly north of east from key observation point 18 on top of a *City* mound, toward Water Gap. Note distant scar of Timber Mountain Pass Road over the Seaman Range in left midground.

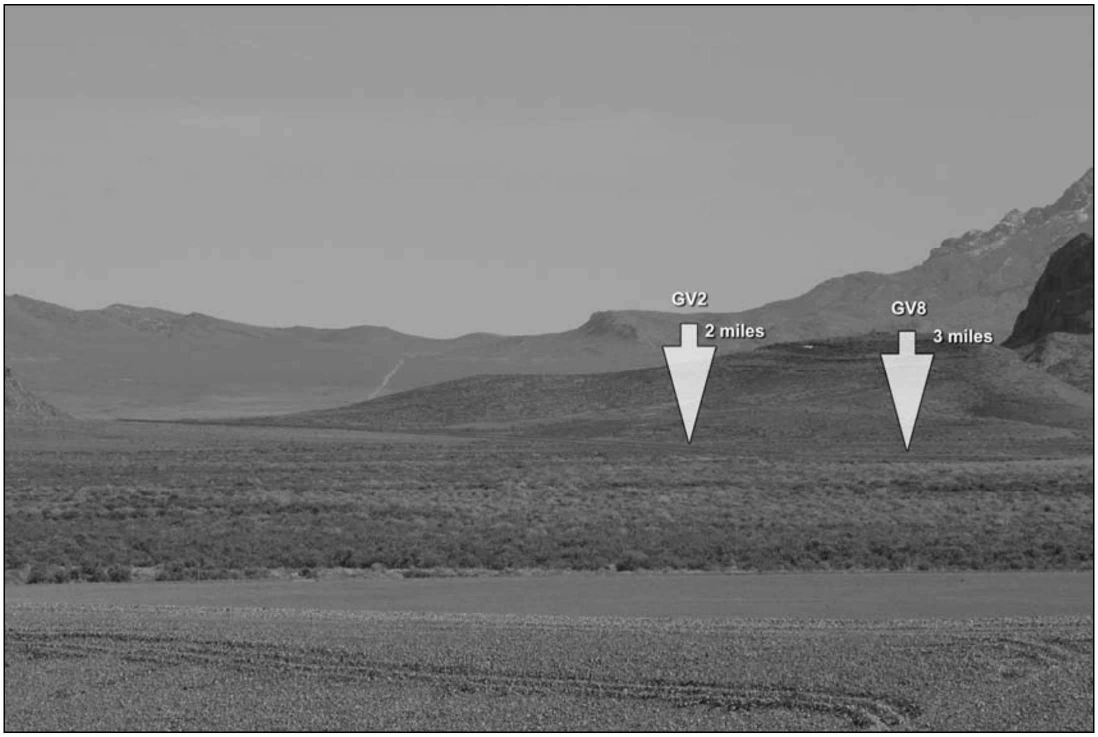


Figure D-49. Simulation of track on Garden Valley alternative segment 2 and Garden Valley alternative segment 8 (more distant) in view slightly north of east from key observation point 18.

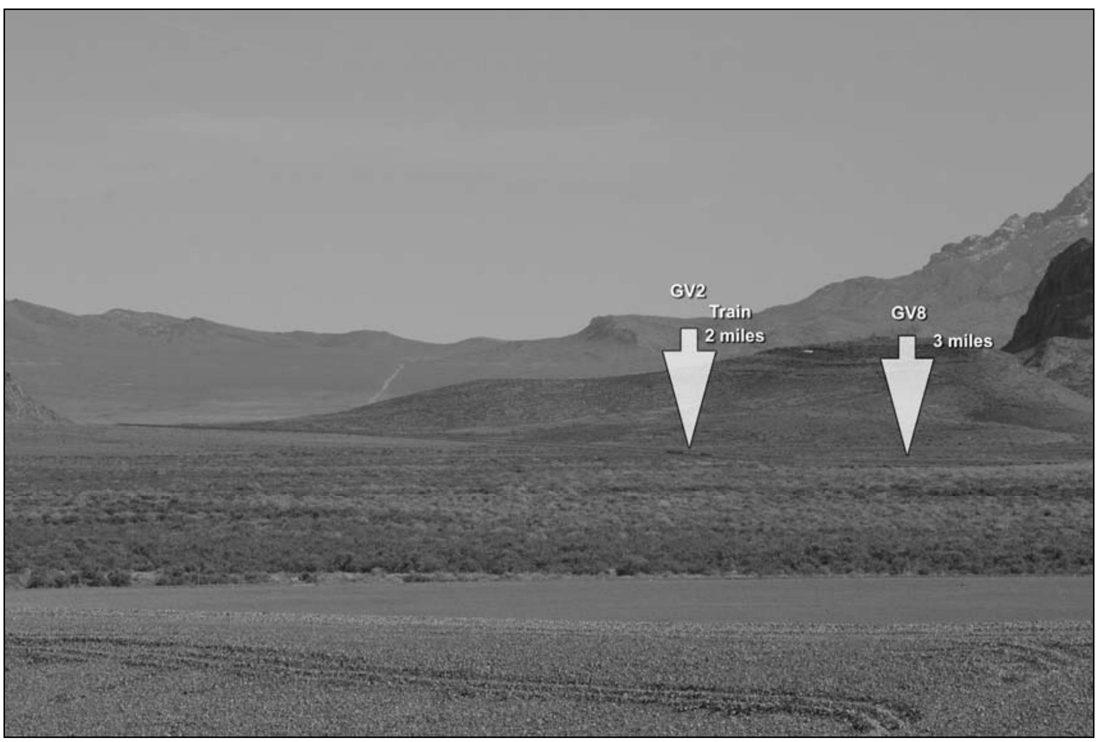


Figure D-50. Simulation of train on Garden Valley alternative segment 2 and track on Garden Valley alternative segment 8 (more distant), in view slightly north of east from key observation point 18.

Figure D-51. View south-southwest from key observation point 19 on State Route 375 near rail line crossing.

Figure D-52. Simulation of track and construction camp in view south-southwest from key observation point 19.

Figure D-53. View northeast from key observation point 20 at Cedar Pipeline Ranch. Quinn Canyon Range in center and right background; cone in center midground is Black Top.

Figure D-54. Simulation of track in view northeast from key observation point 20.

Figure D-55. View south from key observation point 21 on State Route 375 near intersection with U.S. Highway 6. View shows Reveille Valley with Kawich Range in middle ground. Rail line would be too distant to be seen in this view.

Figure D-56. View southwest from key observation point 22 on U.S. Highway 6 near intersection with State Route 375 toward the Kawich Range.

Figure D-57. Simulation of train in view from key observation point 22. As noted on photograph, much of the rail line would be obscured by topography from this viewpoint.

Figure D-58. View south-southwest from key observation point 23 on U.S. Highway 6 on east side of Warm Springs Summit.

Figure D-59. Simulation of track in view south-southwest from key observation point 23. Note simulation of signal in left midground, communications tower in right midground. Power poles are not simulations.

Figure D-60. Simulation of train in view south-southwest from key observation point 23. Note simulation of signal in left midground, communications tower in right midground. Power poles are not simulations.

Figure D-61. View east-southeast from key observation point 24 on Highway 6 toward the Kawich Range at Warm Springs Summit.

Figure D-62. Simulation of rail line in view east-southeast from key observation point 24. Track would be in a cut at this location so viewers would not see it, but the line of the cut would be discerned behind and roughly paralleling the power poles.

Figure D-63. View southeast from key observation point 25 on U.S. Highway 6 toward the Kawich Range. Highway visible on left, road to Clifford mine visible as snow track in center and right. Track would be in a cut at this location so viewers would not see it.

Figure D-64. View east-northeast toward the Kawich Range from key observation point 26 on Test and Training Range Road near location of rail line crossing.

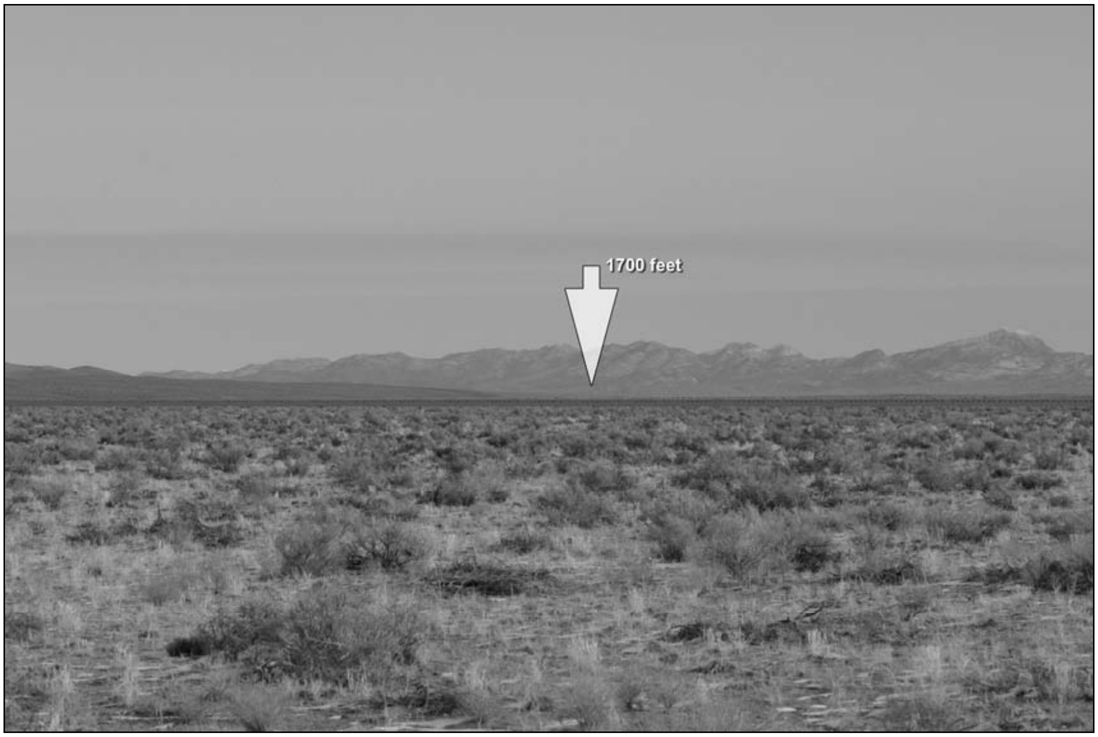


Figure D-65. Simulation of track in view east-northeast from key observation point 26.

Figure D-66. View east-northeast toward the Kawich Range from key observation point 27 on Test and Training Range Road near location of rail line crossing. Reed's Ranch visible in center midground.

Figure D-67. View southwest toward Pilot Peak from key observation point 28 on U.S. Highway 6. Rail line would be approximately two thirds of the distance between viewer and mountains.

Figure D-68. View east-northeast from key observation point 29 north of Goldfield on U.S. Highway 95. Activities and facilities at possible quarry in hills at right side of photo could be seen but would not attract attention.

Figure D-69. View south-southeast from key observation point 30 at north end of Goldfield on U.S. Highway 95.

Figure D-70. Simulation of track on Goldfield alternative segment 4 in view from key observation point 30. Distance and topography would obscure much of the rail line.

Figure D-71. View south-southeast from key observation point 31 on U.S. Highway 95 south of Goldfield.

Figure D-72. Simulation of Goldfield alternative segment 4 crossing over U.S. Highway 95 in view south-southeast from key observation point 31.

Figure D-73. Simulation of train on Goldfield alternative segment 4 in view south-southeast from key observation point 31.

Figure D-74. View east toward Stonewall Mountain from key observation point 32 on U.S. Highway 95 at intersection with State Route 266.

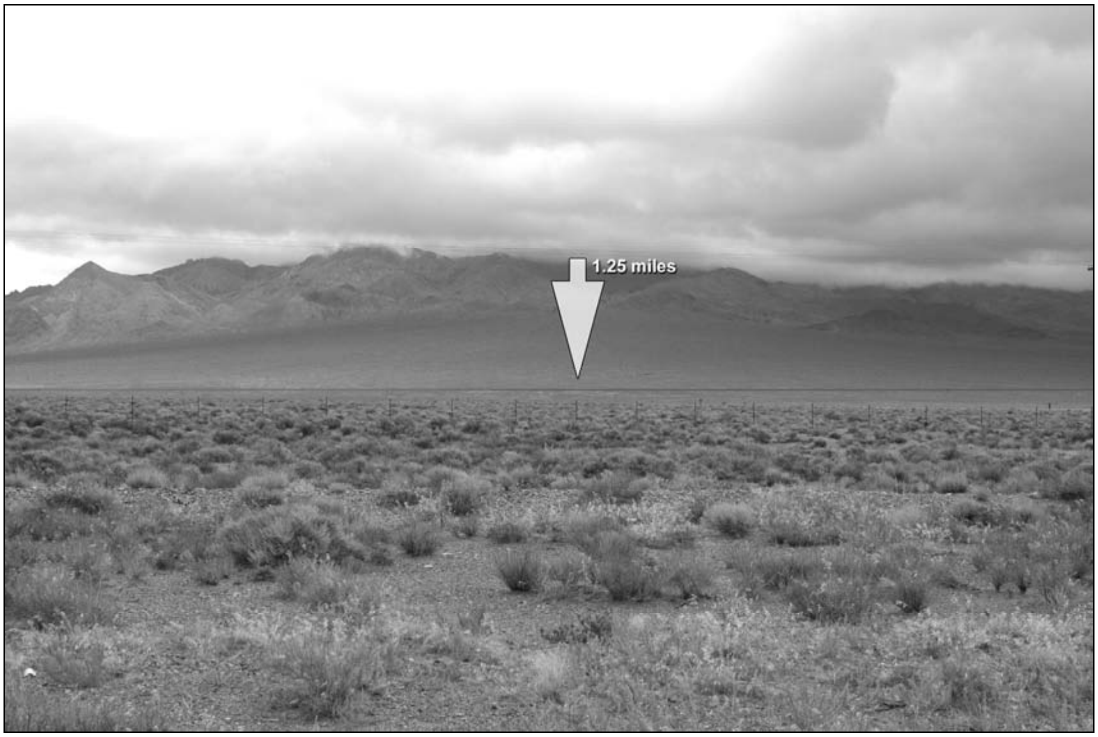


Figure D-75. Simulation of track in view east from key observation point 32. Stonewall Mountain in background.

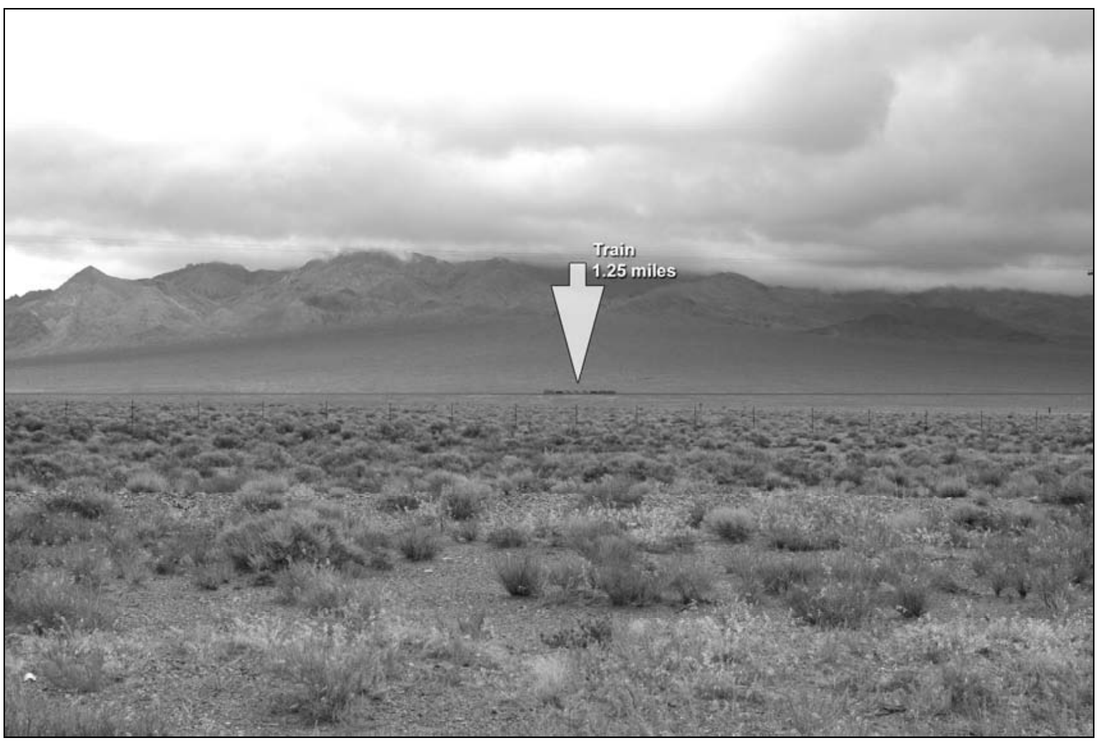


Figure D-76. Simulation of train in view east from key observation point 32. Stonewall Mountain in background.

Figure D-77. View north-northeast from key observation point 33 on U.S. Highway 95 at intersection with State Route 267. Rail line would be several miles in the distance.

Figure D-78. View southeast from key observation point 34 on U.S. Highway 95. Cut would remove lower slope at far right to keep rail line on flat grade.

Figure D-79. View north from key observation point 34 on U.S. Highway 95 toward same cut location shown in Figure D-78. Cut would remove lower slope at far left to keep rail line on flat grade.

Figure D-80. View north-northeast from key observation point 35 on U.S. Highway 95 across a typical landscape. This most northerly of views from this point across the Amargosa River Valley toward Oasis Valley is where the rail line would be closest to the highway.

Figure D-81. View northeast from key observation point 36 on U.S. Highway 95 looking across the road that would be used for construction access to Beatty Wash. Rail line, bridge, and construction camp would not be visible from this point.

Figure D-82. View northeast from key observation point 37 on U.S. Highway 95.

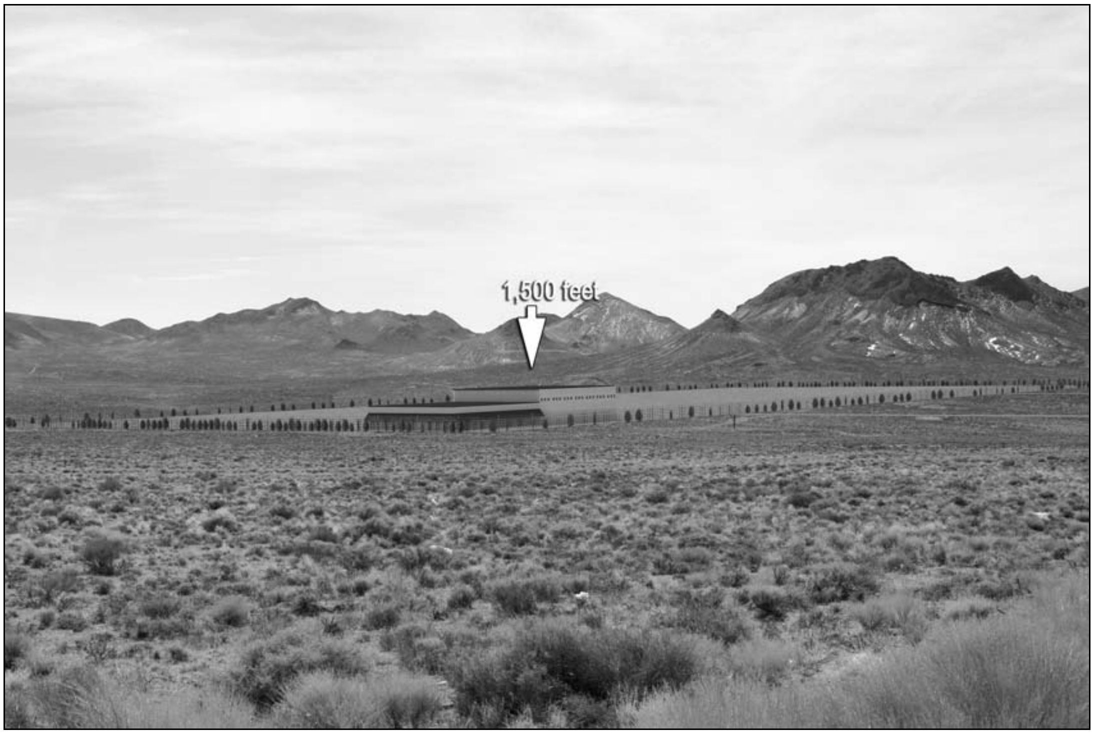
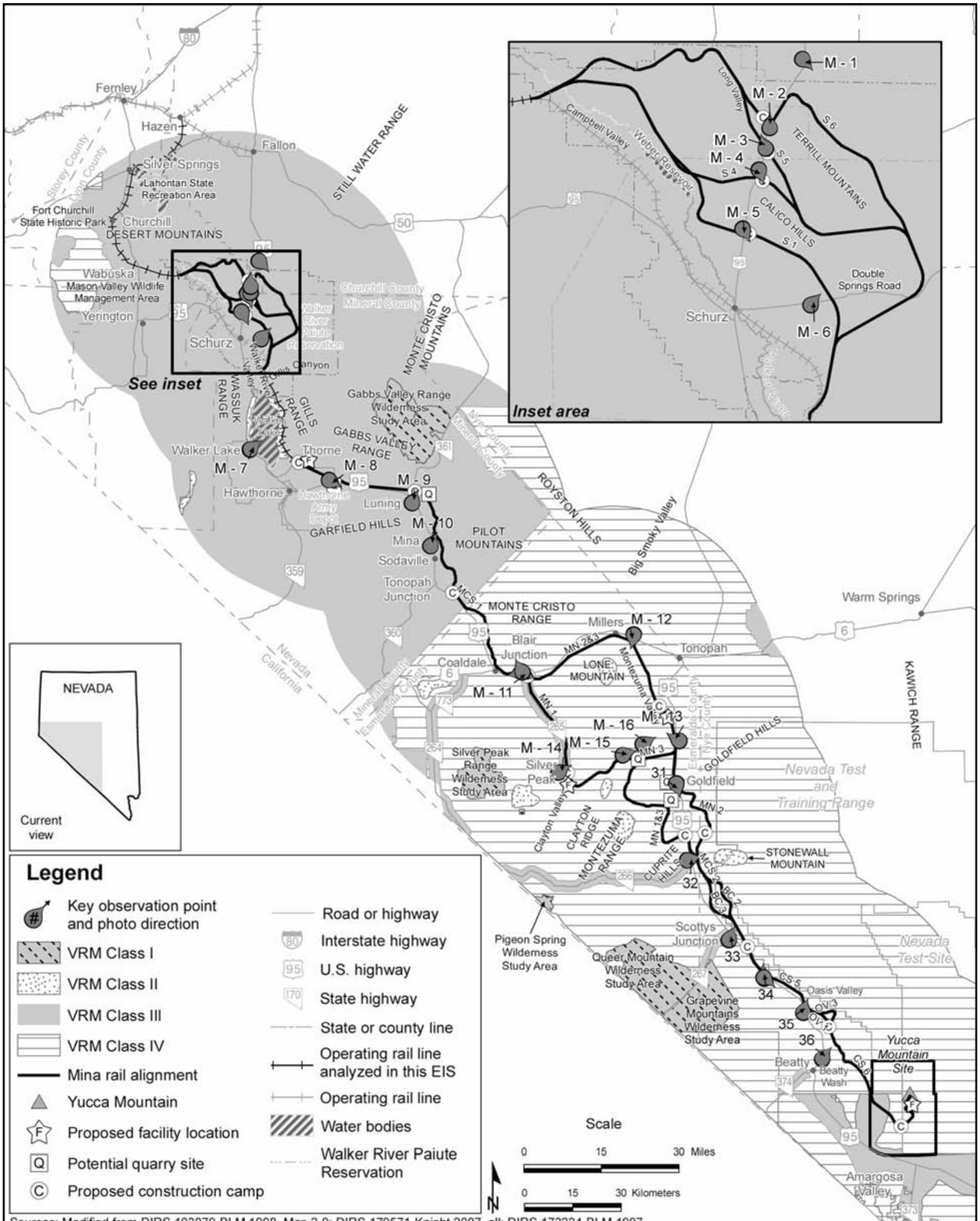


Figure D-83. Simulation of Maintenance-of-Way Headquarters Facility in view northeast from key observation point 37 on U.S. Highway 95.

D.2 Mina Rail Alignment

This section provides photographs taken from key observation points along the Mina rail alignment. For some views, DOE has added simulations to the baseline photographs to show how track, trains, or facilities would appear. Figure D-84 shows the locations of the key observation points and the BLM visual resource management classifications of the lands in the viewsheds. Key observation points 31 through 36 are the same as those shown in Section D.1 for the Caliente rail alignment.



Sources: Modified from DIRS 103079-BLM 1998, Map 2-9; DIRS 179571-Knight 2007, all; DIRS 173224-BLM 1997, pp. 6, 7, 27, and Map 8-9; DIRS 155970-DOE 2002, pp. 3-158 and 3-159.
Notes: VRM = Visual Resource Management; CS = common segment; MCS = Mina common segment; S = Schurz; MN = Montezuma; BC = Bonnie Claire; OV = Oasis Valley.

Figure D-84. Visual resource management classifications and key observation points along the Mina rail alignment.

Figure D-85. View southeast from key observation point M-1 on U.S. Highway 95 toward location of Schurz alternative segment 6 against hills.

Figure D-86. Simulation of Schurz alternative segment 6 across Rawhide Flats southeast from key observation point M-1 on U.S. Highway 95.

Figure D-87. Simulation of train on Schurz alternative segment 6 across Rawhide Flats southeast from key observation point M-1 on U.S. Highway 95.

Figure D-88. View northeast from key observation point M-2 on U.S. Highway 95 toward location of Schurz alternative segment 6 and rail-over-road crossing.

Figure D-89. Simulation of Schurz alternative segment 6 and grade-separated crossing of U.S Highway 95, view northeast from key observation point M-2.

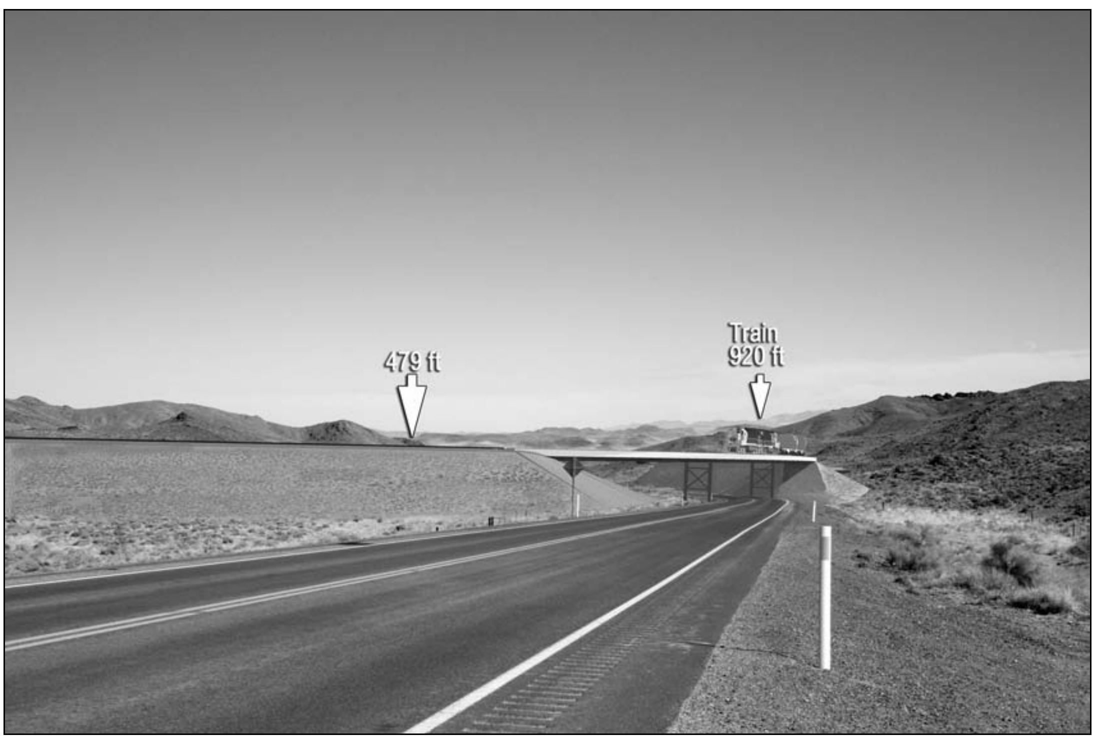


Figure D-90. Simulation of train on Schurz alternative segment 6 and grade-separated crossing of U.S Highway 95, view northeast from key observation point M-2.

Figure D-91. View north in Long Valley, toward location of proposed grade-separated crossing of U.S. Highway 95 over Schurz alternative segment 5 from key observation point M-3.

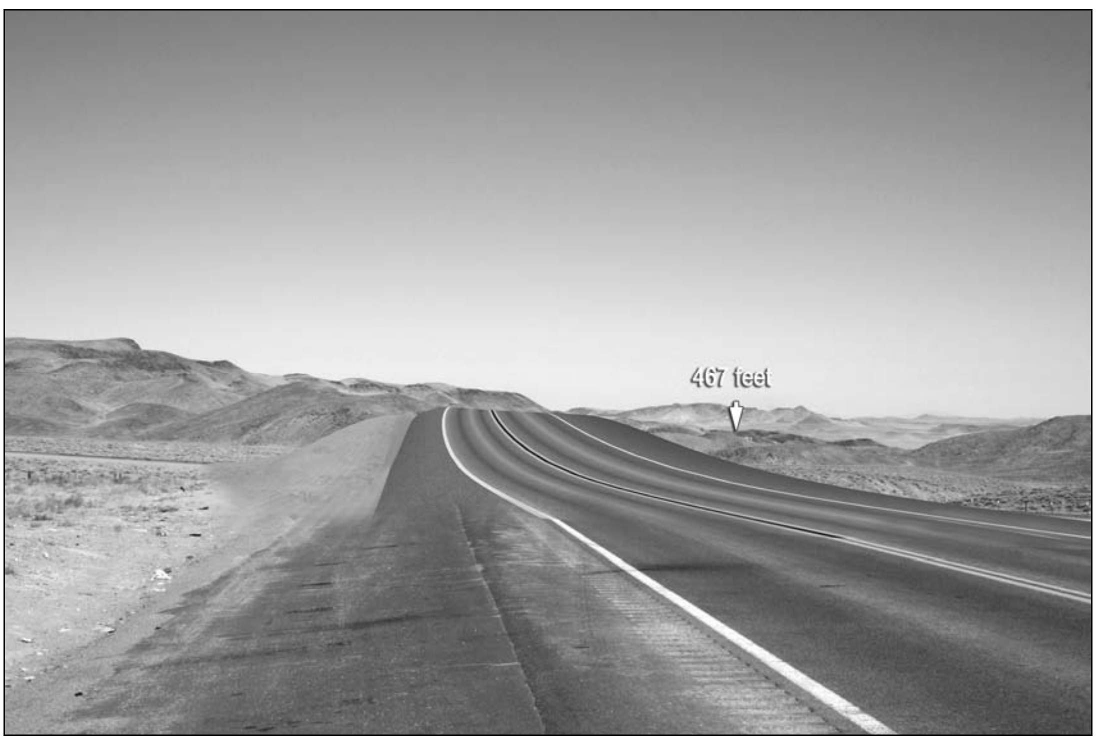


Figure D-92. U.S. Highway 95 in Long Valley, simulation of grade-separated crossing of U.S. Highway 95 over Schurz alternative segment 5 from key observation point M-3.

Figure D-93. View south from key observation point M-4 at intersection of U.S. Highway 95 and Weber Dam Road, toward location of Schurz alternative segment 4 and grade-separated crossing.

Figure D-94. Simulation of U.S. Highway 95 grade-separated crossing and Schurz alternative segment 4, view south from key observation point M-4 near intersection of highway and Weber Dam Road.

Figure D-95. Simulation of U.S. Highway 95 grade-separated crossing and train on Schurz alternative segment 4, view south from key observation point M-4 near intersection of highway and Weber Dam Road.

Figure D-96. View south from key observation point M-5 on U.S. Highway 95 east of Schurz alternative segments, toward location of Schurz alternative segment 1 grade-separated crossing.

Figure D-97. View east from key observation point M-6 on Double Springs Road toward location of at-grade crossing of Schurz alternative segment 1.

Figure D-98. Simulation of at-grade Double Springs Road crossing and Schurz alternative segment 1, view east from key observation point M-6.

Figure D-99. Simulation of at-grade Double Springs Road crossing and train on Schurz alternative segment 1, view east from key observation point M-6.

Figure D-100. View east from key observation point M-7 in the town of Walker Lake across lake toward existing Department of Defense Branchline South. Photo shows the visibility of the existing line at distance of 9.3 kilometers (5.8 miles).

Figure D-101. View southeast from key observation point M-8 on U.S. Highway 95 just east of Hawthorne toward location of potential Garfield Hills quarry facilities.

Figure D-102. Simulation of Garfield Hills quarry facilities in view southeast from key observation point M-8 on U.S. Highway 95.

Figure D-103. View east from key observation point M-9 in the town of Luning toward potential Gabbs Range quarry site.

Figure D-104. Simulation of Gabbs Range quarry from key observation point M-9 in view east from Luning.

Figure D-105. Simulation of train and Gabbs Range quarry from key observation point M-9 in view east from Luning.

Figure D-106. View east from the town of Mina toward Mina common segment 1.

Figure D-107. Simulation of Mina common segment 1 in view east from key observation point M-10 at high point in the town of Mina.

Figure D-108. Simulation of train on Mina common segment 1 in view east from key observation point M-10 at high point in the town of Mina.

Figure D-109. View from key observation point M-11 at intersection of State Route 265 and U.S. Highway 95 (Blair Junction) north to Mina common segment 1 toward Monte Cristo Range. The rail line would travel through the area in the foreground between the viewer and the hills.

Figure D-110. View from key observation point M-11 at intersection of State Route 265 and U.S. Highway 95 (Blair Junction) south-southeast over State Route 265 to Montezuma alternative segment 1.

Figure D-111. Simulation of Montezuma alternative segment 1 running south along State Route 265 in view south-southeast from key observation point M-11 at Blair Junction.

Figure D-112. Simulation of train on Montezuma alternative segment 1 running south along State Route 265 in view south-southeast from key observation point M-11 at Blair Junction.

Figure D-113. View from key observation point M-11 at intersection of State Route 265 and U.S. Highway 95 (Blair Junction) west over Mina common segment 1.

Figure D-114. View south from key observation point M-12 on U.S. Highway 95 in Montezuma Valley toward location of Montezuma alternative segments 2 and 3 and Lone Mountain. Either segment would be in the middleground and would follow an existing rail bed, thus causing little additional contrast.

Figure D-115. View west from key observation point M-13 on U.S. Highway 95, toward location of Montezuma alternative segments 2 and 3 and proposed Maintenance-of-Way Facility at Klondike. A weak degree of contrast would result from the linear feature of the rail line in the foreground of the photo.

Figure D-116. View northeast from key observation point M-14 on Main Street in Silver Peak, south of the Chemetall Foote Corporation processing plant toward Montezuma alternative segment 1. The rail line would cross the white playa bottom in the middleground, and would be visible due to color discrepancy with the ballast material.

Figure D-117. View east from key observation point M-15 on Silver Peak Road toward location of Montezuma alternative segment 1 and North Clayton quarry.

Figure D-118. View northeast from key observation point M-16 on Silver Peak Road toward location of Montezuma alternative segments 2 and 3. Rail line would appear as a faint line in the background or would not be visible.

Figure D-119. View south-southeast from key observation point 31 on U.S. Highway 95 south of Goldfield.

Figure D-120. Simulation of Montezuma alternative segment 2 crossing over U.S. Highway 95 in view south-southeast from key observation point 31.

Figure D-121. Simulation of train on Montezuma alternative segment 2 in view south-southeast from key observation point 31.

Figure D-122. View east toward Stonewall Mountain from key observation point 32 on U.S. Highway 95 at intersection with State Route 266.

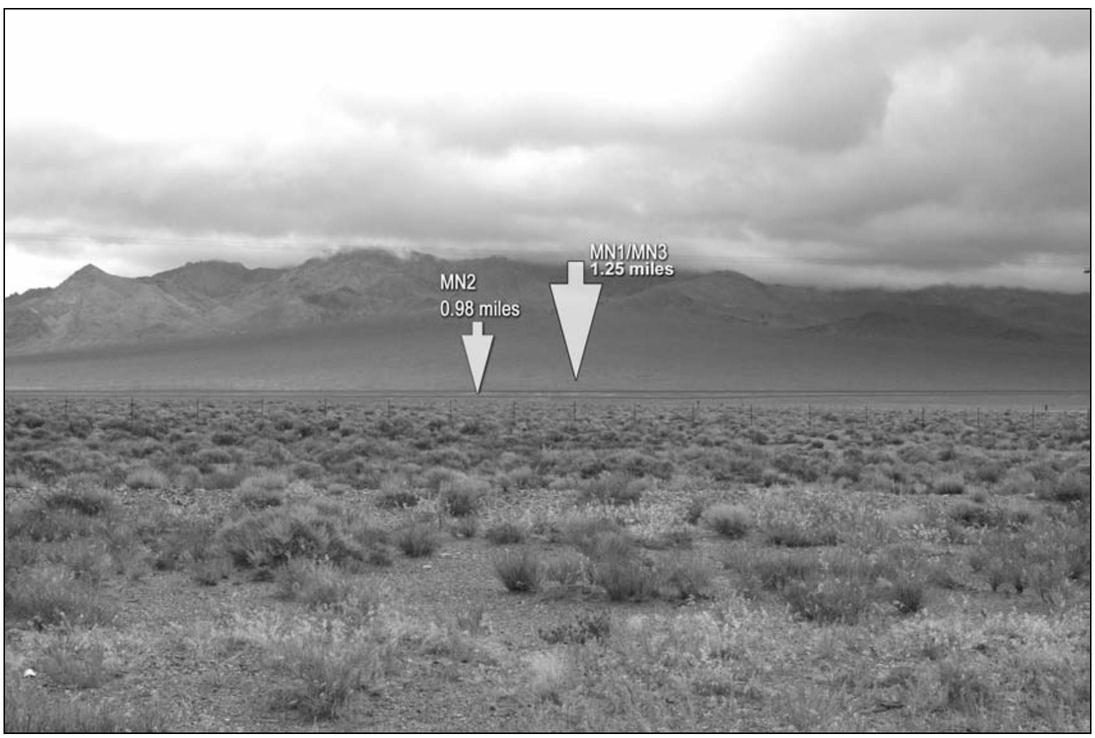


Figure D-123. Simulation of Montezuma alternative segments 1 and 3 (middleground) and Montezuma alternative segment 2 (foreground) in view east from key observation point 32. Stonewall Mountain in background.

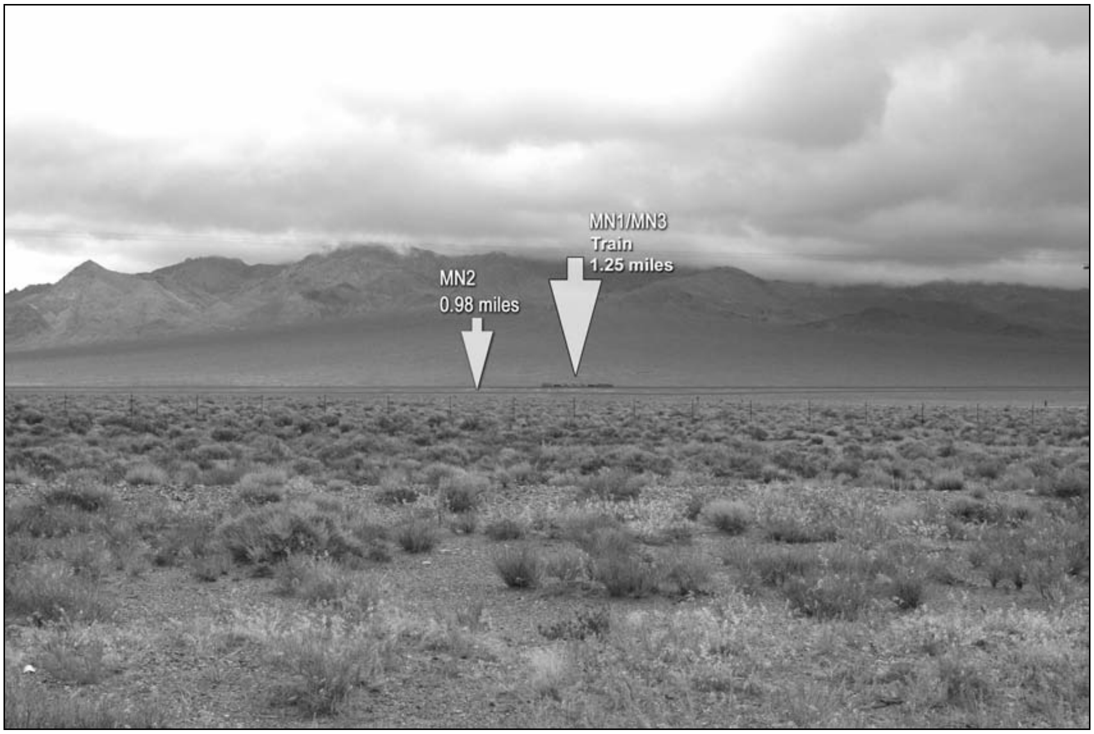


Figure D-124. Simulation of train on Montezuma alternative segments 1 and 3 (middleground) with Montezuma alternative segment 2 in foreground. View east from key observation point 32 with Stonewall Mountain in background.

Figure D-125. View north-northeast from key observation point 33 on U.S. Highway 95 at intersection with State Route 267. Rail line would be several miles in the distance.

Figure D-126. View southeast from key observation point 34 on U.S. Highway 95. Cut would remove lower slope at far right to keep rail line on flat grade.

Figure D-127. View north from key observation point 34 on U.S. Highway 95 toward same cut location shown in Figure D-126. Cut would remove lower slope at far left to keep rail line on flat grade.

Figure D-128. View north-northeast from key observation point 35 on U.S. Highway 95 across a typical landscape. This most northerly of views from this point across the Amargosa River Valley toward Oasis Valley is where the rail line would be closest to the highway.

Figure D-129. View northeast from key observation point 36 on U.S. Highway 95 looking across the road that would be used for construction access to Beatty Wash. Rail line, bridge, and construction camp would not be visible from this point.

D.3 References

173052	BLM 1984	BLM (Bureau of Land Management) 1984. 8400 - Visual Resource Management, BLM Manual. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050406.0039.
101505	BLM 1986	BLM (Bureau of Land Management) 1986. Visual Resource Inventory. BLM Manual Handbook 8410-1. Washington, D.C.: U.S. Bureau of Land Management. ACC: MOL.20010730.0378.
173053	BLM 1986	BLM (Bureau of Land Management) 1986. Visual Resource Contrast Rating, BLM Manual Handbook 8431-1. [Washington, D.C.]: Bureau of Land Management. ACC: MOL.20050406.0040.

APPENDIX E

AIR QUALITY ASSESSMENT METHODOLOGY

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ACRONYMS AND ABBREVIATIONS

CO	carbon monoxide
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
PM_{10}	particulate matter with an aerodynamic diameter equal to or less than 10 micrometers
$PM_{2.5}$	particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometers
SO_2	sulfur dioxide
VOCs	volatile organic compounds

APPENDIX E

AIR QUALITY ASSESSMENT METHODOLOGY

This appendix describes the methods DOE used to develop the assessments of potential impacts to air quality provided in Sections 4.2.4 and 4.3.4 of the Rail Alignment EIS.

Section **E.4** defines terms shown in ***bold italics***.

This appendix provides detail on the basis for:

- The air quality modeling methodology for construction and operation of the proposed railroad
- The emission inventory as used in the air quality modeling and for the county-level emission inventory comparison
- Site-specific details on the air quality modeling employed for each location where the U.S. Department of Energy (DOE or the Department) performed an assessment

Section E.1 is an overview of the air quality modeling methodology and assumptions; Section E.2 addresses the Caliente rail alignment; and Section E.3 addresses the Mina rail alignment.

E.1 Overview of Air Quality Modeling Methodology and Assumptions

This section describes the general approach DOE used to model potential impacts to existing ***ambient air*** quality that would result from emissions during railroad construction and operations along the Caliente rail alignment or the Mina rail alignment.

Air quality is generally a regional issue, and compliance with federal and state air quality standards is most often determined at the county level. Historic data on pollutant emissions inventories and compliance status for the State of Nevada are calculated at the county level, and these provide the best means of comparison to the potential impacts from proposed railroad construction and operations. Therefore, the air quality assessment considered impacts associated with increases in total emissions levels and compliance with regulatory standards at the county level.

However, stationary point sources (such as quarries) and mobile sources of air emissions (such as operating trains and automobiles) can subject certain locations, such as population centers (known as receptors), to higher localized levels of pollutants than a regional analysis would suggest. Therefore, DOE also selected more focused study locations within the region of influence in which to model air quality impacts to specific receptors. The Department modeled potential impacts to air quality using the U.S. Environmental Protection Agency (EPA) ***AERMOD*** Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). Model inputs included (1) the estimated air pollutant emissions rates that would be produced by railroad construction and operations activities and (2) local meteorology, where appropriate.

DOE modeled a set of scenarios for the Caliente rail alignment and a set for the Mina rail alignment, in which each combination of location and activity represents one scenario. Generally, the methodology employed to determine potential impacts from air emissions for a scenario involved the following steps:

1. Determine the appropriate air pollutant emissions rates from all facilities in question at the given location.

2. Set up the modeling scenarios in AERMOD to accurately represent the expected layout of emissions sources and position receptors to capture the maximum expected impact from the scenario, including terrain effects on concentration.
3. Obtain at least 3 years of appropriate meteorological inputs for the modeling scenario.
4. Run the model for 3-year periods for the given scenario with unit values (1 gram per second) for emission rates from all sources.
5. Post-process the model output to adjust the unit emission rates for the actual emission rates for each pollutant from each source and determine peak concentrations for all air pollutants of concern and for all averaging periods.
6. Combine the peak and background concentrations and compare them with the applicable ***National Ambient Air Quality Standards*** (NAAQS) to determine if the scenario would have the potential to exceed the NAAQS.

DOE based the air quality modeling effort on the following:

- Emissions from all construction activities involving surface disturbance, laying track, and other processes would have a release height of 0.5 meter (1.6 feet), representing a typical exhaust height, with a initial vertical dimension of 0.46 meter (1.5 feet) to reflect surface or near-surface releases. Emissions from locomotives would have a release height of 5 meters (16 feet) (DIRS 173568-California Environmental Protection Agency 2004, Appendix G) with an initial vertical dimension of 2.3 meters (7.5 feet).
- DOE modeled construction and operations activities along the rail line and rail sidings as volume sources because those emissions would have both a horizontal and a vertical dimension associated with the train stacks and buoyant plumes. Modeling the highly linear rail line as a volume source best represents the initial shape of the plume. The Department modeled activities during quarry operations as area sources to maximize flexibility in source shape and orientation.
- DOE determined maximum air pollutant concentrations near construction and operations activities. The Department set the distance between each activity and the closest receptors on both sides of the edge of the construction right-of-way during the construction phase and on both sides of the edge of the operations right-of-way during the operations phase. The spacing between receptors averaged 25 meters along the right-of-way. All receptors were set at a standard breathing height of 1.8 meters (5.9 feet) above ground level.
- For purposes of modeling, DOE took the layout of each facility for the Caliente rail alignment from *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 01* (DIRS 176168-Nevada Rail Partners 2006, all).
- For purposes of modeling, DOE took the layout of each facility for the Mina rail alignment from *Facilities–Design Analysis Report Mina Rail Corridor, Task 10: Facilities, Rev. 00* (DIRS 180873-Nevada Rail Partners 2007, pp. 3-1 and 3-2).
- Construction activity along the rail alignment and at all facilities would occur for 12 hours per day, 5 days each week for the duration of each activity.
- During the construction phase, quarries would operate evenly over a 250-day per year schedule (average of 5 days per week), 12 hours per day each week. DOE set receptor locations at the quarry fence line (DIRS 175945-Nevada Rail Partners 2005, pp. 3-7 and 3-8; DIRS 176182-Shannon & Wilson 2006, pp. 15 and 33). Spacing between receptors averaged 50 meters along the fence line.
- DOE determined air pollutant concentrations at all receptors for each scenario using the AERMOD dispersion modeling system version 07026 (DIRS 174202-EPA 2002, DIRS 181091-EPA 2004, all;

DIRS 181090-EPA 2007, all). This software is currently the EPA-recommended model for regulatory applications and is appropriate for this application. Meteorological and terrain inputs for AERMOD were prepared with the ***AERMET*** and ***AERMAP*** preprocessors, respectively. Both employ version 06341.

- DOE aggregated the concentration values from each air pollutant source in each scenario and adjusted from unit to actual emission rates. Generally, this procedure operated by reading the individual model output files for each source group in each scenario, summing the contribution from each source group at each receptor and outputting the receptor exhibiting the peak concentration of each air pollutant.
- DOE computed maximum concentrations (along with maximum background concentration) for all sources in each scenario for all ***criteria air pollutants*** and compared these maximums to the Nevada and National Ambient Air Quality Standards.

E.2 Caliente Rail Alignment

The Caliente rail alignment region of influence for air quality and climate consists of the air basins in three counties (Lincoln, Nye, and Esmeralda) in Nevada through which the rail line would run. DOE performed air quality modeling in four locations: the two largest population centers near the Caliente rail alignment (Caliente in Lincoln County and Goldfield in Esmeralda County), and quarry sites northwest of Caliente (CA-8B) and in South Reveille Valley (NN-9B).

For the Caliente rail alignment, the Department modeled a total of eight scenarios, as listed in Table E-1.

Table E-1. Air quality modeling scenarios for railroad construction and operations along the Caliente rail alignment.

Scenario	Activity	Location
1	Rail line construction	Near the City of Caliente (Lincoln County)
2	Facility construction	Interchange Yard in Caliente
3	Rail line construction and quarry operations	Potential quarry site CA-8B northwest of Caliente
4	Rail line construction and quarry operations	Potential quarry site NN-9B in South Reveille Valley (Nye County)
5	Rail line construction	Near Goldfield (Esmeralda County)
6	Railroad operations	Near Caliente
7	Facility operations	Interchange Yard in Caliente
8	Railroad operations	Near Goldfield

E.2.1 CONSTRUCTION IMPACT ASSESSMENT – CALIENTE RAIL ALIGNMENT

E.2.1.1 Overview

DOE assumed a total duration of the construction phase to be the shortest under consideration (4 years), with 36 months of construction and the remaining 12 months allocated to installation, testing of signal and communications equipment, and commissioning. This assumption produced conservative (high) emission estimates, because longer periods of construction would result in lower annual emission rates.

The construction impact assessment included emissions and impacts to air quality associated with the construction of the rail line, access roads, wells, quarries, construction camps, and construction-material storage piles. *Construction Plan Caliente Rail Corridor, Task 14: Construction Planning Support, Rev. 01* (DIRS 176172-Nevada Rail Partners 2006, all) provides more detail on construction and associated emissions.

The construction impact assessment also included emissions and air quality impacts associated with the construction of the Interchange Yard at the Interface with the Union Pacific Railroad Mainline in Lincoln County, which DOE expects would occur during the first year of the rail line construction phase. Details on the activity and emissions at this facility were taken from the *Air Quality Emission Factors and Socio-Economic Model Input Caliente Rail Corridor, Task 13: EIS Interface Support, Rev. 01* (DIRS 180921-Nevada Rail Partners 2007, all) (the Caliente Rail Corridor Task 13 document).

E.2.1.1.1 Exhaust Emissions

DOE based the estimated exhaust emissions associated with construction of the proposed railroad along the Caliente rail alignment on engineering estimates of activity levels for construction crews operating in either rugged or gentle terrain. The Department assumed the use of similar construction equipment in both types of terrain, but assumed that the duration of activities would be longer in rugged terrain. Rugged terrain would require significant cut-and-fill operations.

DOE estimated exhaust emissions consisting of ***nitrogen oxides*** (NO_x), ***particulate matter*** with aerodynamic diameters equal to or less than 10 micrometers (PM_{10}) and 2.5 micrometers ($PM_{2.5}$), ***sulfur dioxide*** (SO_2), ***carbon monoxide*** (CO), and ***volatile organic compounds*** (VOCs) from both non-road and on-road equipment. Non-road equipment would include bulldozers, graders, front-end and backhoe loaders, excavators, scrapers, cranes, compactors, tampers, drills, and other equipment. On-road equipment would include equipment licensed for on-road use that would be used for construction of the proposed railroad (such as pickup, dump, and water trucks).

To determine annual non-road equipment exhaust emissions, DOE used engineering estimates of equipment size, activity levels, annual hours of operation, and horsepower ratings for the construction equipment as reported in the Caliente Rail Corridor Task 13 document. This document included in its analysis an adjustment to operating hours for the cut-and-fill operations. Activity hours for locations assessed as needing considerable cut and fill operations were increased by 50 percent. Emissions factors for corresponding classes of non-road equipment used in construction were conservatively estimated from EPA Tier 1 (typically, 1997 to 2003 model-year equipment) emissions standards based on horsepower ratings from *Exhaust and Crankcase Emissions Factors for Non-road Engine Modeling—Compression-Ignition* (DIRS 174089-EPA 2004, all). Exhaust emissions of NO_x were conservatively converted to ***nitrogen dioxide*** (NO_2) at the rate of 20 percent.

To determine exhaust emissions from on-road equipment, annual operating hours from the Caliente Rail Corridor Task 13 document (DIRS 180921-Nevada Rail Partners 2007, all) were converted to annual miles traveled assuming average operating speeds of 24 kilometers (15 miles) per hour and combined with emissions factors for appropriate vehicle classifications from the EPA MOBILE 6.2 vehicle emission modeling software (DIRS 174201-EPA 2003, all; DIRS 181954-EPA 2007, all; DIRS 181955-EPA 2004, all).

E.2.1.1.2 Fugitive Dust Emissions

DOE estimated particulate-matter emissions from ***fugitive dust*** associated with construction activities along the Caliente rail alignment based on the calculations in the Caliente Rail Corridor Task 13 document (DIRS 180921-Nevada Rail Partners 2007, all). These calculations are based on EPA emission factor guidance from *AP-42, Compilation of Air Pollutant Emission Factors* (DIRS 103679-EPA 1991, Section 13.2.3) and the *WRAP Fugitive Dust Handbook* (DIRS 174081-Countess 2004, Chapters 3, 6, and 9). DOE estimated fugitive dust emissions for soil disturbance from grading, scraping, bulldozing, and other rail line construction activities; wind erosion; construction material stockpiles; construction and operation of concrete batch plants; construction camps; rail line facilities; quarry and excavation activities; and construction of new access roads or upgrades of unpaved roads.

The rail line construction right-of-way would be nominally 150 meters (500 feet) on either side of the centerline of the rail alignment (300 meters [1,000 feet] total width). In addition, the Caliente rail alignment would include:

- Two major bridges (over Beatty Wash and the White River) and a series of minor bridges.
- Twelve construction camps 0.1 square kilometer (25 acres) each.
- Sites for four railroad operations support facilities (the Interchange Yard, Staging Yard, Maintenance-of-Way Trackside Facility, and Rail Equipment Maintenance Yard) that would occupy 0.06 square kilometer, 0.2 square kilometer, 0.06 square kilometer, and 0.4 square kilometer (15, 50, 15, and 100 acres), respectively.
- A total of 23 kilometers (14 miles) of access roads to facilities, plus the access roads on either side of the rail line.
- Four hundred storage piles to be used in track construction that would be located along the rail route.

Fugitive dust emissions would also be associated with the operation of batch plants (including two coarse and fine storage piles), with new road construction or upgrades, and with quarry and excavation operations. In addition to the rail roadbed construction activity, a substantial amount of fugitive dust emissions would be related to haul trucks in the construction zone.

DOE would ensure that best management practices were implemented during construction to minimize air emissions of particulates. These measures typically would include the application of water or other dust suppressants on disturbed land, and limiting vehicle speeds on all unpaved roads. The EPA provides guidance on estimating emissions, including emissions in specific size ranges and information on watering as a dust-control method for unpaved roads (*WRAP Fugitive Dust Handbook* [DIRS 174081-Countess 2004, pp. 3-13 and 3-14] and in AP-42, Section 13.2.2 [DIRS 103679-EPA 1991, all]). The handbook provides additional guidance on the effectiveness of water in suppressing fugitive dust during construction. Emissions-control efficiency ranges from approximately 40 to 85 percent for short durations (DIRS 174084-Piechota et al. 2002, all), depending on meteorology, soil water content, soil type, and other factors. Typical effectiveness values of 70 percent are characteristic of the southwestern

United States (DIRS 174215-Maricopa County 2004) for applications on the order of hours. For realistic estimation of fugitive dust emissions, DOE assumed:

- A 74-percent best management practice reduction for most fugitive dust emission sources (DIRS 174081-Countess 2004, Executive Summary, pp. 3 and 3-14)

Based on operational guidance, DOE assumed all of the following:

- An 84-percent reduction for construction material storage piles (DIRS 174081-Countess 2004, Executive Summary, p. 3)
- A 62-percent reduction for batch plant operations (DIRS 174081-Countess 2004, Table 4-2, p. 4-5)
- A 70-percent reduction for quarry operations (DIRS 174081-Countess 2004, Executive Summary, p. 3)

E.2.1.2 Lincoln County Detail

E.2.1.2.1 Emissions Inventory

DOE based the total emissions expected to occur within Lincoln County from rail line construction along the Caliente rail alignment on the anticipated rail alignment options (common segments and alternative segments) through the county, which range from approximately 132 kilometers (82 miles) to approximately 148 kilometers (92 miles), depending on the route chosen. Lincoln County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction-material storage piles. Emissions from construction activities that would occur only in Lincoln County (for example, construction of the Interchange Yard, specific access roads, and one quarry) were allocated solely to Lincoln County. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Lincoln County, including construction of the Interchange Yard, for each of the assumed 4 years of construction. The Department determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Lincoln County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.1.2.2 Air Quality Modeling

E.2.1.2.2.1 Construction Activity. DOE modeled air quality to determine how construction activities would be likely to impact air pollutant concentrations at Caliente. Modeling included both the rail line and the Interchange Yard. The Department used the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all) for all model runs.

Caliente meteorological data were provided primarily by the Desert Research Institute-operated Community Environmental Monitoring Program. For missing hours in this record, DOE substituted data from the Pioche Community Environment Monitoring Program site (obtained from the Desert Research Institute) and cloud-cover data from McCarran International Airport in Las Vegas. This surface meteorological data represents the best available information for this region, for which meteorological data are sparse. Upper-air data were taken from Elko, Nevada (National Weather Service station 72582). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Elko is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 1999, 2000, and 2001 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

In all cases, emission rates were expressed in units of grams per second for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

DOE modeled the construction of a portion of the Caliente alternative segment that would begin near Caliente and extend to the northwest for 2 kilometers (1.3 miles) through an area of private property near the city. DOE chose this location for the modeling runs because it represents the closest location of the Caliente rail alignment to population centers.

Because the Department would use existing rail line, construction emissions modeled included only the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). DOE assumed rail line construction would occur at a rate of 260 hours per month (nominally12 hours per day, 5 days per week). The peak result from the model runs was used to determine all averaging periods.

DOE also modeled emissions from construction of the proposed 0.06-square-kilometer (15-acre) Interchange Yard in Caliente. DOE set receptor locations surrounding the proposed Interchange Yard along the public roads that would parallel the Yard. Receptors were set at a standard breathing height of 1.8 meters (5.9 feet) and a release height of 0.5 meter (1.6 feet) was employed to reflect near surface releases from equipment and dust. Construction activities would include surface work, laying track, and building structures for the Interchange Yard. DOE assumed construction of the Interchange Yard would occur at an average rate of 260 hours per month (nominally 12 hours per day, 5 days per week).

E.2.1.2.2.2 Quarry Activity. DOE also performed air quality modeling to estimate air pollutant concentrations resulting from activity at potential quarry site CA-8B northwest of the City of Caliente (DIRS 175945-Nevada Rail Partners 2005, all). All modeling was performed using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

Caliente meteorological data was provided primarily by the Desert Research Institute-operated Community Environmental Monitoring Program. For missing hours in this record, DOE substituted data from the Pioche Community Environment Monitoring Program site (obtained from the Desert Research Institute) and cloud-cover data from McCarran International Airport in Las Vegas. This surface meteorological data represents the best available information for this region, for which meteorological data are sparse. Upper-air data were taken from Elko, Nevada (National Weather Service station 72582). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Elko is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 1999, 2000, and 2001 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

DOE calculated emissions for each of the assumed 3 years of quarry operation, including emissions associated with construction of the quarry facilities during the first year of the construction phase. Emissions included those from the quarry, plant, railroad siding, and access roads. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule (average of 5 days per week), operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

Next DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 3 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.2.1.3 Nye County Detail

E.2.1.3.1 Emissions Inventory

The total emissions expected to occur within Nye County from construction of the proposed rail line along the Caliente rail alignment was based on the proposed rail alignment options (common segments and alternative segments) through the county, which range from 342 kilometers (213 miles) to 398 kilometers (247 miles). Nye County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction material storage piles. Emissions from construction activities that would occur only in Nye County (for example, the Maintenance-of-Way Trackside Facility and construction and operation of one quarry and facility access roads) were allocated solely to Nye County. DOE estimated exhaust and fugitive dust emissions that would be attributable to rail line construction and associated facility construction activity in Nye County for each of the assumed 4 years of construction. The highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase were used in subsequent analysis.

E.2.1.3.2 Air Quality Modeling

E.2.1.3.2.1 Quarry Activity. DOE also performed modeling to determine potential impacts to air quality associated with construction-related activity at proposed quarry site NN-9B in South Reveille Valley (DIRS 175945-Nevada Rail Partners 2005, Appendix B, pp. B-11, B-12, and B-34 through B-37). All model runs were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090 - EPA 2007, all).

For surface meteorological data, DOE relied primarily on the nearby Tonopah Nevada National Weather Service site because of the availability of complete hourly weather data, including cloud-cover data. DOE also used matching upper-air meteorological data from the National Weather Service Mercury/Desert Rock site as model input. DOE was able to assemble a complete 4-year meteorological record for 1989, 1990, 1991, and 1992 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

DOE calculated air pollutant emissions for each of the assumed 3 years of quarry operation associated with construction of the rail line, which included emissions associated with the construction of the quarry facilities during the first year of the construction phase. DOE then modeled the peak annual emissions from activity inside the facility, including the quarry, plant, railroad siding, and access road as area sources. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule (average of 5 days per week), operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 4 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.2.1.4 Esmeralda County Detail

E.2.1.4.1 Emissions Inventory

The total emissions expected to occur within Esmeralda County from rail line construction along the Caliente rail alignment are based on the anticipated rail alignment options (common segments and alternative segments) through the county, which range from 22 kilometers (14 miles) to 44 kilometers (27 miles). Esmeralda County was allocated the fraction of total emissions that would result from rail line construction, alignment access-road construction, well construction, and construction-material storage piles. DOE estimated exhaust and fugitive dust emissions that would be attributable to rail line construction and associated facility construction activity in Esmeralda County for each of the assumed 4 years of construction. The highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase were determined.

E.2.1.4.2 Air Quality Modeling

DOE modeled air quality to determine the impact of emissions from construction of a segment of the rail alignment (Goldfield alternative segment 4; see Figure 2-9 in Chapter 2 of this Rail Alignment EIS) passing near Goldfield extending for 4.7 kilometers (2.9 miles) near the town. DOE selected Goldfield alternative segment 4 as the most conservative alignment in relation to proximity to population and the exposure to emissions from construction of the rail line. All modeling runs were made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE used surface meteorological data from the Tonopah Nevada National Weather Service site in the analysis because of the complete hourly weather data, including cloud-cover data. DOE used matching upper-air meteorological data from the National Weather Service Mercury/Desert Rock site in the modeling effort. DOE was able to assemble a 4-year meteorological record for 1989, 1990, 1991, and 1992 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

In all cases, an appropriate emissions rate was determined with units of grams per second or grams per second per square meter for the appropriate activity, and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year. In addition to the receptors placed alongside the construction and permanent operation rights-of-way, DOE also placed five key receptors at locations within Goldfield. These include the tanks west of Goldfield alternative segment 4, the School Bus Maintenance Facility east of the alignment, and three houses east of the alignment at the periphery of the town nearest the alignment. DOE determined pollutant concentrations at each of these locations in addition to those at the rights-of-ways to indicate potential project impact at key locations in addition to the overall maximum impact at any location along the modeling domain.

DOE modeled construction emissions in two phases. The first phase modeled the emissions associated with construction activities, including surface disturbance, laying track, and other processes with a release height of 0.5 meter (1.6 feet) to reflect surface or near-surface releases from equipment activity. This represented the initial portion of rail line construction. For the second modeling phase, DOE modeled the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). For both model runs, DOE assumed rail line construction would occur at a rate of 260 hours per month. The highest year results from the two model runs were combined for the annual average to estimate the peak annual average concentration. For the shorter-term averages the higher concentration was reported from each of these phases because the track construction and the subsequent ballast deliveries would not occur simultaneously.

E.2.2 RAILROAD OPERATIONS IMPACT ASSESSMENT – CALIENTE RAIL ALIGNMENT

E.2.2.1 Overview

The operations impact assessment included estimating emissions and potential impacts to air quality associated with operation of the rail line and railroad operations support facilities.

E.2.2.1.1 Emissions from Rail line Operation

Spent nuclear fuel and high-level radioactive waste would be transported along the rail line sealed in rail casks. Each DOE cask car would have a gross weight as high as 240 metric tons (264 tons); naval cask cars would weight as much as 355 metric tons (390 tons). The railroad would operate for up to 50 years. DOE would use two to three 4,000-horsepower, diesel/electric locomotives with a maximum weight of approximately 180 metric tons (198 tons) when fully fueled and ready for use to transport the spent nuclear fuel and high-level radioactive waste.

Emissions associated with railroad operations would be related to the weight of the trains and their frequency. To conservatively estimate emissions, each train trip was assumed to operate with the nominal number of three cask cars per trip, but with the maximum number of locomotives and peak activity along the rail line. This estimate results in a total of six train cars (one escort car, three cask cars, and two buffer cars) plus the maximum number of three locomotive engines per trip, with an equal number returning unloaded each week.

DOE expects that train shipments to the repository would peak around 2013 to 2036 (DIRS 176173-Nevada Rail Partners 2006, Table 1, p. 4-2). At that time, there would be eight one-way cask train trips per week, in addition to the other trains anticipated to operate on the rail line. Other trains would include those needed for fuel-oil, repository construction, and maintenance-of-way trains. DOE expects the total rail traffic on the rail line during the peak year would average 17 one-way trips per week (DIRS 175036-BSC 2005, Table 4-2). DOE made the most conservative estimate of activity along the rail line by assuming this activity level throughout the life of the project. DOE then estimated emissions from railroad operations by combining this activity level with estimates of the weight and fuel consumption of the train and appropriate emission factors (DIRS 174085-Sierra Research 2004, pp. 6 and 18), and then dividing the emissions among the counties in which the railroad would operate. Although the level of activity would remain constant, because locomotive emission rates generally are expected to decrease throughout the life of the project due to improvement in emission control technologies, total emissions could decrease over the life of the project.

To assess the impact to air quality from railroad operations emissions near Goldfield (in Esmeralda County) and Caliente (in Lincoln County), DOE modeled air quality using the EPA AERMOD Version 07026 model (DIRS 174202 -EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). In this assessment, a portion of the alternative segments that would pass nearest the two communities were modeled using local meteorological data. To assess the significance of potential impacts to air quality, comparisons were made with the applicable Nevada and National Ambient Air Quality Standards.

E.2.2.1.2 Emissions from Facility Operations

The operations impact assessment also included emissions and potential impacts to air quality associated with operation of the Interchange Yard in Lincoln County. Other facilities would have similar or smaller operations or would be too distant from public access; therefore, their potential to impact air quality would be low.

DOE treated operations at the Interchange Yard as continuous throughout the life of the proposed railroad. Details on the activity and emissions at these facilities were taken from the Caliente Rail Corridor Task 13 document (DIRS 180921-Nevada Rail Partners 2007, Appendix C) and *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 01* (DIRS 176168-Nevada Rail Partners 2006, all).

E.2.2.2 Lincoln County Detail

E.2.2.2.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Lincoln County from railroad operations on the possible rail alignments through the county (common segments and alternative segments), which range from approximately 132 kilometers (82 miles) to approximately 148 kilometers (92 miles) depending on the route chosen. Lincoln County was allocated the fraction of total emissions arising from railroad operations. Emissions from facility operations that would occur only in Lincoln County (operation of the Interchange Yard) were allocated solely to Lincoln County. Exhaust emissions attributable to operation of the railroad were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Lincoln County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.2.2.2 Air Quality Modeling

A portion of the Caliente alternative segment begins near Caliente and extends to the northwest for 1 kilometer (0.62 mile) through an area of private property near the city. DOE performed air quality modeling of the air pollutants released from railroad operations near Caliente using the EPA AERMOD Version 07026 (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2006, all; DIRS 181090-EPA 2004, all) dispersion model.

Caliente meteorological data was provided primarily by the Desert Research Institute-operated Community Environmental Monitoring Program. For missing hours in this record, DOE substituted data from the Pioche Community Environment Monitoring Program site (obtained from the Desert Research Institute) and cloud-cover data from McCarran International Airport in Las Vegas. This surface meteorological data represents the best available information for this region, for which meteorological data are sparse. Upper-air data were taken from Elko, Nevada (National Weather Service station 72582). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Elko is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 1999, 2000, and 2001 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

In all cases, DOE determined an appropriate emissions rate representing the average activity of the railroad corresponding to the above-determined total emissions with units of grams per second for the appropriate activity. Operations emissions were modeled with a release height of 5 meters (16 feet) to reflect locomotive emission release height (California Environmental Protection Agency 2004 [DIRS 173568], Appendix G). DOE assumed the railroad would operate 24 hours per day, 7 days per week.

DOE also modeled emissions with AERMOD based on the operation of the Interchange Yard on a 0.06-square-kilometer (15-acre) site in Caliente. Receptor locations were set surrounding the Interchange Yard along the public roads, which would parallel the Yard. Operations activities would include locomotive switcher and truck operations. DOE assumed the facility would operate 24 hours per day, 7 days per week. Appropriate emissions rates were determined that represented this average activity profile.

DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations from all receptors for each model year.

E.2.2.3 Nye County Detail

E.2.2.3.1 Emissions Inventory

DOE estimated total emissions that would be associated with operation of the railroad through Nye County using the same procedure as previously described for Lincoln County. The anticipated routes through Nye County range from 342 kilometers (213 miles) to 398 kilometers (247 miles).

The analysis compares operations-related emissions with 2002 Nye County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.2.3.2 Air Quality Modeling

Because none of the Caliente rail alignment alternative segments or common segments would pass near a community in Nye County, DOE did not perform any air quality modeling for proposed railroad operations.

E.2.2.4 Esmeralda County Detail

E.2.2.4.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Esmeralda County from railroad operations on the possible rail alignments (common segments and alternative segments) through the county, which range from approximately 22 kilometers (14 miles) to 44 kilometers (27 miles) depending on route chosen. Esmeralda County was allocated the fraction of total emissions that would result from railroad operations. Exhaust emissions attributable to railroad operations were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Esmeralda County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.2.2.4.2 Air Quality Modeling

DOE performed air quality modeling of the air pollutants that would be released from railroad operations near Goldfield using the EPA AERMOD Version 07026 dispersion model (DIRS 174202 -EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090 -EPA 2007, all). DOE modeled Goldfield alternative segment 4 over a total distance of 4.7 kilometers (2.9 miles) from northwest of the town, through the town, and turning to exit southeast of the town.

As with the Caliente modeling, the general layout was selected to reflect emissions into the area of private property around Goldfield. DOE modeled railroad operations emissions with a release height of 5 meters (16 feet) (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). DOE assumed the railroad would operate 24 hours per day, 7 days per week.

DOE used surface meteorological data from the Tonopah Nevada National Weather Service site in the analysis because of the complete hourly weather data, including cloud-cover data. DOE used matching upper-air meteorological data from the National Weather Service Mercury/Desert Rock site in the modeling. DOE was able to assemble a 4-year meteorological record for 1989, 1990, 1991, and 1992 of hourly data, and these data were preprocessed by AERMET for input into AERMOD. An emissions rate expressed in grams per second was determined to represent the average operation of the trains.

The highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at any receptor were determined for each modeled year.

E.2.3 SHARED-USE OPTION – CALIENTE RAIL ALIGNMENT

Although the Shared-Use Option would require the construction of some additional sidings in Lincoln and Nye Counties, the additional sidings would be placed parallel to existing track and would not require additional roadbed foundation, only laying of track. Given that these activities would result in minimal additional construction-related emissions over those produced under the Proposed Action without shared use, it was not necessary to calculate an annual emissions inventory, or conduct additional air quality modeling to assess construction-related impacts for the Shared-Use Option beyond those already conducted for evaluation of the Proposed Action without shared use.

DOE calculated emissions for the three additional round trips per week of commercial train activity consisting of 20 cars and three locomotives in each of the three counties. The emissions for each county were determined by scaling the total emissions along the Caliente rail alignment by the anticipated range of distances associated with the various possible rail alignment options through each county.

The analysis compares operations-related emissions associated with the Shared-Use Option with each county’s 2002 data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO060NEI2002D.000, all).

Emissions would increase marginally beyond those associated with railroad operations without shared use. In turn, the maximum air pollutant concentrations would increase marginally. Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for railroad operations along the Caliente rail alignment under the Shared-Use Option.

E.3 Mina Rail Alignment

The Mina rail alignment region of influence for air quality and climate consists of the five counties (Churchill, Lyon, Mineral, Esmeralda, and Nye) in Nevada through which the rail line would run. The largest population centers near the Mina rail alignment (Schurz, Hawthorne, Mina, and Silver Peak), and quarry sites (Garfield Hills and Malpais Mesa South).

DOE performed air quality modeling in seven Nevada locations along the Mina rail alignment: Schurz, Hawthorne, Garfield Hills, Mina, Silver Peak, Malpais Mesa, and Goldfield. The Department modeled a total of 14 scenarios, as listed in Table E-2.

Table E-2. Air quality modeling scenarios for railroad construction and operations along the Mina rail alignment.

Scenario	Activity	Location
1	Rail line construction	Near Schurz
2	Facility construction	Staging Yard in Hawthorne
3	Rail line construction	Near Hawthorne
4	Quarry operations	Potential quarry site at Garfield Hills
5	Rail line construction	Near Mina
6	Rail line construction	Near Silver Peak
7	Quarry operations	Potential quarry site at Malpais Mesa South
8	Rail line construction	Goldfield
9	Railroad operations	Near Schurz
10	Facility operations	Staging Yard in Hawthorne
11	Railroad operations	Near Hawthorne
12	Railroad operations	Near Mina
13	Railroad operations	Near Silver Peak
14	Railroad operations	Goldfield

E.3.1 CONSTRUCTION IMPACT ASSESSMENT – MINA RAIL ALIGNMENT

E.3.1.1 Overview

DOE assumed a total duration of the construction phase to be the shortest under consideration (4 years), with 36 months of construction and the remaining 12 months allocated to installation, testing of signal and communications equipment, and commissioning. This assumption produced conservative (high) emission estimates, because longer periods of construction would result in lower annual emission rates.

The construction impact assessment included emissions and impacts to air quality associated with construction of the rail line, access roads, wells, and construction material storage piles. *Construction Plan Mina Rail Corridor, Task 14: Construction Plan Mina Rail Corridor, Rev. 00* (DIRS 180875-Nevada Rail Partners 2007, all) provides additional detail on construction and associated emissions.

The construction impact assessment also included emissions and air quality impacts associated with the construction of a Staging Yard at Hawthorne in Mineral County, which DOE expects would occur during the first year of the construction phase. Details on the activity and emissions at this facility were taken from the *Air Quality Emission Factors and Socio-Economic Model Input Mina Rail Corridor, Task 13: EIS Interface Support, Rev. 02* (DIRS 180921-Nevada Rail Partners 2007, Chapters 2 and 3, Appendixes A through C).

E.3.1.1.1 Exhaust Emissions

DOE based the estimated exhaust emissions associated with construction of the proposed railroad along the Mina rail alignment on engineering estimates of activity levels for construction crews operating in either rugged or gentle terrain. The Department assumed the use of similar construction equipment in both types of terrain, but assumed that the duration of activities would be longer in rugged terrain. Rugged terrain would require significant cut-and-fill operations.

DOE estimated exhaust emissions (NO_x, PM_{10}, $PM_{2.5}$, SO_2, CO, VOCs) from both non-road and on-road equipment. Non-road equipment would include bulldozers, graders, front-end and backhoe loaders, excavators, scrapers, cranes, compactors, tampers, drills, and other equipment. On-road equipment would include equipment licensed for on-road use that would be used for construction of the railroad (such as pickup, dump, and water trucks).

To determine annual non-road equipment exhaust emissions, DOE used engineering estimates of equipment size, activity levels, annual hours of operation, and horsepower ratings for the construction equipment as reported in the Mina Rail Corridor Task 13 document (DIRS 180874-Nevada Rail Partners 2007, Appendix B). This document included in its analysis an adjustment to operating hours for the cut-and-fill operations. Emissions factors for corresponding classes of non-road equipment used in construction were conservatively estimated from Tier 1 (typically, 1997 to 2003 model-year equipment) emissions standards based on horsepower ratings from *Exhaust and Crankcase Emissions Factors for Non-road Engine Modeling—Compression-Ignition* (DIRS 174089-EPA 2004, all).

To determine exhaust emissions from on-road equipment, annual operating hours from the Mina Rail Corridor Task 13 document (DIRS 180874-Nevada Rail Partners 2007, Appendix B) were converted to annual miles traveled assuming average operating speeds of 24 kilometers (15 miles) per hour and combined with emissions factors for appropriate vehicle classifications from the EPA MOBILE 6.2 vehicle emission modeling software (DIRS 174201-EPA 2003, all; DIRS 181954-EPA 2007, all; DIRS 181955-EPA 2004, all).

E.3.1.1.2 Fugitive Dust Emissions

DOE estimated particulate-matter emissions from fugitive dust associated with construction activities along the Mina rail alignment based on the calculations in the Mina Rail Corridor Task 13 document (DIRS 180874-Nevada Rail Partners 2007, Appendix B). These calculations are based on EPA emission factor guidance from *AP-42, Compilation of Air Pollutant Emission Factors* (DIRS 103679-EPA 1991, Section 13.2.3) and the *WRAP Fugitive Dust Handbook* (DIRS 174081-Countess 2004, Chapters 3, 6, and 9). DOE estimated fugitive dust emissions for soil disturbance from grading, scraping, bulldozing, and other rail line construction activities; wind erosion; construction material stockpiles; construction and operation of concrete batch plants; construction camps; rail line facilities; quarry and excavation activities; and construction of new access roads or upgrades of unpaved roads.

The proposed rail line construction right-of-way would be nominally 150 meters (500 feet) on either side of the centerline of the rail alignment (300 meters [1,000 feet] total width). In addition, the Mina rail alignment would include:

- Two major bridges (over Beatty Wash and the Walker River) and a series of minor bridges
- Ten construction camps 0.1 square kilometer (25 acres) each
- Sites for three railroad operations support facilities (Hawthorne Staging Yard, Maintenance-of-Way Facility, and Rail Equipment Maintenance Yard) that would occupy 0.2 square kilometer, 0.06 square kilometer, 0.4 square kilometer (50, 15, and 100 acres), respectively
- A total of 18 kilometers (11 miles) of access roads to facilities, plus the access roads on either side of the rail line
- Three-hundred storage piles to be used in track construction that would be located along the rail route

Fugitive dust emissions would also be associated with the operation of batch plants (including two coarse and fine storage piles), with new road construction or upgrades, and with quarry and excavation operations. In addition to the rail roadbed construction activity, a substantial amount of fugitive dust emissions would be related to haul trucks in the construction zone.

DOE would ensure that best management practices were implemented during construction to minimize air emissions of particulates. These measures typically would include the application of water or other dust suppressants on disturbed land, and limiting vehicle speeds on all unpaved roads. The EPA provides guidance on estimating emissions, including emissions in specific size ranges and information on watering as a dust-control method for unpaved roads (*WRAP Fugitive Dust Handbook* [DIRS 174081-Countess 2004, pp. 3-13 and 3-14]) and in AP-42, Section 13.2.2 (DIRS 103679-EPA 1991, all). The handbook provides additional guidance on the effectiveness of water in suppressing fugitive dust during construction. Emissions-control efficiency ranges from approximately 40 to 85 percent for short durations (DIRS 174084-Piechota et al. 2002, all), depending on meteorology, soil water content, soil type, and other factors. Typical effectiveness values of 70 percent are characteristic of the southwestern United States (DIRS 174215-Maricopa County 2004) for applications on the order of hours. For realistic estimation of fugitive dust emissions, DOE assumed:

- A 74-percent best practice reduction for most fugitive-dust emission sources (DIRS 174081-Countess 2004, Executive Summary, p. 3, and p. 3-14)

Based on operational guidance, DOE assumed all of the following:

- An 84-percent reduction for construction material storage piles (DIRS 174081-Countess 2004, Executive Summary, p. 3)
- A 62-percent reduction for batch plant operations (DIRS 174081-Countess 2004, Table 4-2, p. 4-5)
- A 70-percent reduction for quarry operations (DIRS 174081-Countess 2004, Executive Summary, p. 3)

E.3.1.2 Churchill County Detail

E.3.1.2.1 Emissions Inventory

DOE based the total emissions expected to occur within Churchill County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 17 kilometers (11 miles) to approximately 31 kilometers (20 miles), depending on the route chosen. Churchill County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, and construction-material storage piles. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Churchill County. DOE determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Churchill County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.2.2 Air Quality Modeling

Because the Department has not identified any potential quarry sites in Churchill County, and because of the relatively small amount of emissions that would be associated with construction in Churchill County, DOE did not perform any site-specific air quality modeling for that area.

E.3.1.3 Lyon County Detail

E.3.1.3.1 Emissions Inventory

DOE based the total emissions expected to occur within Lyon County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 61 kilometers (38 miles) to approximately 81 kilometers (51 miles), depending on the route chosen. Lyon County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, and construction-material storage piles. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Lyon County for each of the assumed 4 years of construction. The Department determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Lyon County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.3.2 Air Quality Modeling

Because DOE has not identified any potential quarry sites in Lyon County, and because of the relatively limited amount of emissions that would be associated with construction in Lyon County, DOE did not conduct any site-specific air quality modeling.

E.3.1.4 Mineral County Detail

E.3.1.4.1 Emissions Inventory

DOE based the total emissions expected to occur within Mineral County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 153 kilometers (95 miles) to approximately 171 kilometers (106 miles), depending on the route chosen. Mineral County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction-material storage piles. Emissions from construction activities that would occur only in Mineral County (for example, construction of the Hawthorne Interchange Yard, specific access roads, and one quarry) were allocated solely to Mineral County. The Department estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Mineral County, including construction of the Interchange Yard, for each of the assumed 4 years of construction. DOE determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Mineral County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.4.2 Air Quality Modeling

E.3.1.4.2.1 Construction Activity. DOE modeled air quality to determine how construction activities would be likely to affect air pollutant concentrations near Schurz, Hawthorne (including the Hawthorne Staging Yard), and Mina. Modeling included both the rail line and the Staging Yard. All modeling runs were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE modeled Schurz using the meteorological data collected by the Walker River Paiute Tribe in Schurz as reported through the Tribal Environmental Exchange Network. For missing hours in this record, DOE substituted data from the Fallon, Nevada, site (obtained from the Desert Research Institute) and also used cloud-cover data from Fallon because Schurz does not record cloud-cover information. This surface meteorological data represents the best available information for Schurz. Upper-air data for this location were taken from Reno, Nevada (National Weather Service station 72489). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Reno is routine in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record for 2004, 2005, and 2006 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

DOE modeled Hawthorne, the Staging Yard location, and Mina using the meteorological data collected by National Renewable Energy Laboratory at Luning 7W as reported through the Western Region Climate Center. For missing hours in this record, DOE substituted data from the Fallon and Reno, Nevada, sites (obtained from the Desert Research Institute) and also used cloud-cover data from Fallon because Luning does not record cloud-cover information. This surface meteorological data represents the best hourly meteorological information available for Hawthorne. Upper-air data for this location were taken from Reno, Nevada (National Weather Service station 72489). Thus, it was possible to assemble a 3-year meteorological record for 2004, 2005, and 2006 of hourly data, and these data were preprocessed by AERMET for input into AERMOD.

Because DOE would use existing rail line near Hawthorne, construction emissions modeled included only the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. For locations south of the Hawthorne Staging Yard, where there is no existing track, construction emissions included both surface emissions from laying track and emissions from ballast delivery. Both modeling runs used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). DOE assumed rail line construction would occur at a rate of 260 hours per month. The peak results from the modeling runs were taken to determine all averaging periods.

DOE also modeled emissions from construction of the proposed 0.2-square-kilometer (50-acre) Hawthorne Staging Yard. DOE set receptor locations surrounding the proposed Staging Yard along the public roads that would parallel the Yard. Receptors were set at a standard breathing height of 1.8 meters (5.9 feet) and a release height of 0.5 meter (1.6 feet) was employed to reflect near surface releases from construction equipment. Construction activities would include surface work, laying track, and building structures for the Staging Yard. DOE assumed construction of the Staging Yard would occur at an average rate of 260 hours per month.

DOE also modeled air quality to determine the impact of emissions from construction near Schurz and Mina. DOE selected Schurz alternative segment 1 as the most conservative alignment in relation to proximity to Schurz and the exposure to emissions from rail line construction. All modeling runs were made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

In all cases, emission rates were expressed in units of grams per second for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

For Schurz and Mina, DOE modeled construction emissions in two phases. The first phase modeled the emissions associated with construction activities, including surface disturbance, laying track, and other processes with a release height of 0.5 meter (1.6 feet) to reflect surface or near-surface releases from equipment activity. This represented the initial portion of rail line construction. For the second modeling phase, DOE modeled the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). For both model runs, DOE assumed rail line construction would occur at a rate of 260 hours per month. The highest year results from the two model runs were combined for the annual average to estimate the peak annual average concentration. For the shorter-term averages, the higher concentration was reported from each of these phases because the track construction and the subsequent ballast deliveries would not occur simultaneously.

E.3.1.4.2.2 Quarry Activity. DOE also performed air quality modeling to estimate air pollutant concentrations resulting from activity at the Garfield Hills quarry site east of Hawthorne (DIRS 180881-Shannon & Wilson 2007, pp. 32-37). All modeling analyses were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE used the same set of meteorological data as used for Hawthorne and Mina.

DOE calculated emissions for each of the assumed 3 years of quarry operation, including emissions associated with construction of the quarry facilities during the first year of the construction phase. Emissions included those from the quarry, plant, railroad siding, and access roads. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule, operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

Next DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 3 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.3.1.5 Esmeralda County Detail

E.3.1.5.1 Emissions Inventory

DOE based the total emissions expected to occur within Esmeralda County from rail line construction along the Mina rail alignment on the anticipated rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from approximately 134 kilometers (83 miles) to approximately 175 kilometers (109 miles), depending on the route chosen. Esmeralda County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction-material storage piles. Emissions from construction activities that would occur only in Esmeralda County (for example, specific access roads, and one quarry) were allocated solely to Esmeralda County. DOE estimated annual exhaust and fugitive dust emissions of VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ that would be attributable to rail line construction activities in Esmeralda County for each of the assumed 4 years of construction. DOE determined the highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase. The analysis compares construction-related emissions with 2002 Esmeralda County data on annual pollutant emissions obtained from the EPA National Emission Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.1.5.2 Air Quality Modeling

E.3.1.5.2.1 Construction Activity. DOE modeled air quality to determine how construction activities would be likely to impact air pollutant concentrations near Goldfield and Silver Peak. All modeling was performed using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE modeled Silver Peak using the Tonopah Airport meteorological data collected by the National Weather Service. For missing hours in this record, DOE substituted data from the Desert Rock, Nevada, site (obtained from the Desert Research Institute). This surface meteorological data represents the best available hourly weather information for Silver Peak. Upper-air data for this location were taken from Desert Rock, Nevada. Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Desert Rock is routine in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly data for 2004, 2005, and 2006 for Silver Peak and a 4-year record for 1989, 1990, 1991, and 1992 for Goldfield. The older meteorological data were readily available for use in the Goldfield modeling. These data were preprocessed by AERMET for input into AERMOD.

DOE modeled air quality in Silver Peak to determine the impact of emissions from construction of the rail alignment. DOE modeled the alternative segment (Montezuma 1) as the most conservative segment in relation to proximity to Silver Peak and the exposure to emissions from rail line construction. DOE also modeled air quality to determine the impact of emissions from construction of a segment of the rail alignment (Goldfield alternative segment 4) passing near Goldfield extending for 4.7 kilometers (2.9 miles) near the town. DOE selected Goldfield alternative segment 4 as the most conservative segment in relation to proximity to population and the exposure to emissions from construction of the rail line. In addition to the receptors placed alongside the construction and permanent operations rights-of-way, DOE also placed five receptors at key locations within Goldfield. These include the tanks west of Goldfield alternative segment 4, the School Bus Maintenance Facility east of the segment, and three houses east of the segment at the periphery of the town nearest the alignment. DOE determined pollutant concentrations at each of these locations in addition to those at the rights-of-ways to indicate potential project impacts at key locations in addition to the overall maximum impact at any location along the modeling domain. All modeling was performed using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2006, all; DIRS 181090-EPA 2007, all).

In all cases, emission rates were expressed in units of grams per second or grams per second per square meter for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

DOE modeled the Silver Peak and Goldfield construction emissions in two phases. The first phase modeled the emissions associated with construction activities, including surface disturbance, laying track, and other processes with a release height of 0.5 meter (1.6 feet) to reflect surface or near-surface releases from equipment activity. This represented the initial portion of rail line construction. For the second modeling phase, DOE modeled the emissions from the use of locomotives to deliver ballast to subsequent portions of the rail line under construction once the initial rail had been laid. This modeling used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). For both modeling studies, DOE assumed rail line construction would occur at a rate of 260 hours per month. The highest-year results from the two modeling runs were combined for the annual average to estimate the peak annual average concentration. For the shorter-term averages, the higher concentration was reported from each of these phases because the track construction and the subsequent ballast deliveries would not occur simultaneously.

E.3.1.5.2.2 Quarry Activity. DOE also performed air quality modeling to estimate air pollutant concentrations resulting from activity at the potential Malpais Mesa quarry site near Goldfield (DIRS 180881-Shannon & Wilson 2007, pp. 14-21). All model runs were made using the AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE used the same set of meteorological data as used for Silver Peak. DOE calculated emissions for each of the assumed 3 years of quarry operations, including emissions associated with construction of the quarry facilities during the first year of the construction phase. Emissions included those from the quarry, plant, railroad siding, and access roads. All sources were taken as surface-based releases. Annual emissions were distributed evenly over a 250-day-per-year work schedule, operating between 6:00 a.m. and 6:00 p.m. Receptor locations were set at the fence line surrounding the potential quarry and at a standard breathing height of 1.8 meters (5.9 feet).

Next DOE determined the highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations of each air pollutant at all receptors over all 3 years of meteorological data. Therefore, the analysis approach represents a conservative estimate of air pollutant concentrations.

E.3.1.6 Nye County Detail

E.3.1.6.1 Emissions Inventory

DOE based the total emissions expected to occur within Nye County from construction of the proposed railroad along the Mina rail alignment on the proposed rail alignment options (common segments and alternative segments, and movement of construction materials such as concrete ties, steel rails, and ballast) through the county, which range from 126 kilometers (78 miles) to 148 kilometers (92 miles). Nye County was allocated the fraction of total emissions arising from rail line construction, alignment access road construction, well construction, and construction material storage piles. Emissions from construction activities that would occur only in Nye County (for example, the Rail Equipment Maintenance Yard and facility access roads) were allocated solely to Nye County. DOE estimated exhaust and fugitive dust emissions that would be attributable to rail line construction and associated facility construction activity in Nye County for each of the assumed 4 years of construction. The highest annual emission values for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$ over the 4-year construction phase were used in subsequent analysis.

E.3.1.6.2 Air Quality Modeling

Because no quarries are proposed for the southern portion of Nye County in the vicinity of the Mina alignment and the rail line would not pass near any communities, DOE did not conduct any site-specific air quality modeling.

E.3.2 RAILROAD OPERATIONS IMPACT ASSESSMENT – MINA RAIL ALIGNMENT

E.3.2.1 Overview

The operations impact assessment included estimating emissions and potential impacts to air quality associated with proposed railroad operations.

E.3.2.1.1 Emissions from Railroad Operations

Spent nuclear fuel and high-level radioactive waste would be transported along the proposed rail line sealed in rail casks. Each DOE cask car would have a gross weight as high as 240 metric tons (264 tons); naval cask cars would weigh as much as 355 metric tons (390 tons). The railroad would operate for up to 50 years. DOE would use two to three 4,000-horsepower, diesel/electric locomotives with a maximum weight of approximately 180 metric tons (198 tons) when fully fueled and ready for use to transport the spent nuclear fuel and high-level radioactive waste.

Emissions associated with railroad operations would be related to the weight of the trains and their frequency. To conservatively estimate emissions, each train trip was assumed to operate with the nominal number of three cask cars per trip, but with the maximum number of locomotives and peak activity along the rail line. This estimate results in a total of six train cars (one escort car, three cask cars, and two buffer cars) plus the maximum number of three locomotive engines per trip, with an equal number returning unloaded each week.

DOE expects that train shipments to the repository would peak around 2013 to 2036 (DIRS 176173-Nevada Rail Partners 2006, Table 1, p. 4-2). At that time, there would be eight one-way cask train trips per week, in addition to the other trains anticipated to operate on the rail line. Other trains would include those needed for fuel oil, repository construction, and maintenance-of-way trains. DOE expects the total rail traffic on the rail line during the peak year would average 17 one-way trips per week (DIRS 175036-BSC 2005, Table 4.2). DOE made the most conservative estimate of activity along the rail line by assuming this activity level throughout the life of the project. DOE then estimated emissions from railroad operations by combining this activity level with estimates of the weight and fuel consumption of the train and appropriate emission factors (DIRS174085-Sierra Research 2004, pp. 6 and 18), and then dividing the emissions among the counties in which the railroad would operate. Although the level of activity would remain constant, because emissions factors generally decrease throughout the life of the project due to improvement in locomotive control technologies, total emissions could decrease over the life of the project.

To assess the potential impacts to air quality from railroad operations emissions near Schurz, the Staging Yard, Hawthorne, and Mina (all in Mineral County) and Silver Peak (in Esmeralda County), DOE modeled air quality using the EPA AERMOD Version 07026 model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). In this assessment, a portion of the alternative segments that would pass near the two communities were modeled as a series of volume sources using local historical meteorological data. To assess the significance of potential impacts to air quality, comparisons were made with the applicable National Ambient Air Quality Standards.

E.3.2.1.2 Emissions from Facility Operations

The operations impact assessment also included emissions and potential impacts to air quality associated with operation of the Hawthorne Staging Yard in Mineral County. Other facilities (such as the Maintenance-of-Way Facility) would have similar or smaller operations or would be too distant from public access; therefore, their potential to impact air quality would be low.

DOE treated operations at the Staging Yard at Hawthorne as continuous throughout the life of the proposed railroad. Details on the activity and emissions at these facilities were taken from the Mina Rail Corridor, Task 13: EIS Interface Support (DIRS 180874-Nevada Rail Partners 2007, Appendix C) and Facilities–Design Analysis Report Mina Rail Corridor, Task 10: Facilities (DIRS 180873-Nevada Rail Partners 2007, pp. 3-1 and 3-2).

E.3.2.2 Churchill County Detail

E.3.2.2.1 Emissions Inventory

DOE estimated total emissions that would be associated with operation of the railroad through Churchill County from railroad operations on the possible rail alignments through the county (common segments and alternative segments), which range from 17 kilometers (11 miles) to 31 kilometers (20 miles), or between 67 and 69 percent of the total Mina rail alignment. Based on this percentage, Churchill County was allocated a corresponding fraction of total emissions arising from railroad operations. Exhaust emissions attributable to operation of the railroad (none in Churchill County) were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Churchill County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.3 Lyon County Detail

E.3.2.3.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Lyon County from railroad operations on the possible rail alignments through the county (common segments and alternative segments), which range from approximately 81 kilometers (51 miles) to approximately 61 kilometers (38 miles) depending on the route chosen. Lyon County was allocated the fraction of total emissions arising from railroad operations. Exhaust emissions attributable to operation of the railroad were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Lyon County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.4 Mineral County Detail

E.3.2.4.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Mineral County from railroad operations on the possible rail alignments (common segments and alternative segments) through the county, which range from approximately 153 kilometers (95 miles) to 171 kilometers (106 miles) depending on route chosen. Mineral County was allocated the fraction of total emissions that would result from railroad operations. Exhaust emissions attributable to railroad operations, including facilities (Staging Yard at Hawthorne) were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Mineral County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.4.2 Air Quality Modeling

DOE performed air quality modeling of the air pollutants that would be released from railroad operations near the communities of Schurz, Hawthorne, and Mina, as well as in the vicinity of the Staging Yard using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

DOE modeled Schurz using the meteorological data collected by the Walker River Paiute Tribe in Schurz as reported through the Tribal Environmental Exchange Network. For missing hours in this record, DOE substituted data from the Fallon, Nevada, and Reno, Nevada sites (obtained from the Desert Research Institute) but also used cloud-cover data from Fallon as Schurz does not record cloud-cover information. This surface meteorological data represents the best available information for Schurz. Upper-air data for this location were taken from Reno, Nevada (National Weather Service station 72489). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Reno is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly data for 2004, 2005, and 2006. These data were preprocessed by AERMET for input into AERMOD.

DOE modeled Hawthorne, the Staging Yard, and Mina using the meteorological data collected by National Renewable Energy Laboratory at Luning 7W as reported through the Western Region Climate Center. For missing hours in this record, DOE substituted data from the Fallon, Nevada, site (obtained from the Desert Research Institute) and also used cloud-cover data from Fallon as Luning does not record cloud-cover information. This surface meteorological data represents the best hourly meteorological information available for Hawthorne. Upper-air data for this location were taken from Reno, Nevada, (National Weather Service station 72489). Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Reno is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly data for 2004, 2005, and 2006 and these data were preprocessed by AERMET for input into AERMOD.

DOE selected Schurz alternative segment 1 as the most conservative segment in relation to proximity to Schurz, Hawthorne, and Mina using the common segments. All modeling was made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all). These model runs used a release height of 5 meters (16 feet) to reflect locomotive emission release height (DIRS 173568-California Environmental Protection Agency 2004, Appendix G). The peak results from the modeling runs were taken to determine all averaging periods.

DOE also modeled emissions from operation of the proposed 0.2-square-kilometer (50-acre) Staging Yard at Hawthorne. DOE set receptor locations surrounding the proposed Staging Yard along the public roads that would parallel the Yard. Receptors were set at a standard breathing height of 1.8 meters (5.9 feet) and a release height of 0.5 meter (1.6 feet) was employed to reflect near- surface releases from equipment and dust. Operations activities would include light running repairs, switching between Union Pacific Railroad and DOE locomotives, sorting of trains for delivery, and car inspection, refueling, and sanding. In all cases, emission rates were expressed in units of grams per second or grams per second per square meter for the appropriate activity and the resulting highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at all receptors were determined for each model year.

E.3.2.5 Esmeralda County Detail

E.3.2.5.1 Emissions Inventory

DOE based the estimated amount of emissions expected to occur within Esmeralda County from railroad operations on the possible rail alignments (common segments and alternative segments) through the county, which range from approximately 134 kilometers (83 miles) to 175 kilometers (109 miles) depending on route chosen. Esmeralda County was allocated the fraction of total emissions that would result from railroad operations. Exhaust emissions attributable to railroad, including support facilities (Maintenance-of-Way Facility in Esmeralda County), were computed with the peak annual emissions for VOCs, CO, NO_x, SO_2, PM_{10}, and $PM_{2.5}$.

The analysis compares operations-related emissions with 2002 Esmeralda County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.2.5.2 Air Quality Modeling

DOE modeled Silver Peak and Goldfield using the Tonopah Airport meteorological data collected by the National Weather Service. For missing hours in this record, DOE substituted data from the Desert Rock, Nevada, site (obtained from the Desert Research Institute). This surface meteorological data represents the best available hourly weather information for Silver Peak. Upper-air data for this location were taken from Desert Rock, Nevada. Upper-air data are representative of a much larger geographical area than surface stations and the use of upper-air data from a distance as far away as Desert Rock is routinely done in air quality analyses. Thus, it was possible to assemble a 3-year meteorological record of hourly meteorological data for 2004, 2005, and 2006 for Silver Peak and a 4-year meteorological record for 1989, 1990, 1991, and 1992 for Goldfield. The older meteorological data was readily available for use in the Goldfield modeling. These data were preprocessed by AERMET for input into AERMOD.

DOE modeled air quality in Silver Peak to determine the impact of emissions from operation of the rail alignment near Silver Peak. DOE modeled the alternative segment (Montezuma 1) as the most conservative alignment in relation to proximity to Silver Peak and the exposure to emissions from railroad operations. DOE also modeled air quality to determine the impact of emissions from the operation of a segment of the rail alignment (Goldfield alternative segment 4) passing near Goldfield extending for 4.7 kilometers (2.9 miles) near the town. DOE selected Goldfield alternative segment 4 as the most conservative alignment in relation to proximity to population and the exposure to emissions from operation of the railroad. In addition to the receptors placed alongside the construction and permanent operation rights-of-way, DOE also placed five receptors at key locations in Goldfield. These include the tanks west of Goldfield alternative segment 4, the School Bus Maintenance Facility east of the alignment, and three houses east of the alignment at the periphery of the town nearest the alignment. DOE determined pollutant concentrations at each of these locations in addition to those at the rights-of-way to indicate potential project impact at key locations in addition to the overall maximum impact at any location along the modeling domain. All model runs were made using the EPA AERMOD Version 07026 dispersion model (DIRS 174202-EPA 2002, all; DIRS 181091-EPA 2004, all; DIRS 181090-EPA 2007, all).

The highest 1-hour, 3-hour, 8-hour, 24-hour, and annual average concentrations at any receptor were determined for each model year.

E.3.2.6 Nye County Detail

E.3.2.6.1 Emissions Inventory

DOE estimated total emissions that would be associated with operation of the railroad through Nye County using the same procedure as previously described for Esmeralda County. The anticipated routes through Nye County range from 126 kilometers (78 miles) to 148 kilometers (92 miles).

The analysis compares operations-related emissions with 2002 Nye County data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

E.3.3 SHARED-USE OPTION – MINA RAIL ALIGNMENT

Although the Shared-Use Option would require the construction of some additional sidings along the alignment, the additional sidings would be placed parallel to existing track and would not require additional roadbed foundation, only laying of track. Given that these activities would result in minimal additional construction-related emissions over those produced under the Proposed Action without shared use, it was not necessary to calculate an annual emissions inventory, or conduct additional air quality model runs to assess construction-related impacts for the Shared-Use Option beyond those already conducted for evaluation of the Proposed Action without shared use.

DOE calculated emissions for 18 additional one-way trips per week north of Schurz and ten additional one-way trips south of Schurz of commercial train activity consisting of 60 cars and three locomotives. The emissions for each county were determined by scaling the total emissions along the Mina rail alignment by the anticipated range of distances associated with the various possible rail alignment options through each county.

The analysis compares operations-related emissions associated with the Shared-Use Option with each county's 2002 data on annual air pollutant emissions obtained from the EPA National Emissions Inventory database (DIRS 177709-MO0607NEI2002D.000, all).

Emissions would increase marginally beyond those associated with railroad operations without shared use. In sum, the maximum air pollutant concentrations would increase marginally. Therefore, DOE did not perform additional and separate air quality modeling of air pollutant concentrations for railroad operations along the Mina rail alignment under the Shared-Use Option.

E.4 Glossary

AERMAP (AERMOD Maps terrain Preprocessor)	The terrain preprocessor that uses data from the Digital Elevation Model Database and creates a file suitable for use within AERMOD. This file contains elevation and hill-height scaling factors for each receptor for use by AERMOD.
AERMET (AERMOD Meteorological Preprocessor)	The meteorological preprocessor component of AERMOD. Surface meteorological observations, hourly cloud-cover observations, and twice-a-day upper air sounds are "preprocessed" by AERMET into data used by AERMOD.
AERMOD (AMS/EPA Regulatory Model)	A short-range steady-state air quality dispersion model. The model incorporates air dispersion concepts based on the state-of-the-science understanding of planetary boundary layer turbulence structure and scaling concepts. AERMOD became the U.S. Environmental Protection Agency preferred air dispersion model in place of ISC3 on December 9, 2005.
ambient air	The surrounding atmosphere, usually the outside air, as it exists around people, plants, and structures. It is not the air in the immediate proximity to emission sources.
carbon monoxide	A colorless, odorless, poisonous gas produced by incomplete fossil-fuel combustion; one of the six pollutants for which there is a national ***ambient air quality standard***.
criteria air pollutants	Six common pollutants (***ozone***, ***carbon monoxide***, ***particulate matters***, ***sulfur dioxide***, lead, and ***nitrogen dioxide***) known to be hazardous to human health and the environment, and for which the U.S. Environmental Protection Agency sets National ***Ambient Air Quality Standards*** under the Clean Air Act. See ***toxic air pollutants***.
fugitive dust	***Particulate matter*** composed of soil; can include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is removed or redistributed.
hazardous chemical	As defined under the Occupational Safety and Health Act (Public Law 91-956) and the Emergency Planning and Community Right-to-Know Act (42 U.S.C. 116), a chemical that is a physical or health hazard.

hazardous pollutant	A ***hazardous chemical*** that can cause serious health and environmental hazards; listed on the federal list of hazardous air pollutants (Clean Air Act; 42 U.S.C. 7412). See ***toxic air pollutants***.
National Ambient Air Quality Standards	Standards established on a federal or state level that define the limits for airborne concentrations of designated ***criteria pollutants*** [***nitrogen dioxide***, ***sulfur dioxide***, ***carbon monoxide***, ***particulate matter*** with aerodynamic diameters less than 10 micrometers (PM_{10}), particulate matter with aerodynamic diameters less than 2.5 micrometers ($PM_{2.5}$), ***ozone***, and lead] to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).
nitrogen dioxide	See ***nitrogen oxides***.
nitrogen oxides (oxides of nitrogen)	Gases formed in great part from atmospheric nitrogen and oxygen when combustion occurs under conditions of high temperature and high pressure; a major air pollutant. Two primary nitrogen oxides, nitric oxide (NO) and ***nitrogen dioxide*** (NO_2), are noteworthy airborne ***contaminants***. Nitric oxide combines with atmospheric oxygen to produce nitrogen dioxide. Both nitric oxide and ***nitrogen dioxide*** can, in high concentrations, cause lung ***cancer***. ***Nitrogen dioxide*** is a ***criteria air pollutant***.
particulate matter	Any finely divided solid or liquid material other than pure water (such as dust, smoke, mist, fumes, or smog) found in air or emissions.
sulfur dioxide	A pungent, colorless gas produced during the burning of sulfur-containing fossil fuels. It is the main pollutant involved in the formation of acid rain. Coal- and oil-burning electric utilities are the major source of sulfur dioxide in the United States. Inhaled sulfur dioxide can damage the human respiratory tract and can severely damage vegetation. See ***criteria air pollutants***, ***National Ambient Air Quality Standards***.
toxic air pollutants	***Hazardous pollutants*** not listed as either ***criteria air pollutants*** or hazardous pollutants.

E.5 References

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APPENDIX F

FLOODPLAINS AND WETLANDS ASSESSMENT

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ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
CFR	Code of Federal Regulations
DIRS	Document Input Reference System
DOE	U.S. Department of Energy
EIS	environmental impact statement
FEIS	final environmental impact statement
FEMA	Federal Emergency Management Agency
NEPA	National Environmental Policy Act

APPENDIX F

FLOODPLAIN AND WETLANDS ASSESSMENT

F.1 Introduction

Pursuant to Executive Order 11988, *Floodplain Management*, each federal agency is required, when conducting activities in a floodplain, to take actions to reduce the risk of flood damage; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains. Pursuant to Executive Order 11990, *Protection of Wetlands,* each Federal agency is to avoid, to the extent practicable, the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands if a practicable alternative exists. The U.S. Department of Energy (DOE or the Department) issued regulations that implement these Executive Orders (10 Code of Federal Regulations [CFR] 1022, *Compliance with Floodplain/Wetlands Environmental Review Requirements*). In accordance with the terms of this regulation, specifically 10 CFR 1022.11(d), DOE must prepare a floodplain assessment for proposed actions that would take place in floodplains and a wetlands assessment for any proposed actions that would occur in wetlands. The purpose of this appendix is to meet both of these requirements.

In February 2002, DOE published *Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (hereinafter referred to as the Yucca Mountain FEIS) (DIRS 155970-DOE 2002, all). As part of that environmental impact statement (EIS) process, DOE prepared a floodplain/wetlands assessment in accordance with 10 CFR Part 1022, and published the assessment as Appendix L of the Yucca Mountain FEIS. The assessment examined the effects of repository construction and operation and potential construction of a rail line on (1) floodplains near the Yucca Mountain site and (2) floodplains and areas that may have wetlands along potential rail alignments.

Because DOE chose rail as the preferred mode of transporting spent nuclear fuel, high-level radioactive waste, and other materials to the repository site, the Rail Alignment EIS evaluates the potential effects of the construction and operation of the rail line (its common segments, alternative segments, and associated facilities) on floodplains and wetlands along the proposed rail alignment. The EIS also evaluates potential impacts to floodplains and wetlands from the implementation of the Shared-Use Option.

In accordance with 10 CFR 1022.13, this Floodplain and Wetlands Assessment includes a Project Description (see Section F.2), an analysis of floodplain and wetland impacts (see Section F.3), and a discussion of alternatives (see Section F.4).

F.2 Project Description

Chapter 2 of the Rail Alignment EIS contains a detailed description for the Proposed Action and two implementing alternatives (the Caliente Implementing Alternative and the Mina Implementing Alternative, each with a Shared-Use Option). Sections 3.2.5 and 3.3.5 of the Rail Alignment EIS describe the existing environment for surface-water resources along the Caliente and Mina rail alignments; this appendix does not repeat that information. This section of the Floodplain and Wetlands Assessment provides additional information on floodplains and wetlands associated with the Caliente and Mina rail alignments. Section F.3 provides additional data regarding potential impacts to floodplains and wetlands to support the floodplain and wetlands assessment.

F.2.1 FLOODPLAIN DATA REVIEW

Title 10 CFR Part 1022.11 lists four sources of information that must be reviewed to determine whether a proposed action would be located within a floodplain. These sources include the following:

- Flood Insurance Rate Maps or Flood Hazard Boundary Maps prepared by the Federal Emergency Management Agency (FEMA)
- Information from a land-administering agency or from other government agencies with floodplain determination expertise
- Information in safety basis documents as defined in 10 CFR Part 830 (*Nuclear Safety Management*)
- DOE environmental documents

DOE collected and analyzed floodplain data, which are provided in Section F.2.1.1 for the Caliente rail alignment and in Section F.2.1.2 for the Mina rail alignment.

For actions that would be located in a floodplain, DOE is required to describe the nature and extent of the flood hazard. DOE must determine if an action would be located within either a base-action floodplain or a critical-action floodplain, using the most authoritative information available about site conditions. The base floodplain is, at a minimum, the area inundated by a flood having a 1-percent chance of occurring in any given year (referred to as the 100-year floodplain). The critical-action floodplain is the area inundated by a flood having an 0.2-percent chance of occurring in any given year (referred to as the 500-year floodplain).

Critical action is defined as any activity for which even a slight chance of flooding would be too great. Such actions could include the storage of highly volatile, toxic, or water-reactive materials. DOE considered the critical action floodplain (500-year floodplain) in this assessment because petroleum, oil, lubricants, and other hazardous materials could be used during the construction and operation of the proposed railroad and because spent nuclear fuel and high-level radioactive waste would be transported on the rail line.

The spent nuclear fuel and high-level radioactive waste that DOE would transport to a repository at Yucca Mountain would be considered highly toxic, but when in transit or temporarily positioned at an associated facility, this material would be managed in shipping casks that meet U.S. Nuclear Regulatory Commission regulations. Commission regulations (10 CFR Part 71) are intended to ensure that the public will be protected both during normal transportation activities and in the event a shipment is involved in a transportation accident. These regulations state that each shipping cask must meet certain containment, radiation control, and criticality control requirements when it is subjected to specified normal transportation conditions and hypothetical accident conditions. The test conditions include a 9-meter (30-foot) free drop; a puncture test allowing the container to free fall 1 meter (3.3 feet) onto a steel rod 15 centimeters (6 inches) in diameter; a 30-minute, all-engulfing fire at 800°C (1,500°F); and an 8-hour immersion under 0.9 meter (3 feet) of water. Further, an undamaged package must be subjected to 1-hour immersion under 200 meters (655 feet) of water. These regulations define radiological criteria (that is, radioactivity release and radiation levels external to the cask) that must be achieved. These criteria require the cask structural integrity to be effectively unimpaired.

Shipping casks would never be opened during the transportation process and the potential for a release during any accident or flooding scenario would be extremely remote (DIRS 104774-Fischer et al 1987, pp. 9-1 to 9-15). Hazardous materials that would be most susceptible to accidental spills and releases would be the fuels and other petroleum products required to support power and equipment needs during the railroad construction and operations phases. Storage of these materials would be according to normal environmental regulatory requirements (within secondary containment) and, as practicable, would be stored outside of floodplains.

F.2.1.1 Caliente Rail Alignment

DOE analyzed floodplain data in accordance with 10 CFR Part 1022 for the Caliente rail alignment; the analysis is here and documented in the *Hydrologic and Drainage Evaluation Report for the Caliente Rail Corridor* (DIRS 182755-PBS&J 2007, pp. 8 to 12).

FEMA has mapped floodplains on Flood Insurance Rate Maps for areas of Lincoln, Nye, and Clark Counties. In Lincoln County, applicable flood-map coverage was only available for the City of Caliente. FEMA provides these maps for use in community planning and development to adequately prepare for potential flood events. FEMA has mapped 500-year floodplains only within the city limits of Caliente. The FEMA flood map coverage is shown on Figure F-1 and described in detail in Sections F.3.2.1 through F.3.2.12.

Overlaying the Caliente rail alignment on the FEMA maps allows for estimates of crossing distances (that is, the length of the rail alignment within the various floodplains). Table F-1 lists the floodplains identified along the Caliente rail alignment by alternative segments and common segments. Sections F.3.2.1 through F.3.2.12 describe the floodplains, where information is available, that would be encountered by each of the rail line segments.

In addition to the FEMA flood maps, DOE used two studies completed in support of the Rail Alignment EIS to provide additional information related to discharge rates and flood hazards. The *Hydrologic and Drainage Evaluation Report for the Caliente Rail Corridor* (DIRS 182755-PBS&J 2007, all) included field reconnaissance of every drainage feature along the entire Caliente rail alignment and a review of all available streamflow and precipitation data sources. Also, an earlier study completed by Kennedy, Jenks, and Chilton in 1990 (DIRS 176903-De Leuw, Cather and Company 1992, Appendix H) provides approximate design discharge flow rates for portions of the alignment with drainage areas greater than 2.6 square kilometers (1 square mile) in size. The study also identifies locations along the Caliente rail alignment with significant and unusual flooding hazards, including sections of the alignment affected by alluvial fans, closed-basin lakes, extremely high peak discharges, and wide shallow flow. Sections F.3.2.1 through F.3.2.12 summarize these studies.

DOE also contacted Bureau of Land Management (BLM) field offices having jurisdiction over the federally owned lands along the Caliente rail alignment to determine if they were aware of any floodplain data beyond that available from FEMA. None of the offices DOE contacted provided any floodplain data (DIRS 176303-Ong 2005, all; DIRS 176304-Ong 2005, all).

F.2.1.2 Mina Rail Alignment

DOE analyzed floodplain data in accordance with 10 CFR Part 1022 for the Mina rail alignment. The analysis is summarized here and documented in the *Phase I Hydrologic and Drainage Evaluation Report for the Mina Rail Corridor* (DIRS 180885-Parsons Brinckerhoff 2007, pp. 8 to 11).

FEMA has mapped floodplains on Flood Insurance Rate Maps for areas of Lyon, Mineral, and Nye Counties. In Lyon County, applicable flood-map coverage is available for most of the county, which includes areas north and west of the Mason Valley Wildlife Management Area, and approximately 20 percent of Nye County. FEMA has mapped floodplains only in the southernmost section of Walker Lake.

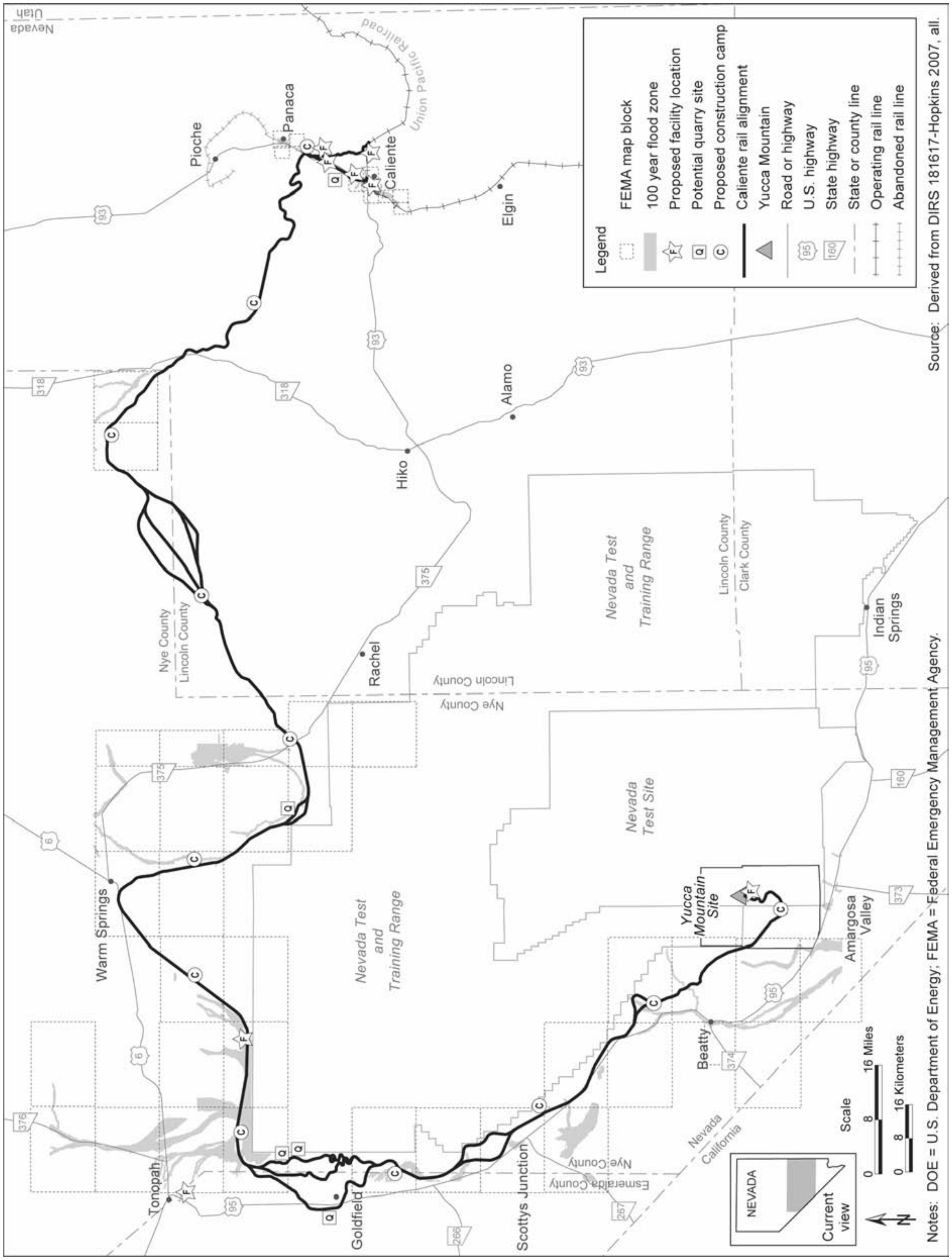


Figure F-1. FEMA floodplain map coverage for the Caliente rail alignment.

Table F-1. Floodplains the Caliente rail alignment would cross (page 1 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b]		Description of feature that would be crossed
		Mapped	Additional estimated	
Caliente alternative segment	28	2.6	2.5	Starting from the southern end of the alignment with the Clover Creek Floodplain to its junction with the Meadow Valley Wash Floodplain and up the alignment approximately 4 kilometers (2.5 miles). No FEMA map available above Caliente city limit. Additional floodplain estimated by using shaded relief map and extending flood plain. Crossing distance for Meadow Valley Wash is based on the width of the flood zones farther south where there is flood map coverage.
Eccles alternative segment	0	0	1.0	FEMA map coverage is not available for the Eccles alternative segment. Crossing distance is estimated from the width of the 100-year flood zone along Clover Creek near its confluence with Meadow Valley Wash where there is flood zone map coverage.
Common segment 1	14	0	2	No floodplains identified.
Garden Valley alternative segment 1	0	0	3.9	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 2	0	0	9.5	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 3	0	0	3.9	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Garden Valley alternative segment 8	0	0	9.5	No FEMA map coverage; floodplain estimated as area adjacent to Coal Valley Playa.
Common segment 2	26	0	0	No floodplains identified.
South Reveille alternative segment 2	100	23.1	0	Reveille Valley braided wash floodplain extending from Railroad Valley around southern tip of Reveille Range.
South Reveille alternative segment 3	100	0	0	No floodplains identified.
Goldfield alternative segment 1	58	1	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up Mud Lake Playa minor tributaries and Jackson Wash and China Wash, respectively.

Table F-1. Floodplains the Caliente rail alignment would cross (page 2 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b]		Description of feature that would be crossed
		Mapped	Additional estimated	
Goldfield alternative segment 3 (continued)	55	1	0	Floodplains from Mud Lake Playa and Stonewall Flat extending up Mud Lake Playa minor tributaries and Jackson Wash and China Wash, respectively.
Goldfield alternative segment 4	43	1.5	0	Floodplains from Mud Lake Playa, Alkali Lake Playa, and Stonewall Flat extending up Mud Lake Playa minor tributaries, Big Wash tributaries, and Jackson Wash and China Wash tributaries, respectively. Alkali Lake Playa floodplain not mapped by FEMA.
Common segment 4	100	1.3	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.9	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.3	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	1.1	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.4	0	Floodplain of the Amargosa River within Thirsty Canyon.
Common segment 6	55	0.1	0	Beatty Wash Floodplain extending from Amargosa River Floodplain.
		0.23[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (wash and tributaries crossed).

a. FEMA = Federal Emergency Management Agency.
b. To convert kilometers to miles, multiply by 0.62137.
c. There are no FEMA maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of flood zone crossings in this area are from DOE 2002 flood mapping efforts (DIRS 155970-DOE 2002, Figure 3-12).

There are no FEMA flood maps for any part of Esmeralda County. The FEMA flood map coverage is shown on Figure F-2 and described in detail in Sections F.3.3.1 through F.3.3.12.

In the areas FEMA has mapped, flood insurance studies have been completed that include a hydraulic analysis and a computation of the floodway and/or flood zones. FEMA defines the floodway as “the

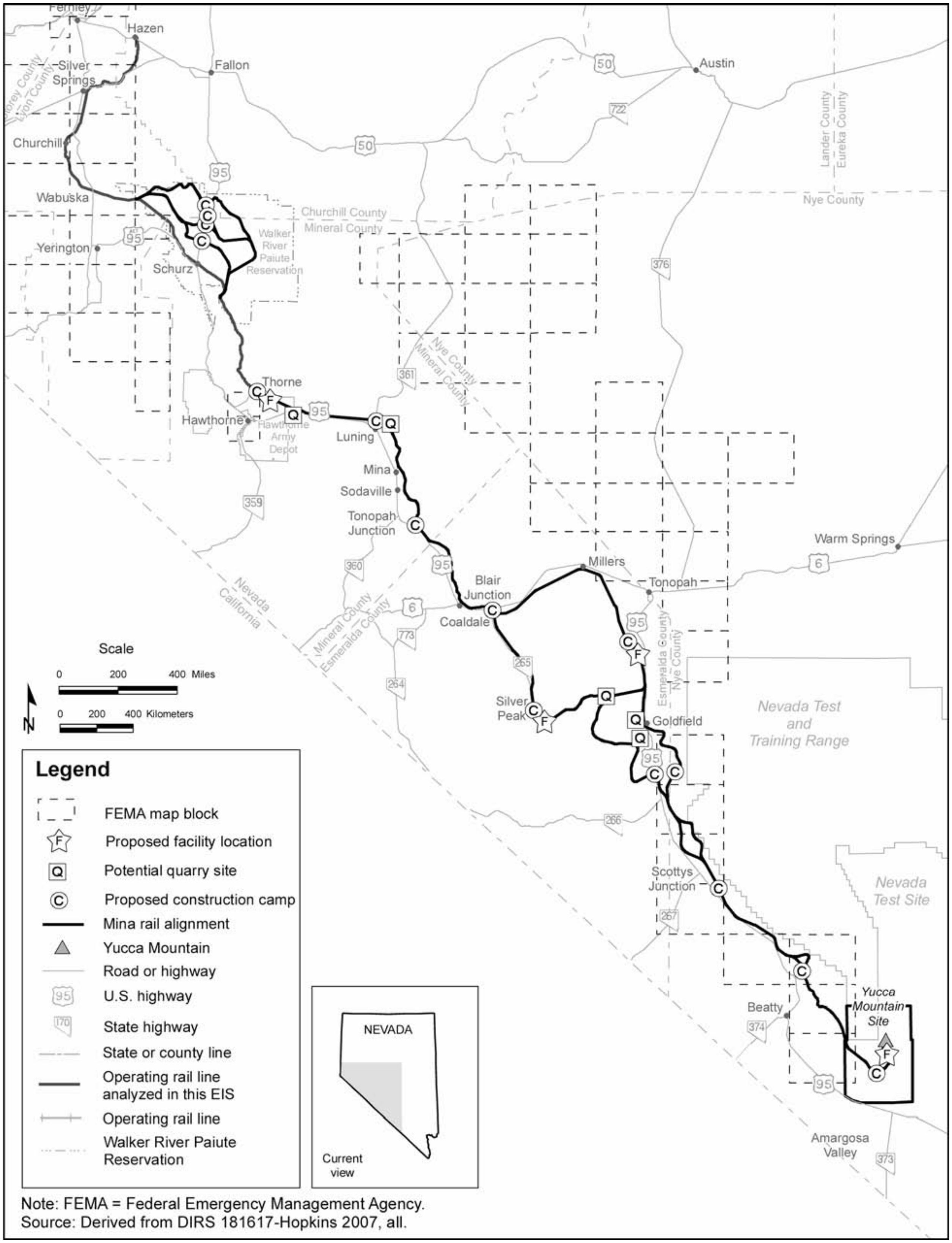


Figure F-2. FEMA floodplain map coverage for the Mina rail alignment.

channel of a stream, plus any adjacent floodplain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights." Minimum federal standards limit such increases to 0.3 meter (1 foot). The area of the floodplain between the floodway and the outer limit of the 100-year flood limit is defined as the floodway fringe. The floodway is identified to assist the community in management of the floodplains detailed in the flood insurance study.

In addition to the FEMA flood maps, DOE used three studies completed in support of the Rail Alignment EIS to provide additional information related to discharge rates and flood hazards. The *Phase I Hydrologic and Drainage Evaluation Report for the Mina Corridor* (DIRS 180885-Parsons Brinckerhoff 2007, all) and the *Hydrologic and Drainage Evaluation Report for the Caliente Corridor* (DIRS 182755-PBS&J 2007, all) included field reconnaissance of every drainage feature along the entire Mina rail alignment and a review of all available streamflow and precipitation data sources. Also, an earlier study completed by Kennedy, Jenks, and Chilton in 1990 (DIRS 176903-De Leuw, Cather and Company 1992, Appendix H) provides approximate design discharge flow rates for portions of the alignment. The study also identifies locations along the Mina rail alignment with significant and unusual flooding hazards, including sections of the alignment affected by alluvial fans, closed-basin lakes, extremely high peak discharges, and wide shallow flow. Sections F.3.3.1 through F.3.3.12 summarize these studies.

Overlaying the Mina rail alignment on the FEMA maps allows for estimates of crossing distances (that is, the length of the rail alignment within the various floodplains). Table F-2 lists the floodplains identified along the Mina rail alignment by alternative segments and common segments. Sections F.3.3.1 through F.3.3.12 discuss the floodplains, where information is available, that would be encountered by each of the rail line segments.

DOE also contacted BLM field offices with jurisdiction over the federally owned lands along the Mina rail alignment to determine if they were aware of any floodplain data beyond that available from FEMA. None of the offices DOE contacted provided any floodplain data (DIRS 176303-Ong 2005, all; DIRS 176304-Ong 2005, all).

Table F-2. Floodplains the Mina rail alignment would cross (page 1 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b]		Description of feature that would be crossed
		Mapped	Additional estimated	
Union Pacific Hazen Branchline	-	-	-	-
Department of Defense Branchline North	-	-	-	-
Schurz alternative segment 1	0	0	-	No floodplains mapped.
Schurz alternative segment 4	0	0	-	No floodplains mapped.
Schurz alternative segment 5	0	0	-	No floodplains mapped.
Schurz alternative segment 6	0	0	-	No floodplains mapped.
Department of Defense Branchline South	-	-	-	-

Table F-2. Floodplains the Mina rail alignment would cross (page 2 of 2).

Rail line segment	Portion covered by FEMA[a] maps (percent)	Floodplain crossing distance (kilometers)[b] Mapped	Floodplain crossing distance (kilometers)[b] Additional estimated	Description of feature that would be crossed
Common segment 1	0	0	0	No floodplains identified.
Montezuma alternative segment 1	0.10	0.0 10	0	Floodplain from Jackson Wash and Jackson Wash tributaries, respectively. Alkali Lake Playa floodplain not mapped by FEMA.
Montezuma alternative segment 2	10	2.0	0	The floodplain is located between Stonewall Mountains and Cuprite Hills and is associated with Stonewall Flat.
Montezuma alternative segment 3	0.10	0.0 10	0	The very southern end of Montezuma 3 would cross a very small section of FEMA floodplains just before it joins with common segment 2.
Common segment 2	100	1.3	0	Floodplain extends downgradient of Stonewall Flat Playa to the Lida Valley Alkali Flat Playa.
Bonnie Claire alternative segment 2	30	0	0	No floodplains identified.
Bonnie Claire alternative segment 3	78	1.9	0	Floodplains extending up tributaries of the Lida Valley Alkali Flat Playa and up the Stonewall Pass wash from the Bonnie Claire Flat area of Sarcobatus Flat.
Common segment 5	74	0.3	0	Floodplain extending from Sarcobatus Flat up to Tolicha Wash.
Oasis Valley alternative segment 1	100	1.1	0	Floodplain of the Amargosa River within Thirsty Canyon.
Oasis Valley alternative segment 3	100	0.4	0	Floodplain of the Amargosa River within Thirsty Canyon.
Common segment 6	55	0.1	0	Beatty Wash Floodplain extending from Amargosa River Floodplain.
		0.23[c]		Busted Butte Wash draining east side of Yucca Mountain to Fortymile Wash (wash and tributaries crossed).

a. FEMA = Federal Emergency Management Agency.
b. To convert kilometers to miles, multiply by 0.62137.
c. There are no FEMA maps covering Busted Butte Wash on the eastern slope of Yucca Mountain. Estimates of flood zone crossings in this area are from DOE flood mapping efforts (DIRS 155970-DOE 2002, Figure 3-12).

F.2.2 WETLAND DATA REVIEW

Title 10 CFR 1022.11 requires DOE to examine the following information to determine whether a proposed action would be located in a wetland, consistent with the most authoritative information available about site conditions:

- U.S. Army Corps of Engineers, *Wetlands Delineation Manual*
- U.S. Fish and Wildlife Service National Wetlands Inventory
- U.S. Department of Agriculture, Natural Resources Conservation Service local identification maps
- U.S. Geological Survey topographic maps
- DOE environmental documents

DOE used these data sources to support the delineation of wetlands along the Caliente and Mina rail alignments. The Department identified and delineated all wetlands within 0.40 kilometer (0.25 mile) of the Caliente and Mina rail alignments, except for the southern portion of the Caliente alternative segment. The evaluation corridor was restricted to a 61-meter (200-foot) width in this area due to the presence of private property and the fact that DOE would construct the alignment within an area narrower than the 61-meter delineation corridor. Wetlands typically must exhibit three general characteristics, including wetland hydrology, hydrophytic vegetation, and hydric soils, and there generally must be a positive indicator of each of these characteristics for a site to be classified as a wetland (DIRS 180914-PBS&J 2006, all; DIRS 180889-PBS&J 2007, all).

Sections F.3.2.1 through F.3.2.12 describe the wetland delineation for the Caliente rail alignment. Sections F.3.3.1 through F.3.3.12 describe the wetland delineation for the Mina rail alignment.

F.3 Floodplain and Wetland Impacts

In accordance with 10 CFR 1022.12(a)(2), a floodplain assessment must discuss the positive and negative, direct and indirect, and long- and short-term effects of a proposed action on floodplains and wetlands. In addition, the effects on lives and property, and on natural and beneficial values of floodplains, must be evaluated. For actions taken in wetlands, the assessment should evaluate the effects of the proposed action on the survival, quality, and natural and beneficial values of the wetlands. If DOE could find no practicable alternative to locating railroad construction and operations activities in floodplains or wetlands, the Department would design or modify its actions to minimize potential harm to or in the floodplains and wetlands.

For the purpose of assessing direct impacts to floodplains and wetlands, the region of influence for these resources is limited in most cases to the area of disturbance. DOE has defined the area of construction as the area within 150 meters (500 feet) on either side of the centerlines of the rail alignments (called the nominal width of the rail line construction right-of-way; see Section 2.2 of the Rail Alignment EIS). The goal of conceptual design and engineering is to limit impacts to this area to the maximum extent practicable. The area of disturbance would be limited to a smaller area along sections of the alignment where there are wetlands or private property; in areas requiring deep cuts or high fills, the area of disturbance could extend beyond the nominal width of the construction right-of-way.

The region of influence for surface-water resources would be limited in most cases to the nominal width of the rail line construction right-of-way. In places where surface-water flow patterns (including floodwaters) could be modified or surface-water drainage could carry eroded soil, sediment, or spills downstream, the region of influence extends beyond the construction right-of-way. Within the region of influence, there could be impacts to floodwaters such that they would back up on the upstream side of the rail line, while there could be impacts to water quality if pollutants traveled downstream during a storm event without precipitating out (soils from erosion) or becoming too dilute (petroleum-based lubricants or fuels) to detect.

DOE evaluated potential impacts to floodplains and wetlands based on a series of criteria, as listed in Table F-3. There would be an impact if railroad construction and operations would cause any of the conditions listed in Table F-3. To avoid or limit adverse impacts to floodplains and wetlands, the Department would comply with applicable laws, regulations, policies, standards, and directives, and implement best management practices (see Chapter 7). Most importantly, careful pre-planning of construction and operations activities will allow the Department to assess and minimize potential impacts before they occur (see Section 2.1 in the Rail Alignment EIS).

Table F-3. Impact assessment standards.

Resource criteria	Basis for assessing adverse impact
Wetlands	• Cause filling of wetlands or otherwise alter drainage patterns such that wetlands or waters are adversely affected.
Floodplains	• Alter floodway or floodplain or otherwise impede or redirect flows such that human health, the environment, or personal property is adversely impacted. • Conflict with applicable flood management plans or ordinances.

The areas where surface-water impacts would be greatest and where DOE would implement direct controls (such as erosion and sedimentation controls) would be within the construction right-of-way. DOE would reduce impacts to floodplains and wetlands by avoiding these resources where practicable and reducing the footprint of impact where the alignment would cross floodplains or wetlands. The Department would minimize the filling of wetlands and in some cases would reduce the width of the construction footprint in areas where the rail line would intersect or abut wetlands to reduce adverse impacts to wetlands in these areas. Impacts are addressed in this section in relation to the impact assessment standards listed in Table F-3, including construction in floodplains, alterations to floodwater discharge, construction in wetlands, and water-quality degradation.

The presence of floodplains or wetlands in the areas of the Caliente and Mina rail alignments depends in large part on the meteorology and hydrology of the area. Central and southern Nevada is characterized by low precipitation and high annual evaporation rates typical of desert climates, as described in Sections 3.2.5 and 3.3.5 of the Rail Alignment EIS. Because of the climate and topography (which is mostly north-south trending, parallel mountain ranges with broad, intervening valleys) in this area, internal drainage is the predominant hydrologic feature. Important characteristics of this hydrologic system include ephemeral streams and playas. Ephemeral streams might be dry over multiple seasons or years during periods of drought, but could have multiple periods of flow or standing water during wet periods, as happened during the winter of 2004-2005.

Runoff in the area is the result of snowmelt and seasonal precipitation that occurs most commonly in winter and occasionally in fall and spring. Localized thunderstorms also occur in this area, primarily in the summer. Thunderstorms can be intense, creating runoff in one wash while an adjacent wash receives little or no rain. In rare cases, however, storm and runoff conditions can be extensive enough to result in flow being present throughout the drainage systems. Although flow in most washes is rare, the area is subject to flash flooding from intense summer thunderstorms or sustained winter precipitation. When it occurs, intense flooding can include mud and debris flows in addition to runoff. Much of the runoff quickly infiltrates into rock fractures or into the dry soils, some is carried down alluvial fans in arroyos, and some drains onto dry lakebeds where it might stand for weeks as a lake (DIRS 180885-Parsons Brinckerhoff 2007, p. 17).

Washes in the areas of the Caliente and Mina rail alignments typically terminate in playas and flats within enclosed basins, typical of the Great Basin hydrologic regime (DIRS 174207-NDWR [n.d.], Part 1, p. 4-1). The exception is Meadow Valley Wash at the eastern end of the Caliente rail alignment, which is part of the Colorado River drainage system. The Amargosa River drainage system terminates within an enclosed basin, but in this case, outside of the Nevada state boundary into the Death Valley area of California. Sections 3.2.5 and 3.3.5 of the Rail Alignment EIS includes a detailed discussion of all of the mapped surface-water features along the Caliente and Mina rail alignments, respectively.

The proposed rail alignments pass through numerous valleys and over or around numerous ranges, as described in Sections 3.2.5 and 3.3.5 of this EIS. Physical limitations on the design of a rail line (for example, the need for relatively gentle gradients and wide turns) require that the alignments follow valley floors to go around ranges or parallel the mountain ranges in transition zones to gradually change elevation to reach, or descend from, passes. In the valley floors, the alignments parallel predominant drainage channels and cross through or near flats and playas. Closer to ranges, the alignments are laid out at a right angle to the predominant drainage (from topographic highs to inland basins). As a result, the proposed rail alignments would encounter a wide variety of surface drainage features.

50-year flood is a flood that has a 2-percent chance of being equaled or exceeded in any given year.

100-year flood is a flood that has a 1-percent chance of being equaled or exceeded in any given year. A base flood may also be referred to as a 100-year storm and the area inundated during the base flood is sometimes called the 100-year floodplain.

500-year flood is a flood that has a 0.2-percent chance of being equaled or exceeded in any given year.

F.3.1 COMMON IMPACTS

F.3.1.1 Construction in Floodplains

Many of the floodplains that would be encountered by the proposed rail line are associated with internally draining basins with few, if any, inhabitants or facilities, and where the floodwaters end up in playa areas. The floodplains assessed herein are primarily those areas of normally dry washes that are temporarily and infrequently inundated from runoff during 100-year or 500-year floods. The proposed rail alignments are in a region where flash flooding events are the primary concern. Although such flooding can be violent and hazardous, it is generally focused in its extent and duration, limiting the potential for extensive impacts associated with the proposed rail line; that is, any damage would be expected to be confined to a small portion of the rail line.

Construction of a rail line along the Caliente rail alignment or the Mina rail alignment would affect floodplains, either through direct alteration of the stream channel cross section that would affect the flow pattern of the stream, or through indirect changes in the amount of impervious surfaces and additional water volume added to the floodplain. In most of the areas along the proposed rail alignment, construction in a floodplain would not increase the risk of future flood damage or increase the impact of floods on human health and safety because there are very few human activities or facilities in the areas adjacent to the proposed alignments, with a few exceptions, such as the City of Caliente along the Caliente rail alignment and town of Mina along the Mina rail alignment. DOE expects that adverse impacts along the proposed rail alignments would be minimized because construction activities would adhere to design standards that limit the degree to which floodwaters would be allowed to rise. DOE would incorporate hydraulic modeling into the engineering design process to ensure that all crossings are designed in a manner that limits adverse impacts to nearby populations and resources; therefore, DOE expects that impacts associated with construction in floodplains would be small.

Subgrade elevation of the rail line is the elevation of the top of the ***subballast***.

Subballast is a layer of crushed gravel that is used to separate the ***ballast*** and roadbed for the purpose of load distribution and drainage.

Ballast is crushed stone used to support the railroad ties and provide drainage.

Except in areas where drainage structures cross a Federal Emergency Management Agency-designated 100-year floodplain, hydraulic design would be based upon typical Class 1 freight railroad standard design criteria. Class 1 freight railroad standard criteria require that the ***50-year flood*** should not come into contact with the top (crown) of the culvert or the lowest point of the bridge, whichever is applicable. For the ***100-year flood***, these criteria require that the floodwaters should not rise above the ***subgrade elevation*** at the structure. To conform to these standards, DOE would use circular culverts where flow rates would be small (less than 4 cubic meters per second [140 cubic feet per second]). For larger flows (up to 28 cubic meters per second

[1,000 cubic feet per second]), DOE would use box culverts. The Department would construct bridges where flows were larger and where the rail surface would not be tall enough to accommodate a sufficiently sized culvert, and would install the culverts with ***riprap*** around the exposed ends to protect the fill material from erosion (DIRS 176166-Nevada Rail Partners 2006, p ii). Bridge abutments and piers would be similarly protected. In some places, training dikes or ***berms*** would be required to redirect flow and ensure that the flow would be conveyed through the structure. In places, channel improvements might be necessary for a short distance upstream and downstream of the rail line to intercept and effectively redirect flows through drainage structures.

DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible. Where there would be very wide and shallow depths of flow during a 100-year flood, or the flow would be divided into multiple natural channels that would cross the rail line, the Department would use a series of multiple culverts, potentially in concert with small bridges to span the main flow channel. In locations where there were very high fill conditions, it would be more economical to use multiple culverts than to construct a bridge (DIRS 176166-Nevada Rail Partners 2006, p ii). Because DOE would design stormwater conveyance systems to safely convey design floods (50-year and 100-year) and would minimize concentration of flow to the greatest extent practicable, impacts associated with construction of the rail line on stormwater conveyance would be small.

Although DOE would generally design rail line features to accommodate 100-year floods, based on typical Class 1 freight railroad standard design criteria as described above, the final design process could also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2c). In areas where drainage structures cross a Federal Emergency Management Agency-designated 100-year floodplain, the bridge would be designed to comply with Agency standards and appropriate county regulations. Federal Emergency Management Agency standards require that floodway surcharge (the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. These standards are designed to limit the impacts of floodwater impacts to structures built in or adjacent to floodplains (DIRS 176166-Nevada Rail Partners 2006, p. ii). By adhering to these standards, the Department would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

The placement of a bridge typically involves encroachment into the floodplain by the bridge abutments. This encroachment can have some impact on the height of floodwaters upstream of the bridge. Excessive encroachment can also result in increased scour potential at the abutments, piers, and the stream bottom, and through the bridge opening, due to increases in flow velocities. Based on the conceptual design for the proposed alternative segments, encroachments up to 30 percent of the floodplain width would be possible, which could result in an increase of 0.3 meter (1 foot) in the height of floodwaters at the upstream side of the proposed bridge where the floodplain is wide and shallow (DIRS 180918-Nevada Rail Partners 2007, p. ii).

DOE would reduce impacts to floodplains and the resources close to the floodplains by adhering to the design standards that limit the degree to which floodwaters would be allowed to rise. DOE would incorporate hydraulic modeling into the engineering design process to ensure that all crossings were designed to limit impacts to nearby populations and resources.

In general, construction-related impacts associated with the floodplains would be similar to those that could occur in any other identified drainage areas (in other words, the alteration of natural drainage patterns and possible changes in erosion and sedimentation rates or locations). Construction in washes or other flood-prone areas may reduce the area through which floodwaters naturally flow, which could cause water levels to rise at the upstream side of crossings. Sedimentation would be likely to occur on the upstream side of crossings in these areas where the flow of water is restricted to the point where ponding occurs. DOE would manage sedimentation of this type under a regular maintenance program (DIRS 155970-DOE 2002, pp. 6 to 79). Impacts to floodplains resulting from restrictions in flow and resulting sedimentation are expected to be small due to the regular maintenance DOE would perform.

F.3.1.2 Alterations to Floodwater Discharge

Alterations to natural drainage, sedimentation, and erosion would be unlikely to increase future flood damage, increase the effect of floods on human health and safety, or cause significant harm to the natural and beneficial values of the floodplains. This is because of the relatively limited size of the disturbance that would be necessary to construct a rail line and because the rail line design would include appropriate water-conveyance structures or devices to accommodate flood flows.

Alterations to floodplains (such as cuts and fills) due to rail line construction could cause the alteration of natural drainage patterns and runoff rates that could affect downgradient resources. Construction activities that could alter surface drainage temporarily include moving large amounts of soil and rock to develop the track platform (or subgrade) and constructing temporary access roads to reach construction initiation points and major structures, such as bridges, and to allow movement of equipment to the construction initiation points. Permanent alterations to drainage would be limited to engineered drainage structures and grading and excavation activities. DOE would not expect alterations to floodplain drainage to adversely impact people and property downstream because DOE would use best management practices and standard engineering design and construction practices to minimize adverse impacts.

Depending on site-specific conditions, construction grading may be used to channel a number of minor drainage channels into a single culvert or under a single bridge, which would result in water flowing from a single location on the downstream side rather than across a broader area. As a result, some localized changes in drainage patterns would occur. However, these changes would be limited to areas where natural drainage channels were small; therefore, DOE would expect adverse impacts associated with altered drainage patterns to be small. The Department does not expect that any increase in the velocity of floodwaters caused from rechanneling or regrading would result in adverse impacts to downgradient resources because alterations to drainage would be limited to the area of construction and the associated facility locations.

F.3.1.3 Construction in Wetlands

Direct impacts to wetlands associated with the rail alignment would result from temporary or permanent filling or draining of these resources. Indirect impacts would include potential water-quality degradation resulting from actions in and around these resources. Wetland areas would be filled or disturbed as a result of construction of the proposed rail line.

Wetlands improve water quality by acting as filters and slowing seasonal floodwater as it moves around wetland vegetation. It acts similar to a sponge by storing water and then slowly releasing water downslope (DIRS 178594-EPA 2006, all). Wetlands also filter water-borne sediments out of the water column when seasonal floodwaters come in contact with vegetation and other debris such as rocks and logs. Plant roots and microorganisms on plant stems and roots function in transforming pollutants into a less mobile form and play an important role in the atmospheric nitrogen cycle.

DOE would minimize filling of wetlands by incorporating avoidance into engineering and design of the rail line to the maximum extent practicable. DOE would use a minimum-width footprint when possible.

This would be accomplished by increasing the slope of the roadbed or bridging across wetlands and not constructing access roads in wetlands.

F.3.1.4 Water-Quality Degradation

Construction and operation activities associated with the Proposed Action would have the potential to degrade water quality and cause negative impacts to floodplains and wetlands due to the potential release and spread of contaminants (that is, materials potentially harmful to human health or the environment), which could be released through an accidental spill or discharge. These types of releases could be localized (in the event of a small spill) or widespread (in the case where precipitation or intermittent runoff carried contaminants away from the site of the spill). Sections 4.2.12 and 4.3.12 of the Rail Alignment EIS discuss hazardous materials in more detail, including petroleum products (such as fuels and lubricants) and coolants (such as antifreeze) for equipment operation. Other contaminants could include solvents used in cleaning or degreasing actions. The construction camps and some of the railroad operations support facilities would include some bulk storage of hazardous materials, and supply trucks would routinely bring new materials and remove used materials and wastes (such as lubricants and coolants) from the construction sites (see Section 4.2.12 of the Rail Alignment EIS). These activities would present some potential for accidental spills and releases, the significance of which would greatly depend on the nature and volume of the material spilled and its location. A release or spill of contaminants to a stream or wash, or carrying of contaminants to such receptors by stormwater runoff, would have the greatest potential for adverse environmental impact.

The potential for such impacts would be reduced because of the arid environment and lack of flowing water along either rail alignment. Also, construction contractors would be required to comply with regulatory requirements on spill prevention measures, reporting and remediating spills, and properly disposing or recycling used materials. Employees responsible for railroad operations would also be required to comply with any regulatory requirements and best management practices applicable to the proper storage and use of hazardous materials. Common stormwater pollution control practices mandate that hazardous materials be stored inside facilities, or have secondary containment or other protective devices, and that spill control and containment equipment be stationed close to hazardous material (such as fuel) storage areas. Thus, the potential for an accidental release that would not be localized or contained would be very small. During construction activities, water sprayed to control dust and achieve soil compaction criteria would not be used in quantities large enough to support surface-water flow and possible contaminant transport for any distance.

During operation of the rail line, it would be extremely unlikely that a railcar carrying spent nuclear fuel or high-level radioactive waste would derail in a floodplain or wetland, or in one of the washes crossed by the proposed rail alignment that drains to a floodplain or wetland. If a railcar transporting a shipping cask containing radioactive waste were to derail, the chances of a radiation release would be remote. As described in Section F.2.1, the shipping casks are designed to withstand accident conditions and are subject to very stringent design and testing standards to ensure their structural integrity. Impacts to wetlands and floodplains resulting from a release of hazardous materials of any type would be expected to be very small because of the precautions that would be taken to avoid and respond to spills. Further, shipping casks would never be opened during the transportation process and the potential for a release to occur during any accident or flooding scenario is extremely remote (DIRS 104774-Fischer et al. 1987, pp. 9-1 to 9-15).

Increased sediment loading as a result of soil disturbance actions during construction would be the most likely adverse impact associated with the Proposed Action. DOE would be required to identify the appropriate and applicable steps that would be taken during construction to minimize sediment loading. These steps most likely would be actions to reduce potential for increased erosion and subsequent sedimentation and to ensure that any downstream water did not experience increases in sediment loading or turbidity that would threaten the beneficial use of that water. DOE would not expect adverse impacts to surface waters along the proposed rail alignment that would interfere with any beneficial use of the water, which is a primary criterion applied by the State of Nevada environmental standards (Nevada Administrative Code 445A.121).

F.3.2 SEGMENT-SPECIFIC IMPACTS FOR THE CALIENTE RAIL ALIGNMENT

F.3.2.1 Interface with the Union Pacific Railroad Mainline – Caliente and Eccles Alternative Segments

Two alternative segments (Caliente and Eccles alternative segments) are under consideration for connecting to the existing Union Pacific Railroad Mainline. Facilities at the Interface with the Union Pacific Railroad Mainline include the Interchange Yard, the Staging Yard, a Satellite Maintenance-of-Way Facility, train crew facilities, and possibly the Nevada Railroad Control Center and National Transportation Operations Center.

F.3.2.1.1 Caliente Alternative Segment

FEMA has mapped flood zones only for the very southern portion of the Caliente alternative segment, as shown in Figures F-3 and F-4. From its starting point on the southern bank of Clover Creek, the alignment would cross 100-year and 500-year flood zones associated with both Clover Creek and Meadow Valley Wash. The Interchange Yard would be within 100-year and 500-year flood zones associated with Clover Creek. The alignment would remain in the 100-year floodplain associated with Meadow Valley Wash as it traveled north and left the area mapped by FEMA. Based on an analysis of the FEMA flood mapping and topographic contour data for the alignment, it appears that the Caliente alternative segment would be in a floodplain associated with Meadow Valley Wash from the time it left Caliente until it turned west just before joining Caliente common segment 1.

As listed in Table F-1, the alignment would cross a total of 2.6 kilometers (1.6 miles) of FEMA-mapped floodplains and approximately 2.6 kilometers of additional floodplains that FEMA has not mapped. It should be noted that the Caliente rail alignment would follow an existing abandoned Union Pacific rail bed from where it originates in Caliente for most of its length before joining common segment 1. Therefore, most rail line construction activities (except for operations support facilities) would be confined to the existing railbed.

The Interchange Yard on the Caliente alternative segment would be in the City of Caliente, directly across from the former Union Pacific Railroad Caliente Station within the area of the former Union Pacific Railroad yards. FEMA floodplain maps for this area show that a 240-meter (790-foot) section of the Interchange Yard would be in a 100-year floodplain and the remainder would be in a 500-year floodplain. Floodwaters from Meadow Valley Wash flow through the center of Caliente to the south where they merge with the runoff from three dry washes that flow to the southwest. In the area where the Interchange Yard would intersect the 100-year floodplain, the floodwater depth was calculated to be 0.90 meter (3 feet) during the 100-year storm event (DIRS 176806-FEMA 1985, all). Because the interchange tracks would be in an area already occupied by an existing Union Pacific siding, the Interchange Yard would not be likely to obstruct the flow of floodwaters to the point that floodwater depths would increase.

Two of the three alternative locations being considered for the Staging Yard are along the Caliente alternative segment (Indian Cove and Upland). The southern portion of the Indian Cove Staging Yard would be constructed in the 100-year floodplain mapped by FEMA along Meadow Valley Wash. Based on the elevation of the meadow in which the Staging Yard would be constructed, it appears that the

Figure F-3. FEMA floodplain map for map area 1 of the Caliente rail alignment.

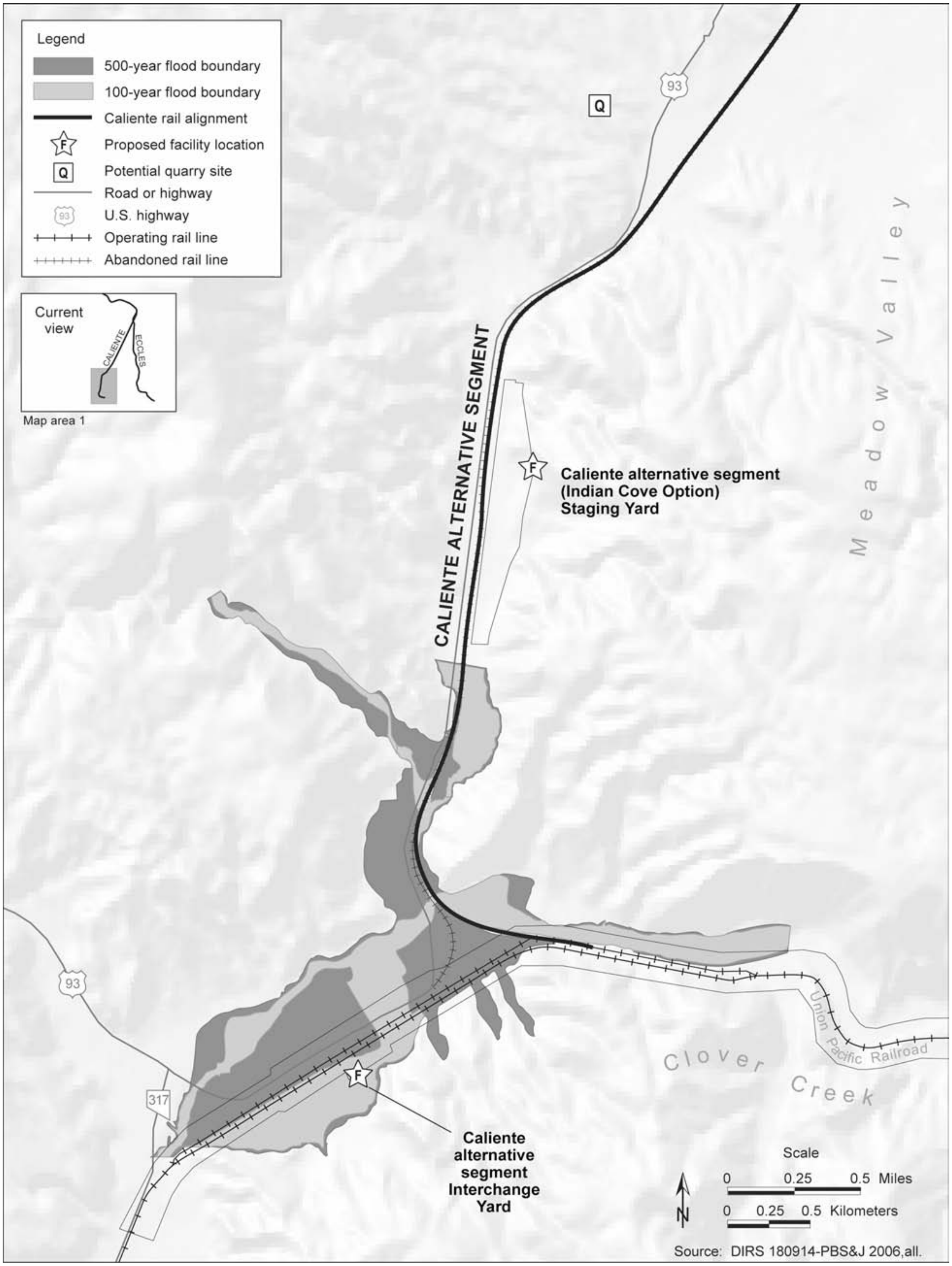


Figure F-4. FEMA floodplain map for the Caliente alternative segment.

entire meadow could be considered floodplain. The Caliente-Upland optional location for the Staging Yard is also susceptible to flooding from Meadow Valley Wash; however, FEMA has not mapped floodplains in this area. One of the construction camps would be about 2.5 kilometers (1.6 miles) south of the Caliente alternative segment junction with Caliente common segment 1. This construction camp would not intersect floodplains or wetlands. Section F.3.1 addresses the common impacts to floodplains the Caliente alternative segment and its associated facilities would cross.

DOE delineated wetlands within 30 meters (100 feet) of the Caliente alternative segment (see Figures F-5 and F-6) in a field survey completed in support of the Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figures 4A to 4RT). Some larger wetland areas extend beyond the area delineated. Field investigations for wetlands along the Caliente alternative segment determined wetlands are primarily vegetated by herbaceous plants, but contain scattered clusters of scrub/shrub plant communities, pools of open water, and drainages (DIRS 180914-PBS&J 2006, Table 6). Most wetlands along the Caliente alternative segment contain dense communities of persistent herbaceous wetland plants that cause water-borne sediments to precipitate out of the seasonal sheet flow and slow the velocity of surface water flowing over the landscape. The root structure of herbaceous plants also functions in binding and retaining soil sediments. Persistent herbaceous vegetation along the rail alignment can provide a high magnitude of water-quality functions. Persistent vegetation is characterized as plants that retain their above-ground biomass during the nongrowing season (DIRS 178728-Bartoldus, Garbisch, and Kraus 1994, pp. 6 to 14) and contribute to sediment stabilization and flood flow attenuation functions. Nonpersistent vegetation decomposes during the nongrowing season, and therefore provides a lower magnitude of sediment retention functions.

Some wetlands along the Caliente alternative segment have a moderately complex wildlife habitat structure, as evidenced by the presence of trees and shrubs, and pools of open water or streams with flowing water. These wetlands function as important breeding sites, provide habitat for larval development, and serve as a primary food source for adults. Insects, spiders, snails, worms, and small fish living in wetlands are prey for certain amphibians. Wetlands also function as reproductive and nursery habitat for a variety of reptiles (DIRS 178594-EPA 2006, p. 3). Left undisturbed, these wetlands would continue to provide a variety of commonly recognized ecological functions such as wildlife habitat, sediment stabilization, nitrogen and nutrient cycling, flood attenuation, and water-quality benefits. These wetlands could play a more significant role in maintaining water quality and wildlife habitat during rail line construction. For example, undisturbed wetlands would intercept and cause the precipitation of sediments carried by ephemeral water. In addition, wetland vegetation could transform, relocate, and volatize small amounts of pollutants accidentally released into the environment.

The magnitude and quality of functions provided by undisturbed wetlands depends on the size of wetlands. Generally, large contiguous wetlands provide a suite of functions and higher ecological functional capacity. For example, a moderate- to large-sized wetland could provide the food, shelter, and reproductive requirements for wildlife, provide flood reduction capabilities, and filter sediments. Smaller wetlands might only provide limited habitat for transient wildlife, have little or no flood storage capacities, or depending on its position within the landscape, could easily be overwhelmed by a sudden influx of sediments and lose its capacity to effectively filter sediments.

Construction along the Caliente alternative segment would result in the permanent loss of some wetland habitat. Removal of the persistent wetland vegetation would result in short-term exposure to erosion by wind or water and desiccation by the warm climate. Undisturbed wetlands would continue to perform water-quality functions by filtering potential unconsolidated sediments; however, the flood flow attenuation capacity would be slightly reduced, and could result in some minor localized flooding and erosion during seasonal precipitation events. Wetlands could also be affected by increased sedimentation

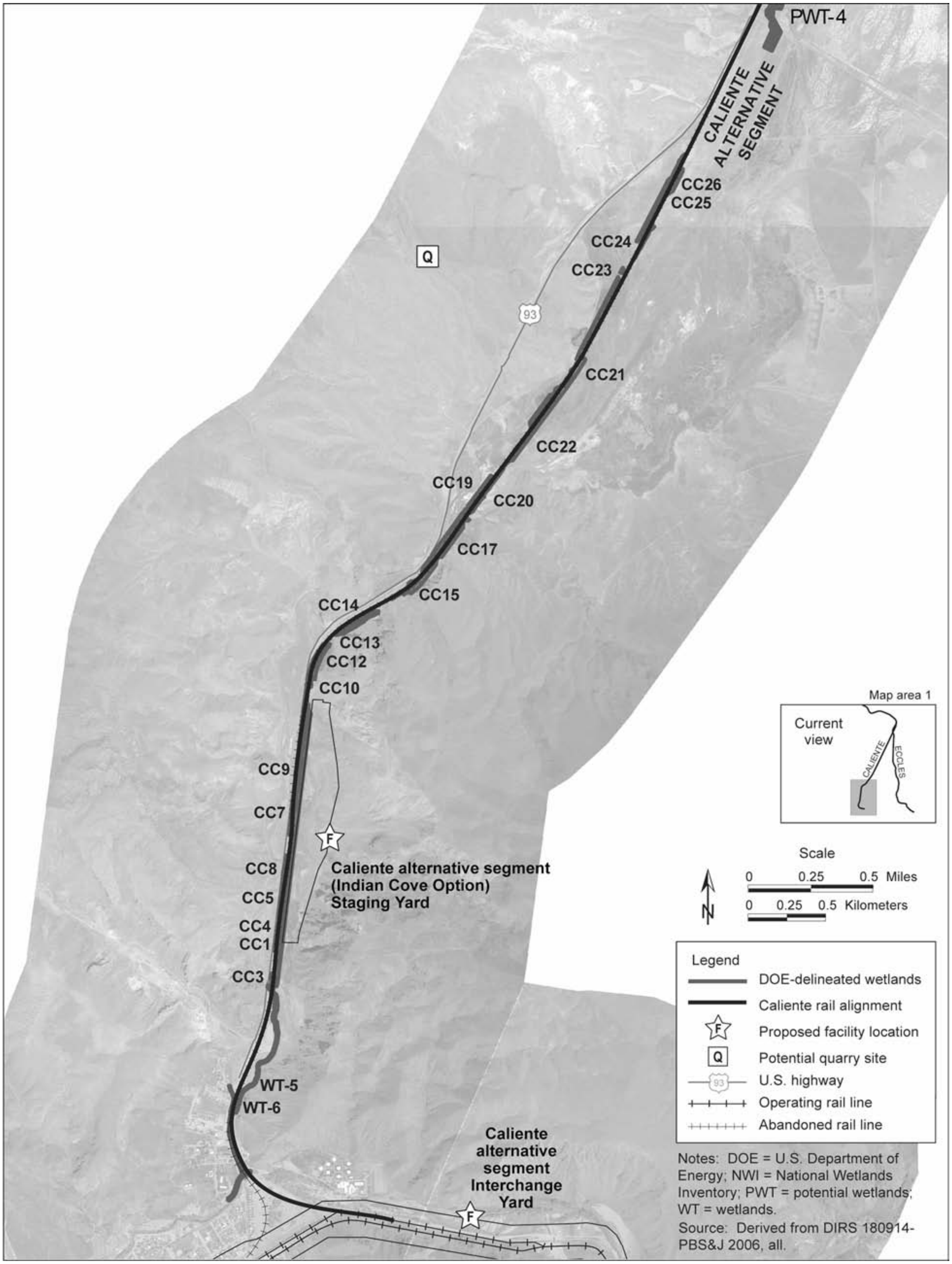


Figure F-5. Wetlands along southern portion of the Caliente alternative segment.

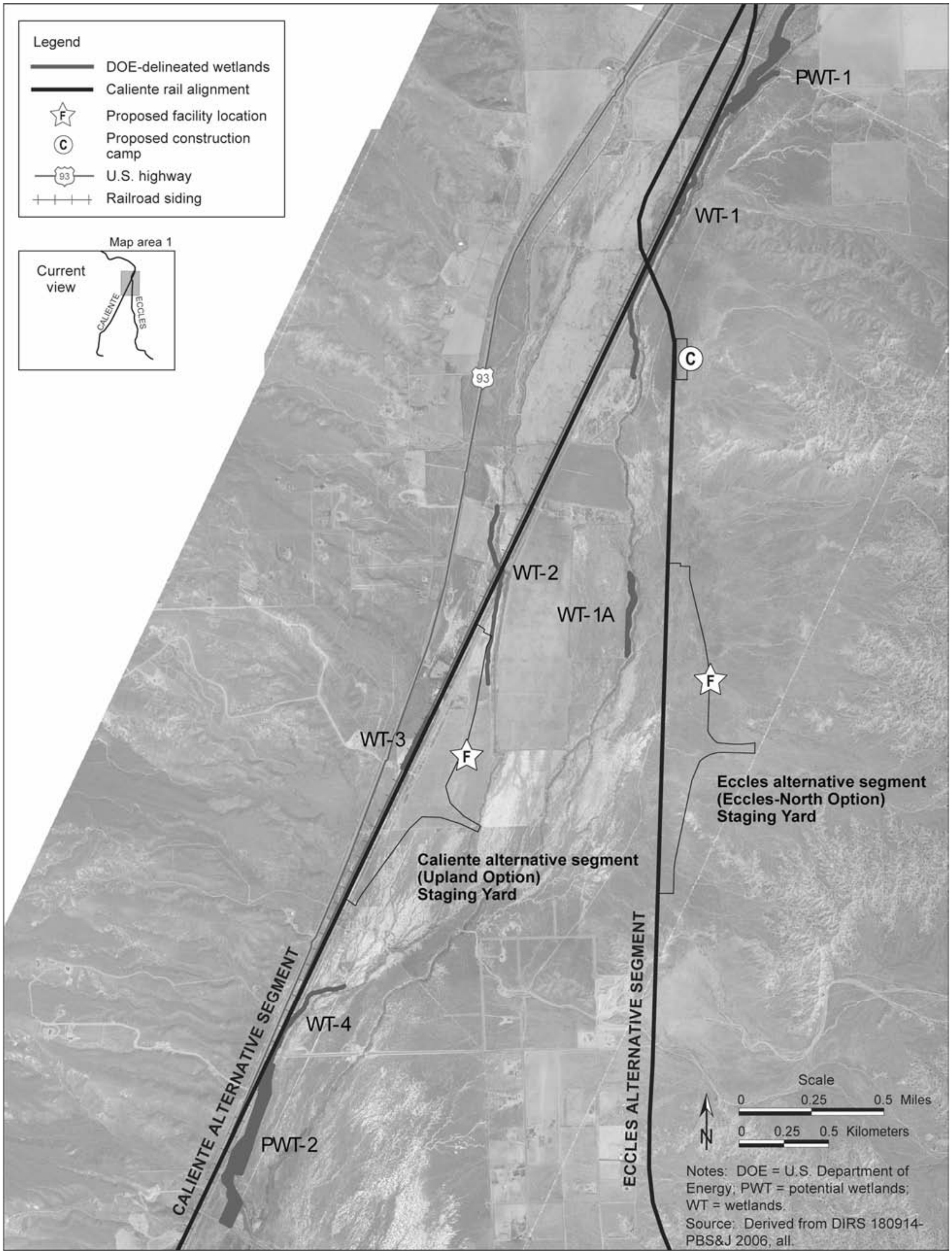


Figure F-6. Wetlands along northern portion of the Caliente alternative segment.

resulting from construction-related activities. Implementing best management practices such as constructing sediment ponds and installing hay bales or silt fences would minimize potential impacts. Wildlife utilizing wetlands in the proposed disturbance areas would be temporarily displaced, but would probably use nearby wetlands. DOE would minimize impacts to wetlands, which in turn, would minimize adverse impacts to herpetofauna (amphibians and reptiles) using these water resources. Where feasible, affected areas would be restored to the maximum extent practicable.

Removal of vegetation along the Caliente rail alignment would reduce the flood alteration capacity, and result in the loss of wildlife and increased sedimentation, particularly during rain events. In some areas, an influx of sediments related to disturbances could produce an accreting environment on the streambed and result in decreased flood storage capacities. Wildlife affected by the Caliente alternative segment would be temporarily displaced and would utilize nearby habitats. Over time, some wildlife species would return to affected areas, especially if lost habitat was reestablished.

The total area of wetlands delineated within 30 meters (100 feet) of the Caliente alternative segment is 0.28 square kilometer (68 acres). DOE would minimize impacts to wetlands in this area by reducing the width of the construction footprint to approximately 21 meters (70 feet), which would reduce the area of wetlands to be filled to 0.05 square kilometer (12 acres). Although DOE evaluated the use of vertical retaining walls and other methods to further reduce the construction footprint and the amount of wetlands that would be filled, the Department found that those methods would be impracticable due to cost (DIRS 180916-Nevada Rail Partners 2007, Appendix F-1). DOE could modify the final design of the alignment to avoid additional wetlands, such as those adjacent to the old rail roadbed along Meadow Valley Wash, by using a slightly narrower construction footprint; however, this would only slightly reduce the area of wetlands that would be filled.

DOE is considering two optional locations for the Staging Yard along the Caliente alternative segment (Indian Cove and Upland), as shown on Figures F-5 and F-6. The Indian Cove Staging Yard would be constructed in a wetland. Construction of the Staging Yard in Indian Cove would require the wetland meadow area to be drained and built up above the level of the floodplain. It might also require an active drainage system and a channel around the site to keep the area dry and in a stable condition. Meadow Valley Wash drainage through the site is from north to south toward the City of Caliente. Drainage of the site would be accomplished by constructing a channel along the eastern edge of the facility. The channel around the site would be approximately 1,680 meters (5,500 feet) long. The Department would determine final channel dimensions during final design of the Staging Yard. It is very likely that a system of drains would have to be constructed under the Staging Yard tracks. Fill could be needed to elevate portions of the site out of the floodplain. These actions would require permits from the U.S. Army Corps of Engineers, as well as compliance with Section 404 of the Clean Water Act for stormwater runoff control measures. Assuming that the entire meadow is wetlands, the Staging Yard at Indian Cove would require up to 0.19 square kilometer (47 acres) of wetlands to be filled.

One of the proposed quarry locations (and its associated siding) is also along the Caliente alternative segment. The railroad siding for this quarry would be constructed on the west side of the alignment in the vicinity of the quarry. Since the wetland delineation did not extend into this area, the amount of wetlands that would be filled must be estimated based on the wetlands that were delineated along the alignment. The total area of the siding is 0.18 square kilometer (44 acres) and a conservative assumption that half of this area is wetlands that would be filled would mean that 0.09 square kilometer (22 acres) of wetlands would be filled to construct the quarry siding.

The construction of the Caliente alternative segment would require the filling of wetlands associated with Meadow Valley Wash. In addition, if the Caliente quarry and/or the Indian Cove Staging Yard are selected, a significant portion of additional wetlands would be filled. In order to mitigate the loss of wetlands that must be filled, DOE would enhance adjacent wetlands. By minimizing the footprint of the rail roadbed within wetlands and mitigating the loss of wetlands that are filled, DOE would minimize adverse impacts to these wetlands (and the functions served by wetlands); therefore, direct impacts to wetlands left intact are expected to be localized and small. Indirect impacts, such as disruption of water flow, will be avoided by constructing the rail line on an existing berm and constructing bridges and culverts in areas where water crosses the rail line; therefore, indirect impacts from the construction of the rail line would be small. The filling of up to 0.19 square kilometer (47 acres) of wetlands in Indian Cove for the Staging Yard would greatly impact the wetland functions served by the wet meadow, such as its ability to support wildlife, retain flood flows, and filter water; therefore, this is considered a large impact.

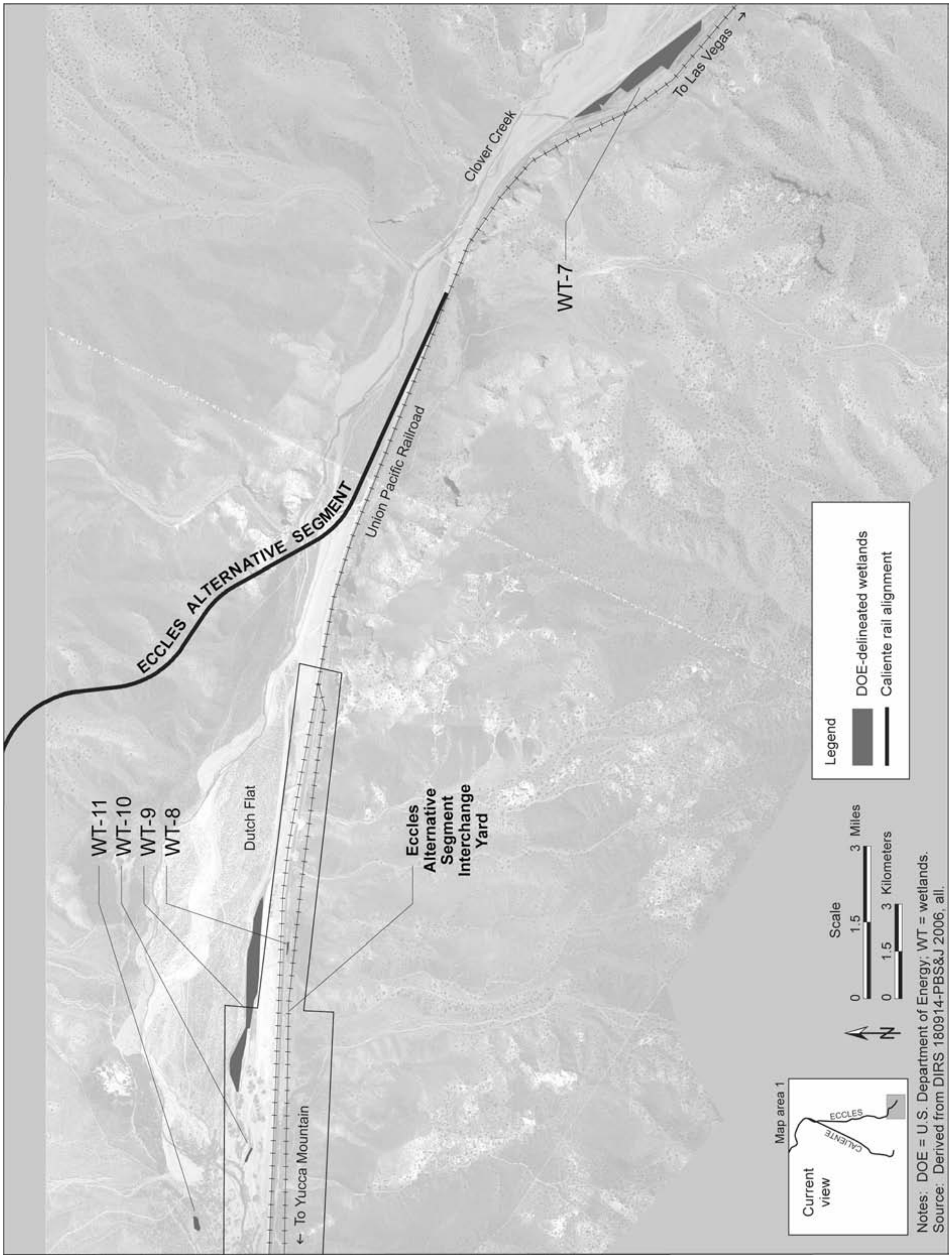
F.3.2.1.2 Eccles Alternative Segment

There are no FEMA flood maps for the area of the Eccles alternative segment; however, it is reasonable to assume that the floodplain mapped for Clover Creek in the area of Caliente extends to the east, upstream to the starting point of this alternative segment (see Figure F-3). Clover Creek is a tributary of Meadow Valley Wash. The place where the Eccles alternative segment would cross Meadow Valley Wash is also a likely floodplain. Section F.3.1 addresses the common impacts to floodplains that would be crossed by and adjacent to the Eccles alternative segment.

DOE delineated one wetland area in an incised channel along Meadow Valley Wash that would be crossed by the Eccles alternative segment approximately 1.5 kilometers (0.93 mile) south of the junction with common segment 1. A bridge would be used to cross Meadow Valley Wash and its associated wetlands in this area. The wetlands in this area are about 7.6 meters (25 feet) wide. Since a bridge will be used to cross this area, the fill estimate is based on the assumption that one pier would be constructed in the wetlands encompassing an area of 1.9 square meters (20 square feet).

Five other areas with wetlands (see Figure F-7) were identified near the proposed location of the Eccles Interchange Yard in Clover Creek (DIRS 180914-PBS&J 2006, Figure 4B). Three of those wetlands (WT-9, WT-10, and WT-11) are in Clover Creek about 30 to 180 meters (100 to 600 feet) north of the proposed Interchange Yard and would not be disturbed during construction. These three wetlands could be indirectly impacted by the construction of the Staging Yard. The existing railroad embankment would be expanded by filling and grading to match the mainline elevation, which would require fill along and within the confines of Clover Creek. The fill would extend approximately 15 meters (50 feet) into the creek for approximately 1,400 meters (4,600 feet) along the creek. For construction of the interchange siding, the fill would extend approximately 7.5 meters (25 feet) into the creek for approximately 900 meters (3,000 feet) on the east end and 600 meters (2,000 feet) on the west end of the interchange tracks. Based on these assumptions, the total amount of fill required for the Interchange Yard would be approximately 0.033 square kilometer (8.2 acres). Appropriate protection measures (for example, lining the fill with riprap and gabions) would be used along the entire length of the Interchange Yard to stabilize and protect the structure from the floodwaters.

Filling a long section of a stream bank has the potential to create greater adverse impacts than simply crossing a stream, because the structure of the stream itself would be modified to a much greater extent as opposed to a bridge crossing or culvert that would have less of a presence within the stream. It is likely that fill required to construct the Interchange Yard could result in the permanent alteration of the localized hydraulic conditions. Such alterations to the hydraulic conditions of the stream would have the potential to increase flow velocity and result in a higher potential for erosion during high flow (flood) events. Indirect impacts to the wetlands within Clover Creek could result from the increased flow rates during flood events. Clover Creek and its associated floodplain, which encompasses Dutch Flat, ranges in width from 130 to 400 meters (430 to 1,300 feet). Since the Staging Yard would only extend about 15 meters (50 feet) into Clover Creek and its associated floodplain, impacts to the wetlands within Clover Creek



Notes: DOE = U.S. Department of Energy; WT = wetlands.
Source: Derived from DIRS 180914-PBS&J 2006, all.

Figure F-7. Wetlands in vicinity of Eccles Interchange Yard.

from increased flow rates are expected to be small. DOE would minimize these impacts through the use of erosion control practices and hydraulic design. The other two areas with wetlands (WT-7 and WT-8) are on the opposite side of the existing Union Pacific tracks from the proposed Interchange Yard and would not be filled for construction of that yard. DOE would maintain all surface-water connections from those two wetlands to Clover Creek by constructing bridges or culverts at connecting drainage features. DOE would flag or fence all wetlands within the area of construction to protect them during construction activities; therefore, no direct impacts are expected to these wetlands during construction.

F.3.2.2 Caliente Common Segment 1

FEMA has published only one flood map that covers a small section of the area crossed by Caliente common segment 1. This flood map covers a portion of land in White River Valley and the adjacent north end of the Seaman Range, as shown in Figure F-8. Common segment 1 would not cross any FEMA floodplains shown in the area on this single map. Common segment 1 would run 1.4 kilometers (0.87 mile) north of an unnamed playa that is 47 square kilometers (18 square miles) in size when crossing Dry Lake Valley. During periods of heavy rainfall, runoff from the Highland, Chief, North Pahroc, and Seaman Ranges can produce ephemeral lakes in these playas. One construction camp would be located along the common segment, but it would not intersect floodplains or wetlands. Common impacts to nearby playas and their associated floodplains are addressed in Section F.3.1.

In the North Pahroc Range pass (between White River Valley to the west and Dry Lake Valley to the east), Caliente common segment 1 would pass within 600 meters (2,000 feet) of a small group of three isolated wetlands (see Figure F-9). These isolated, nonjurisdictional (not regulated under Section 404 of the Clean Water Act) wetlands were delineated during the field survey conducted in support of the Rail Alignment EIS (DIRS 180914-PBS&J 2006, Figure 4S). These wetlands are labeled WT-12, WT-13, and WT-14 and are associated with an unnamed spring. A lack of wildlife habitat was observed in this area. The shoreline of the ponds lacks the vegetation that would provide food, shelter, or reproductive habitat for a variety of species (DIRS 180914-PBS&J 2006, Photos 50 and 51, pp. B-25 and B-26). Using the Cowardin (DIRS 178724-Cowardin et al. 1979, all) classification scheme, the stock watering pond (WT-12) is classified as a palustrine emergent/rock bottom/unconsolidated bottom wetland and the other areas (WT-13 and WT-14) as emergent wetlands (DIRS 180914-PBS&J 2006, p. 19).

The unnamed spring appears to have been created by excavating (or blasting) a hole into the soil and excavating a channel to convey water into a basin used as a stock watering pond. The spring head and excavated channel (WT-13) and the stock pond (WT-12) occupy less than 0.0081 square kilometer (2 acres). The channel was flowing from the spring head through the channel to the stock pond at the time of the field survey (DIRS 180914-PBS&J 2006, p. 13). No direct impacts are anticipated to these wetlands since they are uphill of and outside the rail line construction right-of-way; therefore, there would be no direct or indirect impacts to these wetlands as a result of the construction or operation of the proposed rail line.

F.3.2.3 Garden Valley Alternative Segments

FEMA flood maps do not cover any of the Garden Valley alternative segments. However, it is likely that some areas in the valley experience periodic flooding. Garden Valley alternative segment 2 would cross three of the same intermittent creeks and washes and the drainage feature designated as Water Gap, which is characterized as a topographically constricted area through which several small drainage channels run. Although the area is normally dry, Water Gap must be considered a suspect area for flooding issues. Garden Valley alternative segment 2 would also skirt (within 1 kilometer [0.6 mile]) the Coal Valley

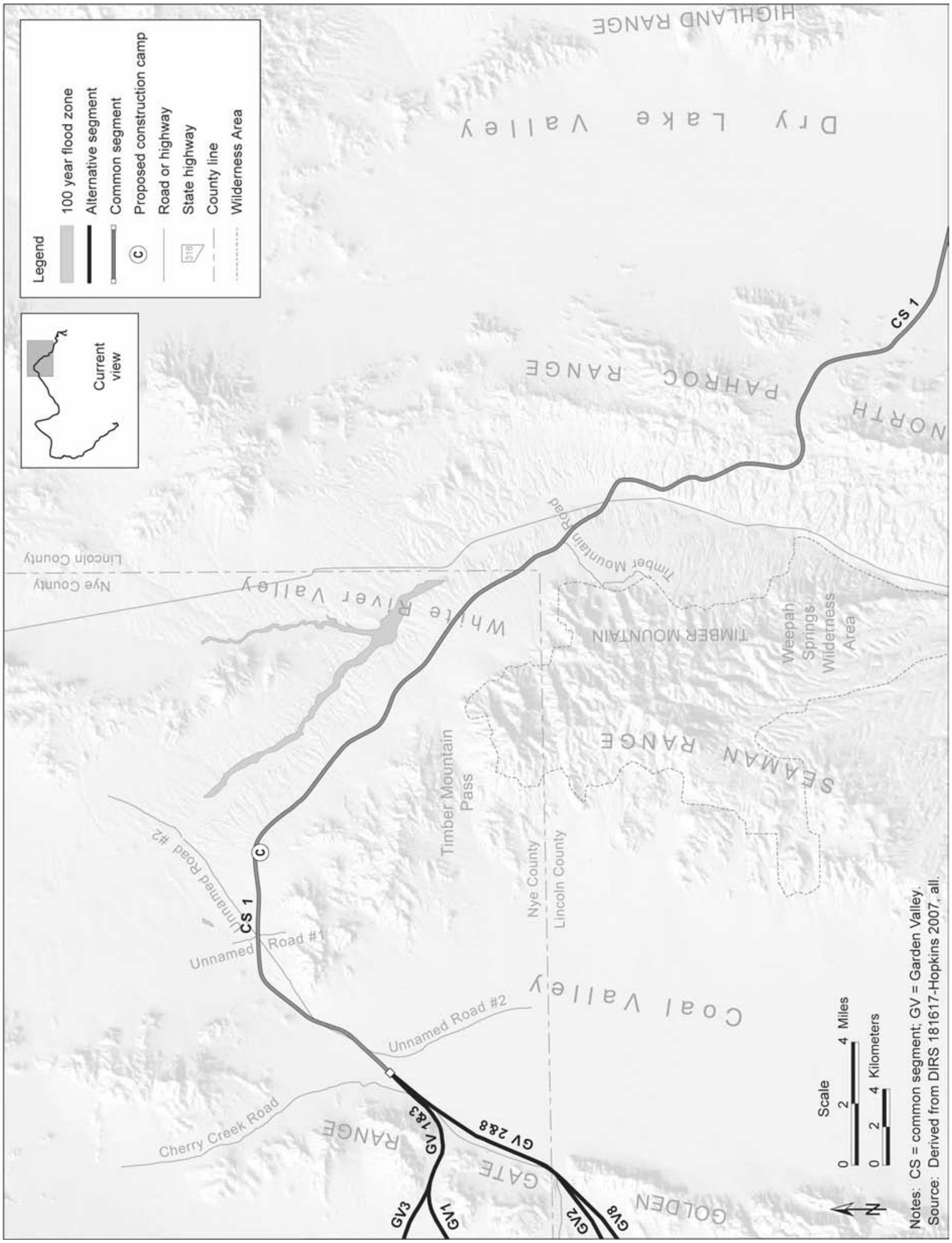


Figure F-8. FEMA floodplain map for map area 2 of the Caliente rail alignment.

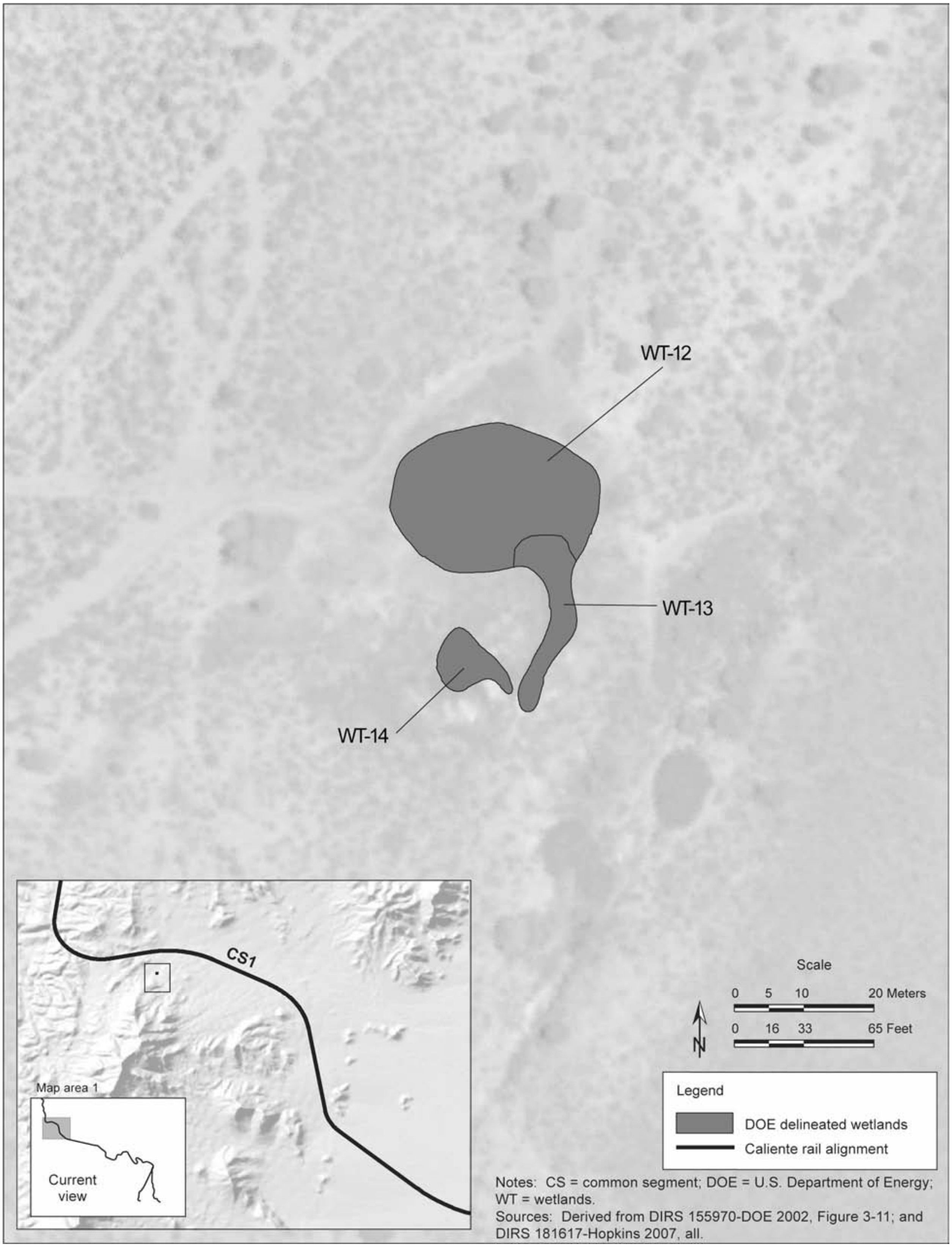


Figure F-9. Isolated wetlands south of Caliente common segment 1.

playa, another area expected to be susceptible to flooding and standing water. Each alternative segment would have a construction camp located about 6 kilometers (3.7 miles) east of the junction with Caliente common segment 2. None of these three locations intersect floodplains. Common impacts to nearby floodplains are addressed in Section F.3.1.

Although the National Wetlands Inventory dataset identifies the Coal Valley playa as a lacustrine littoral unconsolidated shore wetland, DOE field studies in support of the Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-PHE 2007, p. 3). No wetlands were identified along any of the Garden Valley alternative segments.

F.3.2.4 Caliente Common Segment 2

The only portion of Caliente common segment 2 covered by FEMA flood maps is the west end in Railroad and Reveille Valleys, but common segment 2 would not cross any floodplains in this limited area, as shown in Figure F-10. Two washes in this area have associated floodplains. One of these washes originates in Reveille Valley and runs adjacent to the proposed rail alignment and the other originates in the hills to the south and would be crossed by the rail alignment. Both of these washes terminate in the Railroad Valley playa north of the rail alignment. The floodplain for the adjacent wash does not extend laterally as far as the proposed rail alignment and the floodplain associated with the wash that would be crossed does not extend as far south as the proposed rail alignment. In the eastern portion of common segment 2, where there is no flood map coverage, the proposed rail alignment would cross drainage features, including Davis Creek and Quinn Canyon Wash, both of which have the potential to be associated with floodplains that have not been mapped. Two construction camps would be located along common segment 2; however, neither intersects floodplains. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Caliente common segment 2.

There are no wetlands identified along Caliente common segment 2 or its associated facilities.

F.3.2.5 South Reveille Alternative Segments

FEMA flood maps encompassing the area of these two short alternative segments are shown in Figure F-10. South Reveille alternative segment 2 would cross a 3.1-kilometer (1.9-mile) stretch of the 100-year floodplain associated with five tributaries draining to the well-defined, unnamed braided wash. Two potential quarry sites are located near the origination of the alternative segments. The proposed sites for the quarry plants that would support quarry NN-9A are located within the same floodplain that South Reveille alternative segment 2 would cross. South Reveille alternative segment 3 lies farther away from the wash and would not cross any 100-year floodplains. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the South Reveille alternative segments.

There are no wetlands identified along the South Reveille alternative segments or their associated facilities.

F.3.2.6 Caliente Common Segment 3

Most of Caliente common segment 3 would cross land that has FEMA flood map coverage. According to the FEMA maps, the common segment would not cross 100-year floodplains until it nears the vicinity of Mud Lake Playa and its tributaries where the flood boundaries are fairly extensive, as shown in Figures F-10 and F-11. From the east, the rail alignment would first encounter floodplains associated with Stone Cabin Creek and Saulsbury Wash as they converge on Mud Lake Playa. The proposed rail alignment would then cross the floodplain of a wash draining the central Ralston Valley before it would

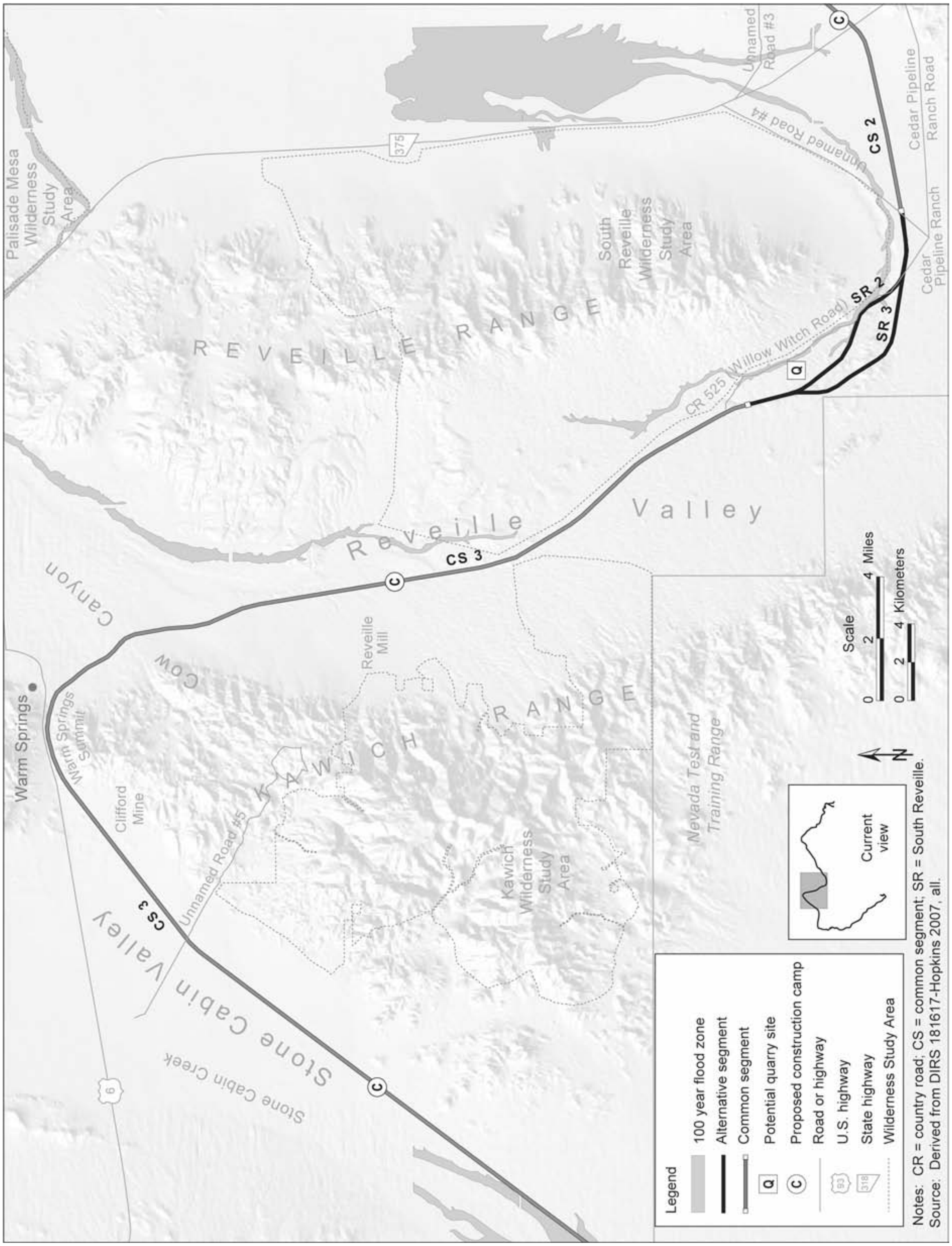


Figure F-10. FEMA floodplain map for map area 4 of the Caliente rail alignment.

cross through two legs of a drainage system draining the western Ralston Valley. The Mud Lake Playa area has by far the most extensive area of 100-year floodplains. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Caliente common segment 3.

Three construction camps would be located along Caliente common segment 3 (see Figures F-10 and F-11), one of which would be constructed within a floodplain associated with Mud Lake Playa. DOE would construct the Maintenance-of-Way Trackside Facility (see Section 2.2.4.1.2.1) in the southwestern portion of Stone Cabin Valley (see Figure F-11) in floodplains associated with Stone Cabin Creek. Common impacts to floodplains in which these facilities would be constructed are addressed in Section F.3.1.

There are no wetlands identified along Caliente common segment 3 or its associated facilities.

F.3.2.7 Goldfield Alternative Segments

FEMA flood maps cover the northern and southern portions of the Goldfield alternative segments, but not the central area that includes Goldfield, as shown on Figure F-11. According to FEMA flood maps, the alternative segments would cross a small portion of the floodplain associated with Mud Lake Playa, and each segment would cross a small portion of the floodplain associated with the drainage channel leading to Stonewall Flat Playa. There are three proposed quarry sites along the Goldfield alternative segments, two along Goldfield alternative segment 3, and one that would be accessible from Goldfield alternative segment 4; however, none of them intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by or adjacent to the Goldfield alternative segments..

There are no wetlands identified along the Goldfield alternative segments.

F.3.2.8 Caliente Common Segment 4

The FEMA flood maps provide coverage for almost all of Caliente common segment 4. The proposed rail alignment segment would skirt within 0.5 kilometer (0.31 mile) of Stonewall Flat Playa to the east and Alkali Flat Playa to the southwest and cross over the drainage path that connects the two areas. As shown in Figure F-11, the rail alignment would cross a 1.3-kilometer (0.81-mile) portion of the 100-year floodplain associated with the drainage between Stonewall Flat Playa and Alkali Flat Playa in Lida Valley. One construction camp would be located along common segment 4; however, it would not intersect any floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Caliente common segment 4.

Although the segment would not cross any mapped wetlands, Stonewall Flat Playa is classified by the National Wetlands Inventory dataset as a lacustrine littoral unconsolidated shore (L2US) wetland system. DOE field studies in support of the Rail Alignment EIS confirmed that there are no hydric soils, plant species indicative of wetlands, or other indicators of wetlands on or adjacent to the playa near the alignment (DIRS 180696-PHE 2007, p. 6).

There are no wetlands within the region of influence for Caliente common segment 4.

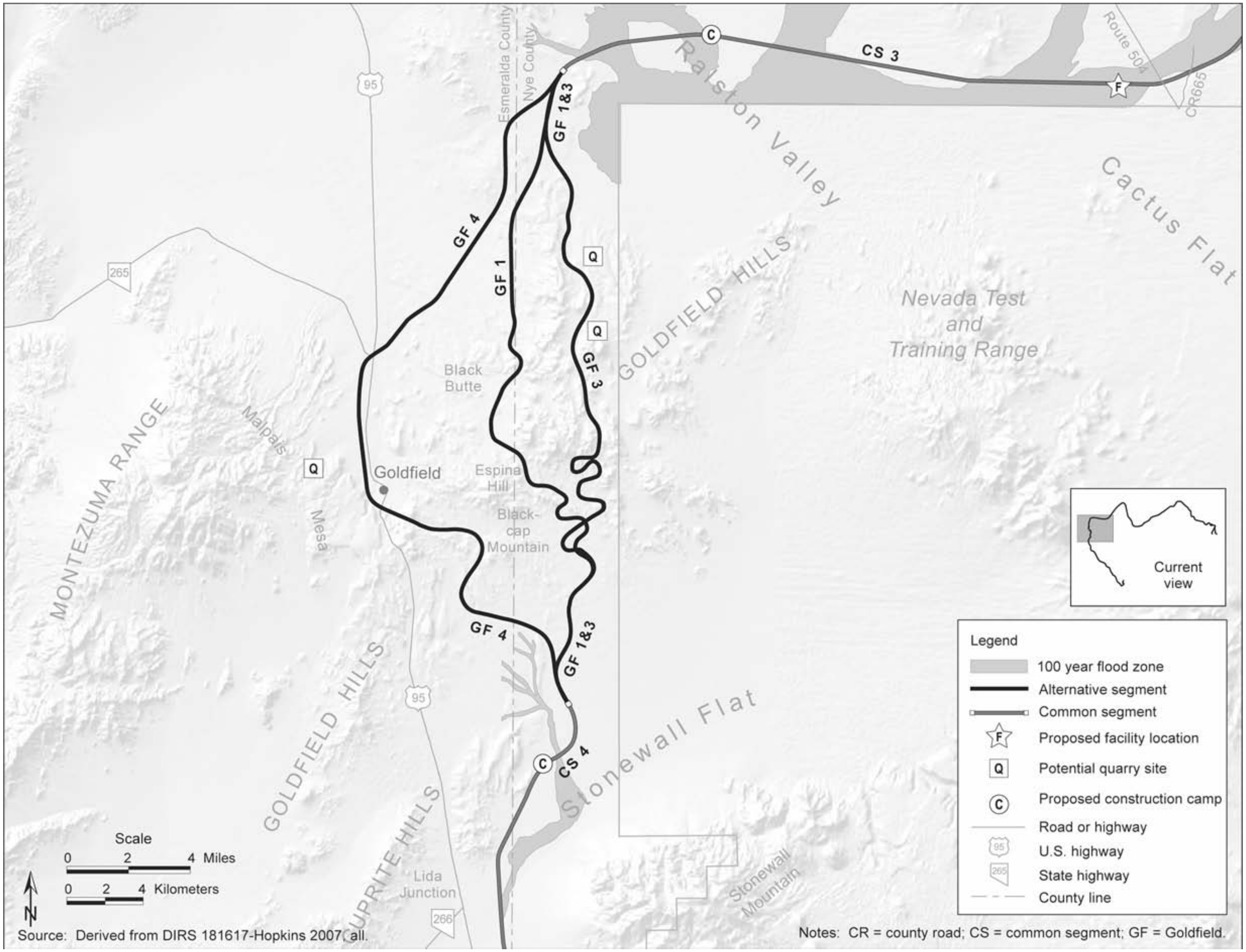


Figure F-11. FEMA floodplain map for map area 5 of the Caliente rail alignment.

F.3.2.9 Bonnie Claire Alternative Segments

FEMA flood maps cover most of the Bonnie Claire alternative segments, but do not include land east of the segments, which are shown on maps as an old boundary of the Nevada Test and Training Range. Consequently, there is no floodplain mapping east of this boundary. Bonnie Claire alternative segment 3, the western alternative segment, has more extensive flood map coverage than Bonnie Claire alternative segment 2. As shown in Figure F-12, the northwest end of Bonnie Claire alternative segment 3 would cross a 100-year floodplain associated with the Alkali Flat playa. The flood maps also show a floodplain for an unnamed drainage channel from Pahute Mesa. This floodplain ends just south of Bonnie Claire alternative segment 3 at one of the old Test and Training Range boundaries.

The floodplain is sufficiently close to Bonnie Claire alternative segment 3 to assume it could have a similar width if floodplain mapping were extended upslope to where it would be crossed by Bonnie Claire alternative segment 3. It is possible this floodplain would extend far enough northeast to be encountered by Bonnie Claire alternative segment 2; however, the distance is too far to support such an assumption. In addition, Bonnie Claire alternative segment 2 would occur at higher elevations in the foothills where the wash would encounter fewer tributaries. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Bonnie Claire alternative segments.

There are no wetlands identified along the Bonnie Claire alternative segments.

F.3.2.10 Common Segment 5

FEMA flood maps provide coverage for almost all of common segment 5 (see Figures F-12 and F-13) and indicate the proposed rail alignment would cross a 100-year floodplain associated with Tolicha Wash as it drains toward Sarcobatus Flat. FEMA has also identified a 100-year floodplain approximately 2 kilometers (1.2 miles) southwest of the alignment. This small floodplain is associated with two minor playas in Sarcobatus Flat. One construction camp would be located along common segment 5; however, it would not intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to common segment 5.

There are no wetlands identified along common segment 5.

F.3.2.11 Oasis Valley Alternative Segments

FEMA flood maps provide complete coverage for the Oasis Valley alternative segments, as shown in Figure F-13. The maps show both alternative segments would cross the Amargosa River 100-year floodplain. The linear distance required to cross the Amargosa River in Oasis Valley would be less for Oasis Valley alternative segment 3 because there are fewer braided channels upstream than there are downstream. One construction camp would be located along the alternative segments; however, it would not intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Oasis Valley alternative segments.

DOE field surveys identified a small isolated wetland, WT-15, (74 square meters [0.018 acre]) just outside the construction right-of-way, approximately 160 meters (530 feet) north of Oasis Valley alternative segment 1 (see Figure F-14). This wetland does not have a connection to interstate commerce, and would be regarded as isolated, and thus considered nonjurisdictional. The wetland occurs within a slight topographic depression (DIRS 180914-PBS&J 2006, Table 6 and Figure 4T). This wetland can be characterized as a shrub-shrub/emergent wetland complex with a moderately complex wildlife habitat structure (DIRS 180914-PBS&J 2006, Photos 52 and 53). There would be no direct impacts to this wetland during rail line construction because it is outside the construction right-of-way and it would be

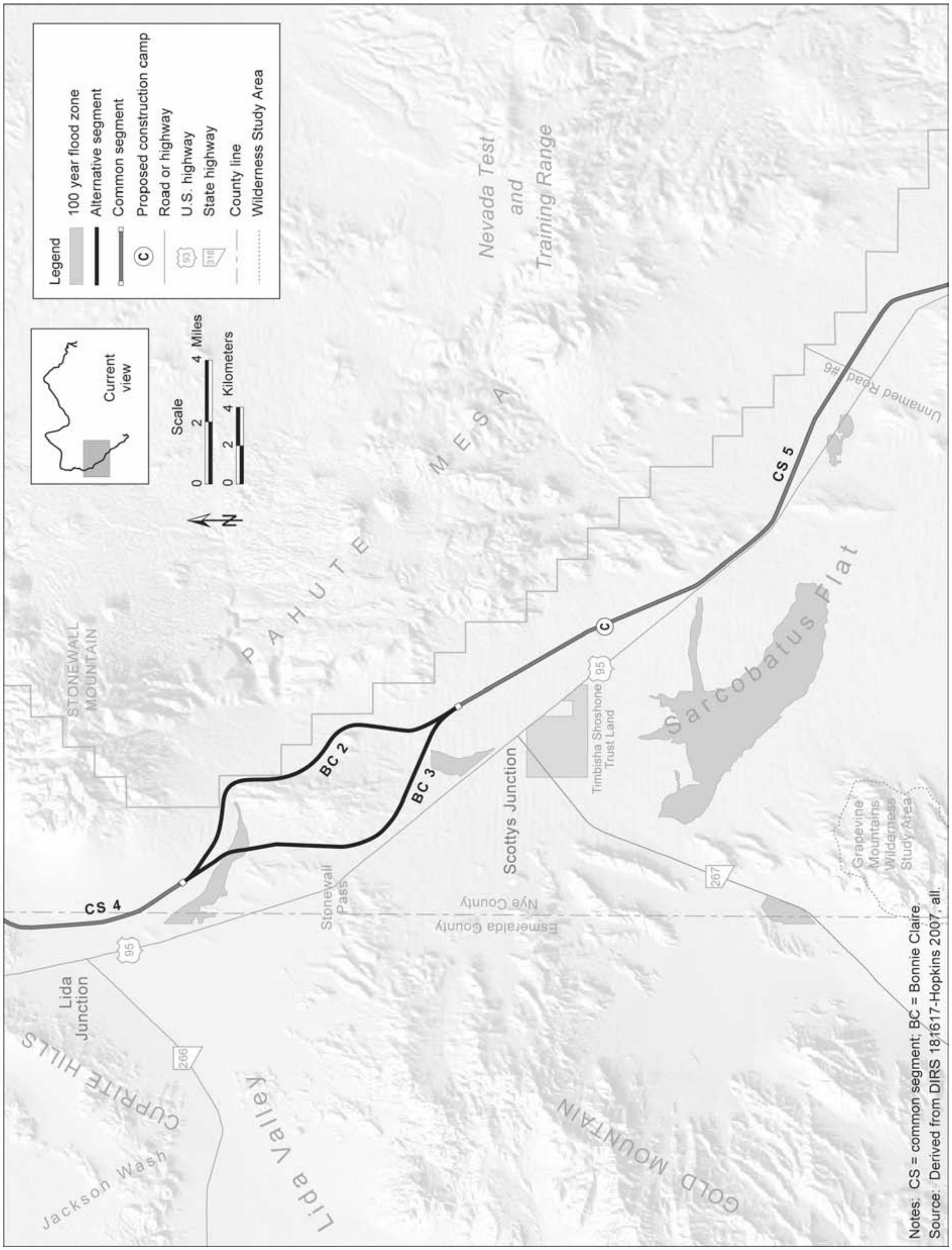


Figure F-12. FEMA floodplain map for map area 6 of the Caliente rail alignment.

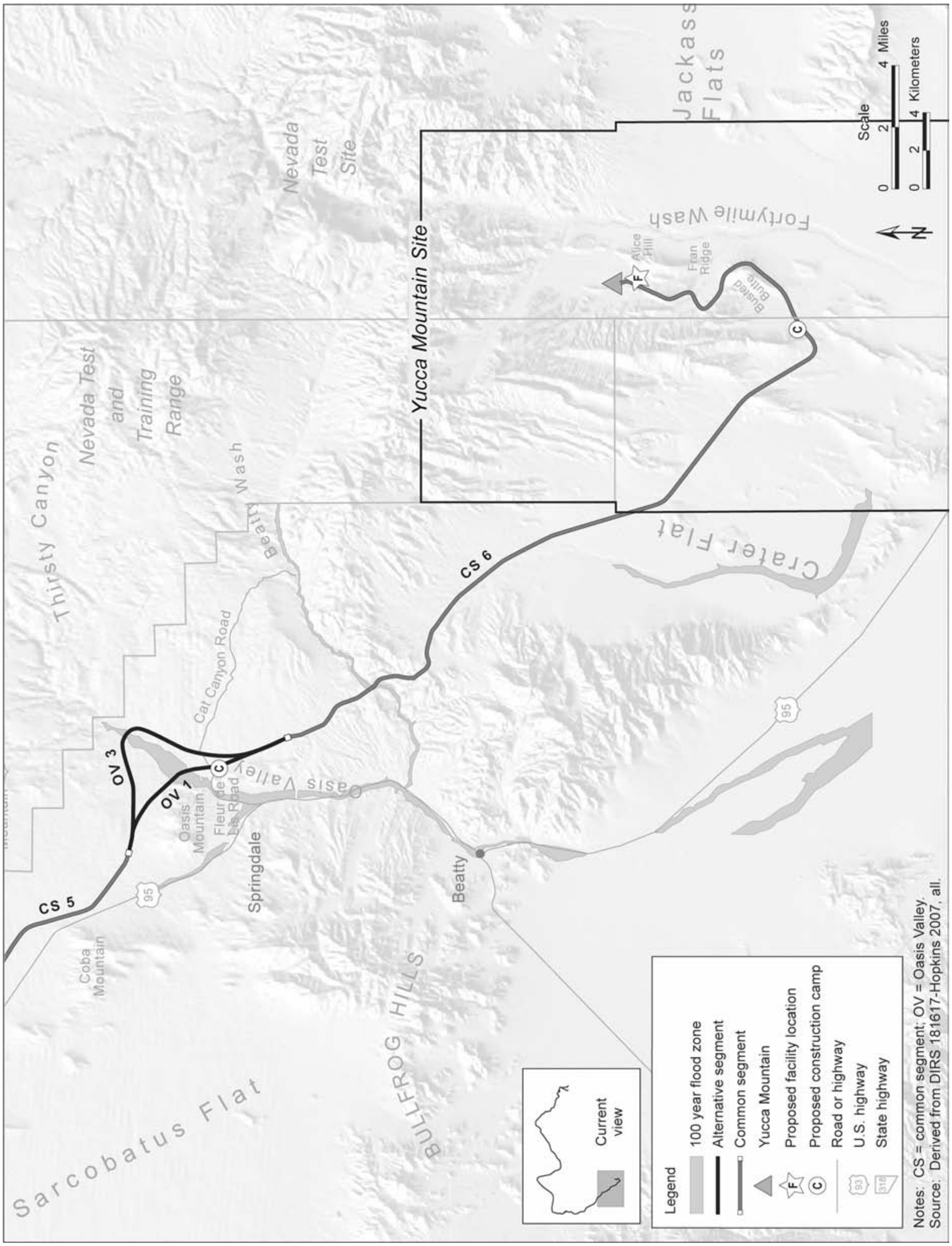


Figure F-13. FEMA floodplain map for map area 7 of the Caliente rail alignment.

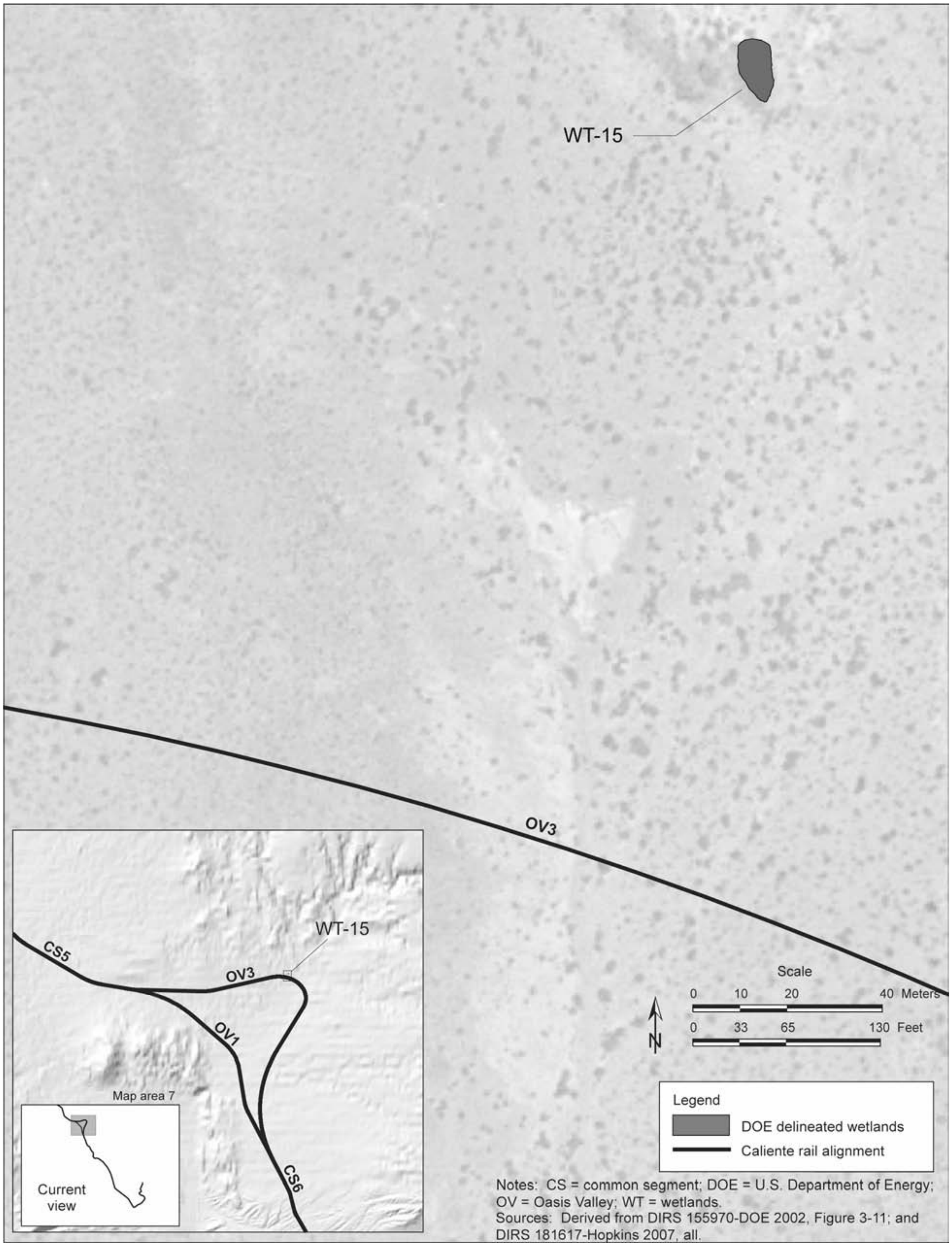


Figure F-14. Isolated wetland near Oasis Valley alternative segment 3.

fenced or flagged. Indirect impacts such as sedimentation, erosion, and incidental spills would still be possible and are addressed in Section F.3.1.

F.3.2.12 Common Segment 6

Slightly more than half of common segment 6 has coverage on FEMA flood maps. The coverage terminates at about the point where the proposed rail alignment reaches the repository land withdrawal area (see Figure F-13). Although the flood maps do not provide coverage for the area of the repository on the eastern side of Yucca Mountain, DOE has performed flood studies on several washes in that area, as addressed in the Yucca Mountain FEIS. An overlay of the proposed rail alignment with the Yucca Mountain FEIS (see Figure-15) indicates that common segment 6 would cross short stretches of 100-year floodplains associated with Busted Butte Wash (also known as Dune Wash) and Drill Hole Wash (DIRS 155970-DOE 2002, pp. 3-38 and 3-39, and Figure 3-11). As shown in Table F-1, common segment 6 would cross a 0.10-kilometer (0.062-mile) section of the Beatty Wash floodplain. The FEMA flood maps also show a floodplain associated with an unnamed wash in Crater Flat; however, the floodplain does not extend upstream to the point where it would be crossed by the proposed rail alignment.

Table F-4 lists peak discharges for estimated floods along the main washes at Yucca Mountain, including a value for the estimated regional maximum flood. In addition to the flood estimates listed in the table, DOE used another estimating method, the probable maximum flood methodology (based on American National Standards Institute and American Nuclear Society Standards for Nuclear Facilities) to generate another maximum flood value for washes adjacent to the existing facilities and operations at the repository north and south portals. The flood value this method generates, which includes a bulking factor to account for mud and debris (including boulder-size materials), is the most severe reasonably possible for the location under evaluation and is larger than the regional maximum flood. DOE used the probable maximum flood values to predict the areal extent of flooding in the area of the repository and to determine if facilities and operations at the repository could be at risk for flood damage.

Table F-4. Estimated peak discharge along washes at the Yucca Mountain Repository.[a]

Name	Drainage area, square kilometers (square miles)	Peak discharge 100-yr flood, cubic meters per second (cubic feet per second)	Peak discharge 500-yr flood, cubic meters per second (cubic feet per second)	Regional maximum flood, cubic meters per second (cubic feet per second)
Fortymile Wash	810 (310)	340 (12,000)	1,600 (56,800)	15,000 (530,000)
Busted Butte Wash	17 (6.6)	40 (1,400)	180 (6,400)	1,200 (42,000)
Drill Hole Wash	40 (15)	65 (2300)	280 (9,900)	2,400 (85,000)
Yucca Wash	43 (17)	68 (2,400)	310 (11,000)	2,600 (92,000)

a. Source: DIRS 155970-DOE 2002, Table 3-9.

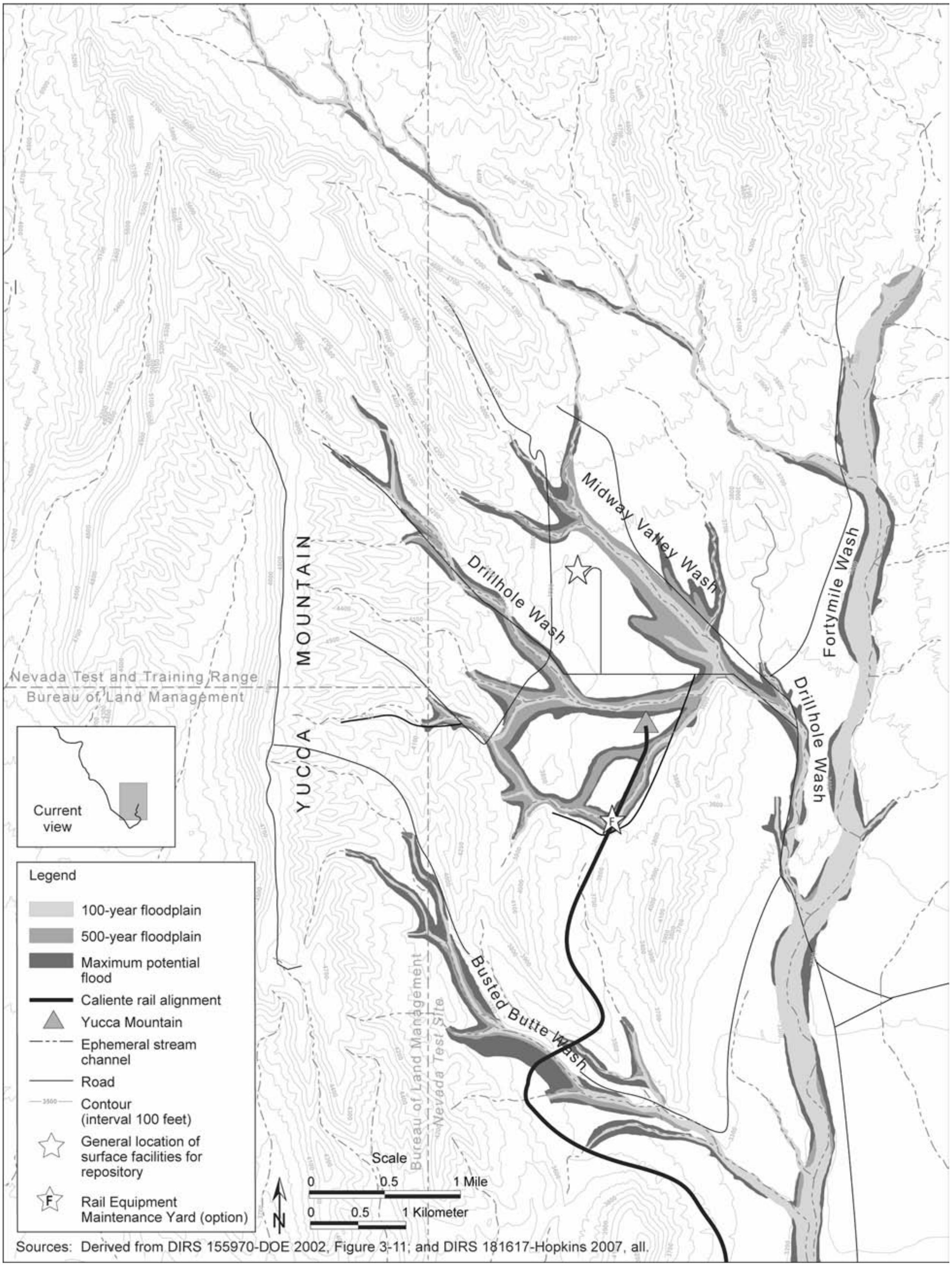


Figure F-15. DOE floodplain map for repository area.

During March 1995 and February 1998, Fortymile Wash and the Amargosa River flowed simultaneously through their primary channels to Death Valley. The 1995 event represented the first documented case of this flow condition. During the 1995 event, the peak flow near the location where the existing Yucca Mountain access road crosses Fortymile Wash was reported as approximately 85 cubic meters per second (3,000 cubic feet per second) (DIRS 182755-Parsons Brinckerhoff 2007, p. 13). The 1995 event was brought about by relatively short-term precipitation events at higher altitudes near Yucca Mountain; the 1998 flood was characterized by sustained regional precipitation over several days (DIRS 159895-Tanko and Glancy 2001, p. 3). One construction camp would be located along common segment 6; however, it would not intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to common segment 6.

No wetlands were identified along common segment 6.

F.3.3 SEGMENT-SPECIFIC IMPACTS FOR THE MINA RAIL ALIGNMENT

F.3.3.1 Interface with the Union Pacific Railroad Hazen Branchline (Hazen to Wabuska)

DOE would not perform any construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to floodplains or wetlands along the existing Union Pacific Railroad Hazen Branchline.

F.3.3.2 Department of Defense Branchline North (Wabuska to the boundary of the Walker River Paiute Reservation)

DOE would not perform any construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to floodplains or wetlands along the existing Department of Defense Branchline North (see Figure F-16).

F.3.3.3 Department of Defense Branchline through Schurz

DOE would not perform any new construction activities along this portion of the Mina rail alignment. Therefore, there would be no impacts to floodplains or wetlands along the existing Department of Defense Branchline through Schurz (see Figure F-16).

F.3.3.4 Schurz Alternative Segments

As shown in Figure F-2, FEMA flood maps do not cover any of the Schurz alternative segments. However, it is reasonable to assume that the floodplain mapped for the very southern portion of Walker Lake extends upstream to where the Schurz alternative segments would cross over the Walker River. Because the alternative segments would follow valley floors, utilize mountain gaps, and cross unnamed ephemeral playas, it is feasible that floodplains could exist in low-lying areas along the alternative segments. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Schurz alternative segments.

A survey for wetlands along the Mina rail alignment conducted by DOE in support of the Rail Alignment EIS identified emergent wetlands (WRN-1, WRN-2, WRN-3, and WRN-4) that would be crossed by the Schurz alternative segments (see Figure F-17). The total surface area for these wetlands is 0.065 square kilometer (16 acres). Emergent and scrub-shrub wetlands continue north and south beyond the region of influence.

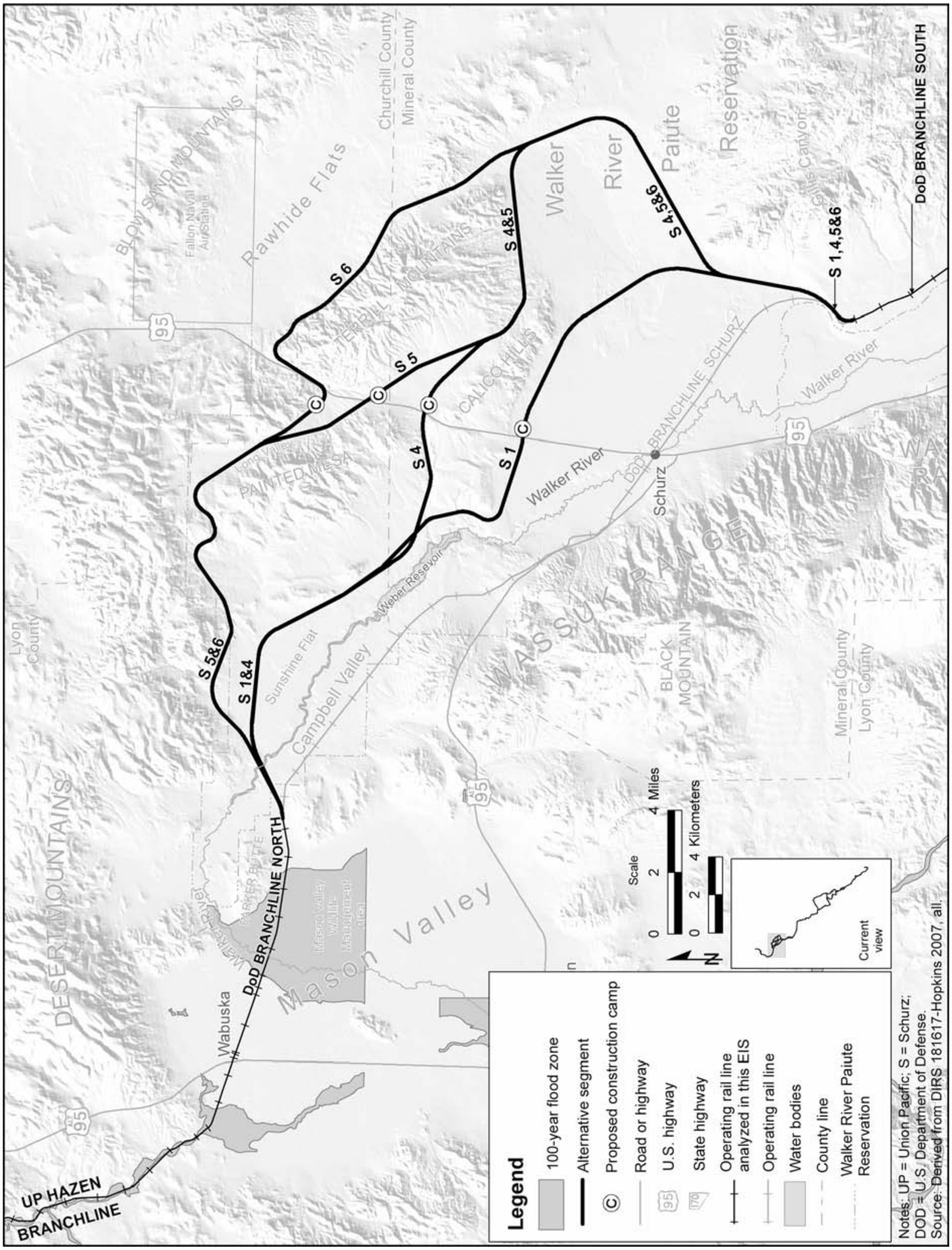


Figure F-16. FEMA floodplain map for map area 1 of the Mina rail alignment.

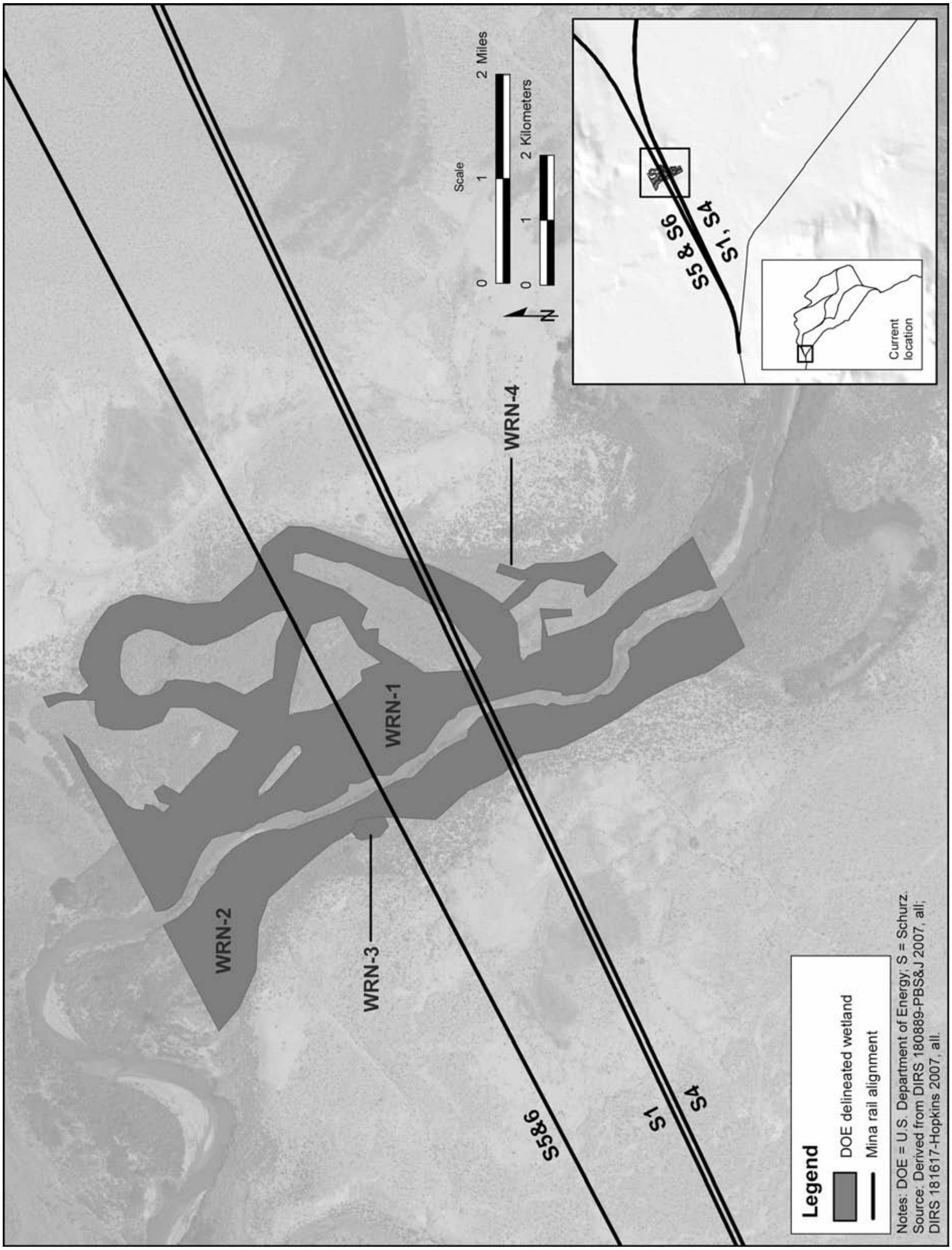


Figure F-17. Wetlands along Walker River (shows WRN-1 through WRN-4).

Placement of piers and construction of the bridge in the active stream would occur during low flow (generally September through April). To provide access for cranes and other heavy equipment to the stream channel, which is about 12 meters (40 feet) wide in this area, heavy mats made of wood or other solid material would be sunk into the stream. There would be sufficient gaps between the mats to allow flow of water. No sand, gravel, or other loose fill will be placed in the stream channel. The mats would be removed from the channel after the bridge pilings are driven into ground and the concrete bridge sections are erected over the channel.

The double-cell bridge would be about 300 meters (1,000 feet) long with 12-meter (40-foot) pier spacing. The only permanent fill will be the concrete pilings required to support the bridge piers. Using these methods, the only permanent fill or loss of wetlands would be a total of about 20 square meters (0.005 acre) for emplacement of about 10 piers in wetlands for Schurz alternative segments 1 and 4, or 28 square meters (0.007 acre) for emplacement of about 14 piers for Schurz alternative segments 5 and 6.

Construction of the Schurz alternative segments would result in the permanent loss of wetland habitat. Wildlife migration corridors would be fragmented, and result in a localized loss of shelter and concealment for some wildlife species. Shading provided by the riparian vegetation would be lost in the areas of disturbance, which would result in localized increased surface-water temperatures. The removal of vegetation could also result in the permanent loss of fisheries habitat, sediment stabilization and retention, and flood flow attenuation functions.

Removal of the persistent wetland vegetation in temporarily impacted areas would result in short-term exposure to wind erosion and enhanced desiccation by the summer sun heat, loss of shade to the Walker River shoreline, and loss of fish and wildlife habitat. Freshly disturbed areas would provide an opportunity for non-native invasive species, such as salt cedar, to colonize new areas and further decrease the quality of the wetland habitat.

Undisturbed wetlands would continue to perform water-quality functions by filtering potential unconsolidated sediments. The flood flow attenuation capacity would be slightly reduced, and could result in some minor localized flooding and erosion during seasonal precipitation events. The remaining undisturbed wetlands would continue to provide commonly recognized functions. For example, Baltic rush and salt grass would filter water-borne sediments from draining into Walker River from the surrounding terrestrial environment and would provide nesting habitat for water-dependant wildlife species. The remaining woody vegetation would continue to provide flood flow attenuation functions and provide wildlife habitat.

DOE would minimize impacts by constructing a bridge over the Walker River and its associated wetlands. Of the 0.065 square kilometer (16 acres) crossed in this area, only 28 square meters (300 square feet) would be permanently filled to facilitate the construction of the bridge. By maximizing avoidance in this way, DOE would minimize permanent impacts to the maximum extent practicable. DOE would also implement best management practices such as constructing sediment ponds and installing hay bales or silt fences, which would minimize potential impacts during construction. Wildlife utilizing wetlands in the proposed disturbance areas would be temporarily displaced, but would continue to use the undisturbed adjacent areas; therefore, impacts to the wetlands in this area from the construction of the rail alignment are expected to be small.

F.3.3.5 Department of Defense Branchline South (Hawthorne to Mina Common Segment 1)

Although Department of Defense Branchline South represents an existing railway, DOE would develop construction camp 17 on the southern portion of this rail alignment. The construction camp would not overlie any floodplains or wetlands. Aside from construction of this camp, DOE does not anticipate any other surface disturbances along this portion of the Mina rail alignment (see Figure F-18).

F.3.3.6 Mina Common Segment 1 (Gillis Canyon to Blair Junction)

FEMA flood maps do not cover any part of Mina common segment 1. Because the proposed segment would follow valley floors, cross unnamed ephemeral washes and playas, or utilize mountain gaps, it is feasible that a floodplain could exist in low-lying areas along the common segment, especially in low-lying areas receiving seasonal water from ephemeral washes. The Staging Yard at Hawthorne, four construction camps, and two potential quarry sites would be located along common segment 1; however, none of these facilities intersect with floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Mina common segment 1.

Although the National Wetlands Inventory dataset indicates Mina common segment 1 would cross through wetlands within Soda Springs Valley, field investigations conducted by DOE in support of this EIS determined that surface water shown by the NWI dataset are absent from the region of influence (DIRS 180889-PBS&J 2007, Figures 5A and 5B, Photos 16 to 22). These areas are mostly unvegetated, barren landscapes that are more representative of ephemeral playas. A review of existing data indicates that areas shown as NWI wetlands actually correspond to unnamed ephemeral playas as identified by the National Hydrologic Dataset. No wetlands were identified along Mina common segment 1.

F.3.3.7 Montezuma Alternative Segments

FEMA flood maps only cover a small portion of the Montezuma alternative segments, near their southern termination. Because the proposed alternative segments would follow valley floors, cross unnamed ephemeral washes and playas, or utilize mountain gaps, it is feasible that a floodplain could exist in low-lying areas along the alternative segments, especially in low-lying areas receiving seasonal water from ephemeral washes. As shown in Figure F-19, Montezuma alternative segment 2 would cross approximately 2 kilometers (1.2 miles) of floodplains associated with a drainage in Lida Valley and the Stonewall Flat playa. Two alternative locations for the Maintenance-of-Way Facility (Klondike option and Silver Peak option) would also be located along the alternative segments, as well as four proposed construction camp sites and three quarry sites. None of these facilities would intersect floodplains or wetlands. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to the Montezuma alternative segments.

For Montezuma alternative segment 1, the National Wetland Inventory dataset identifies an unnamed pond in the private area near the Town of Silver Peak as wetlands; however, DOE field studies in support of the Rail Alignment EIS determined there are no wetlands in this area. For Montezuma alternative segments 2 and 3, the National Wetland Inventory dataset classifies the large playas in Big Smoky Valley and Stonewall Flat as wetlands; however, DOE field studies in support of this EIS confirmed no wetlands exist within the region of influence (DIRS 180889-PBS&J 2007, Figure 5C, Photos 23 and 24). No wetlands were identified along the Montezuma alternative segments.

F.3.3.8 Mina Common Segment 2

As shown in Figure F-19, FEMA flood maps provide coverage for the entire length of Mina common segment 2; however, no floodplains are crossed by the segment. Because the proposed segment would follow valley floors, cross unnamed ephemeral washes and playas, or utilize mountain gaps, it is feasible that a floodplain could exist in low-lying areas along common segment 2, especially in low-lying areas receiving seasonal water from ephemeral washes. Section F.3.1 addresses common impacts to floodplains that would be crossed by and adjacent to Mina common segment 2.

No wetlands were identified along Mina common segment 2.

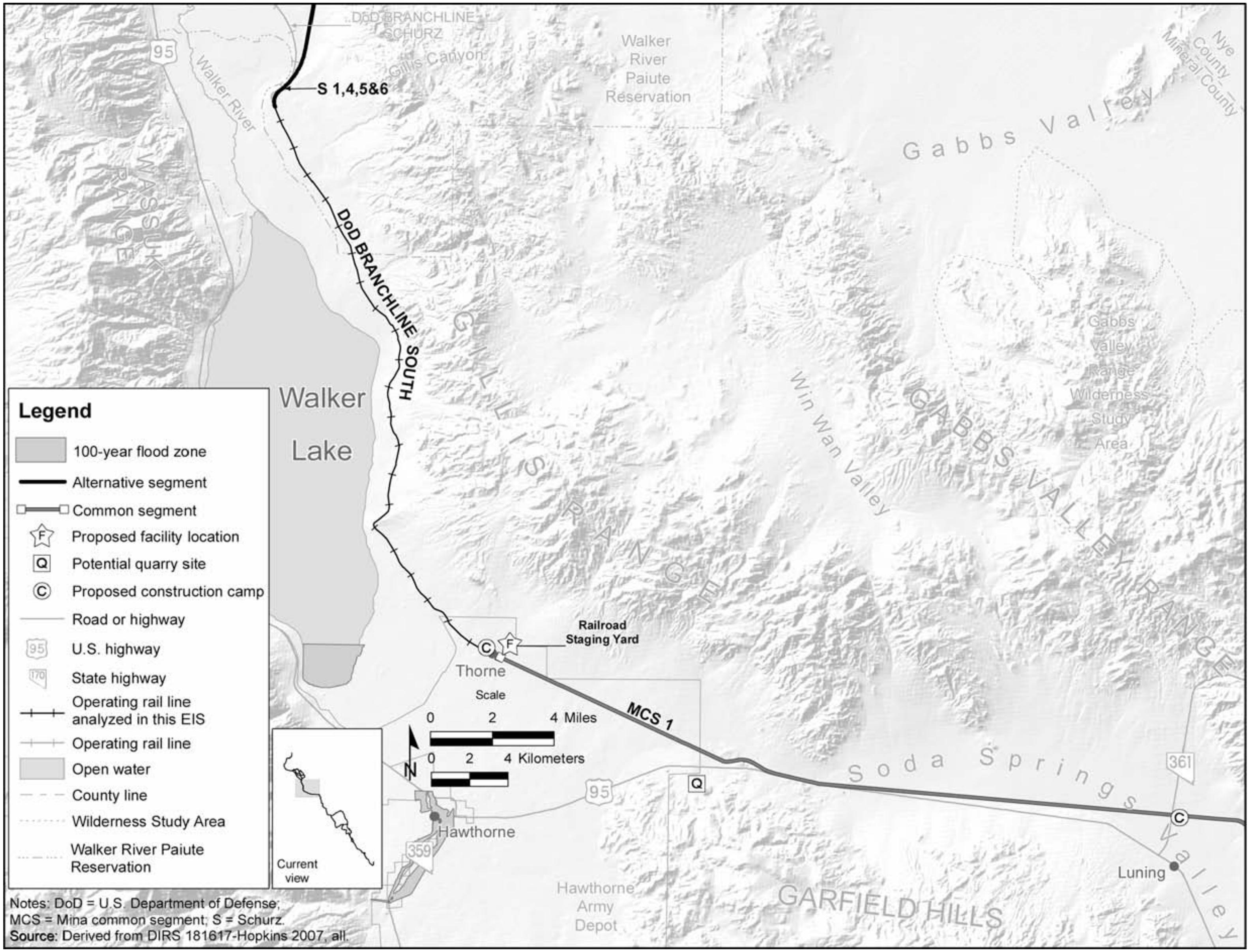


Figure F-18. FEMA floodplain map for map area 2 of the Mina rail alignment.

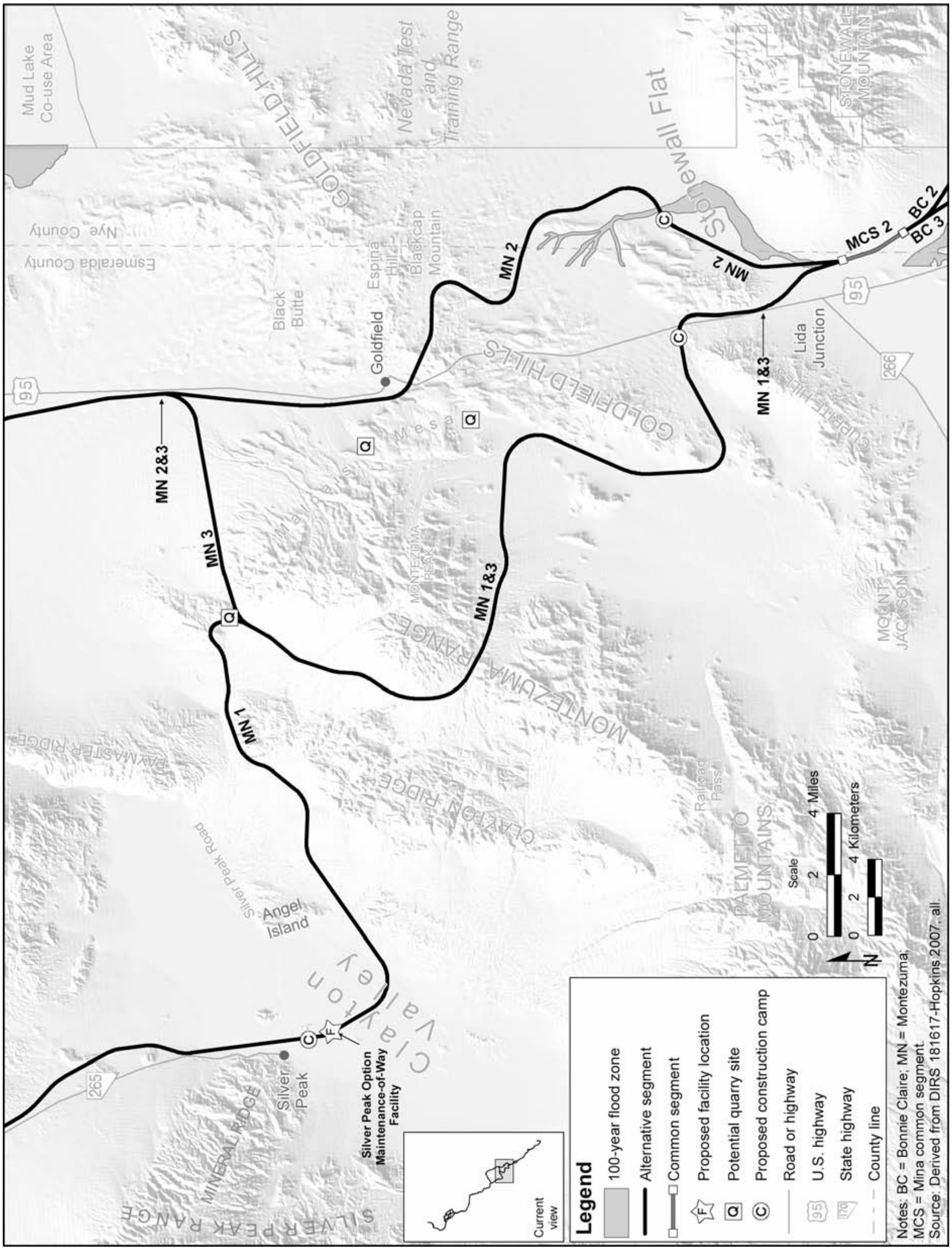


Figure F-19. FEMA floodplain map for map area 5 of the Mina rail alignment.

F.3.3.9 Bonnie Claire Alternative Segments

Refer to Section F.3.2.9.

F.3.3.10 Common Segment 5 (Sarcobatus Flat Area)

Refer to Section F.3.2.10.

F.3.3.11 Oasis Valley Alternative Segments

Refer to Section F.3.2.11.

F.3.3.12 Common Segment 6 (Yucca Mountain Approach)

Refer to Section F.3.2.12.

F.4 Alternatives

In accordance with 10 CFR 1022.13(a)(3), DOE must consider alternatives to the Proposed Action that would avoid adverse impacts and incompatible development in the floodplain or wetland, including alternative sites, alternative actions, and no action. Further, DOE must evaluate measures that mitigate the adverse impacts of actions in a floodplain or wetland including, but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically sensitive areas.

As shown in Figure F-20, the Proposed Action includes two implementing alternatives, each with a ***Shared-Use Option***.

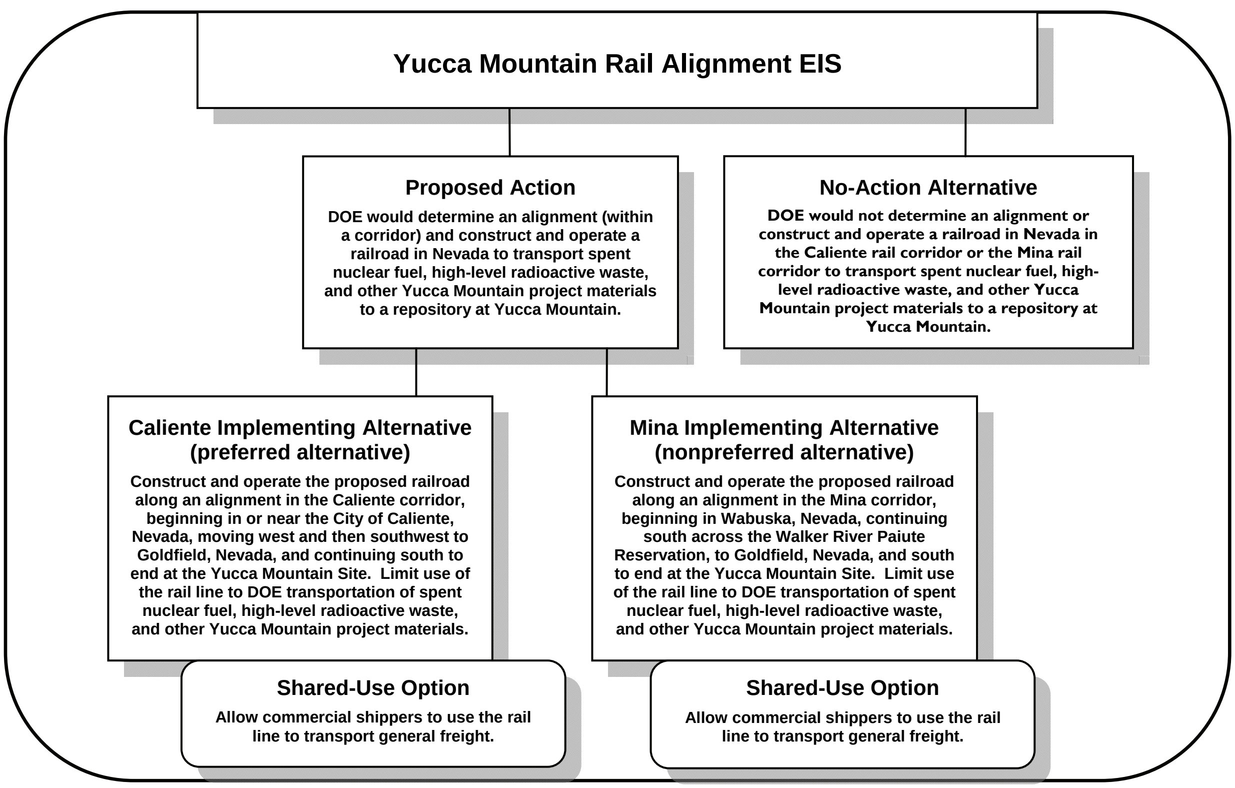


Figure F-20. Alternatives analyzed in the Rail Alignment EIS.

Under the Proposed Action Caliente Implementing Alternative, DOE would determine a rail alignment within the Caliente rail corridor and would construct and operate a railroad for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials within Nevada. The proposed railroad would run from a site in or near the City of Caliente, Lincoln County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. The Caliente Implementing Alternative is the DOE preferred alternative.

Under the Proposed Action Mina Implementing Alternative, DOE would determine a rail alignment within the Mina rail corridor and would construct and operate a railroad for the shipment of spent nuclear fuel, high-level radioactive waste, and other materials within Nevada. The proposed railroad would run from Wabuska, Lyon County, Nevada, to a geologic repository at Yucca Mountain, Nye County, Nevada. The Mina Implementing Alternative is the DOE nonpreferred alternative.

Along each of the rail alignments, DOE considered a range of alternative segments and a series of common segments, and eliminated some of the alternative segments from detailed analysis. Appendix C, Evolution of Common Segments and Alternative Segments, describes the elimination process.

Under either Proposed Action implementing alternative, the Shared-Use Option would allow commercial shippers to use the rail line. Under the Shared-Use Option, other organizations could construct commercial sidings and additional facilities that would allow commercial commodities (such as nonmetallic minerals or stone) to be transported on the rail line.

Under the ***No-Action Alternative***, DOE would not determine a rail alignment or construct and operate the proposed railroad within the Caliente rail corridor or the Mina rail corridor. As such, the No-Action Alternative provides a basis for comparison with the Proposed Action.

Section F.4.1 summarizes the process DOE used to define and select the two implementing alternatives. It also addresses the more recent selection of the preferred alignment.

F.4.1 PROPOSED ACTION

F.4.1.1 Alternative Evaluations under the Proposed Action

Appendix C describes the process DOE used to evaluate and determine the range of alternative segments for the Caliente and Mina rail alignments considered in the Rail Alignment EIS, and the results of that process.

F.4.1.2 Preferred Alignment

The Council on Environmental Quality NEPA implementing regulations require an agency to identify its preferred alternative, if one or more exists, in the Draft EIS (40 CFR 1502.14[e]). For the Rail Alignment EIS, the DOE preferred alternative is to construct and operate a railroad along the Caliente rail alignment and to implement the Shared-Use Option. DOE identified preferred alternative segments (Figure F-21) within the Caliente rail alignment based on analysis of environmental impacts, engineering and cost factors, and regulatory compliance issues, including permit requirements and challenges, stakeholder preference, land-use conflicts, and uncertainties (see Table 2-30 of the Rail Alignment EIS).

Appendix C provides a more detailed description of the evaluation process DOE used to screen the various alternative segments and select the proposed rail alignments (still with some alternative segments).

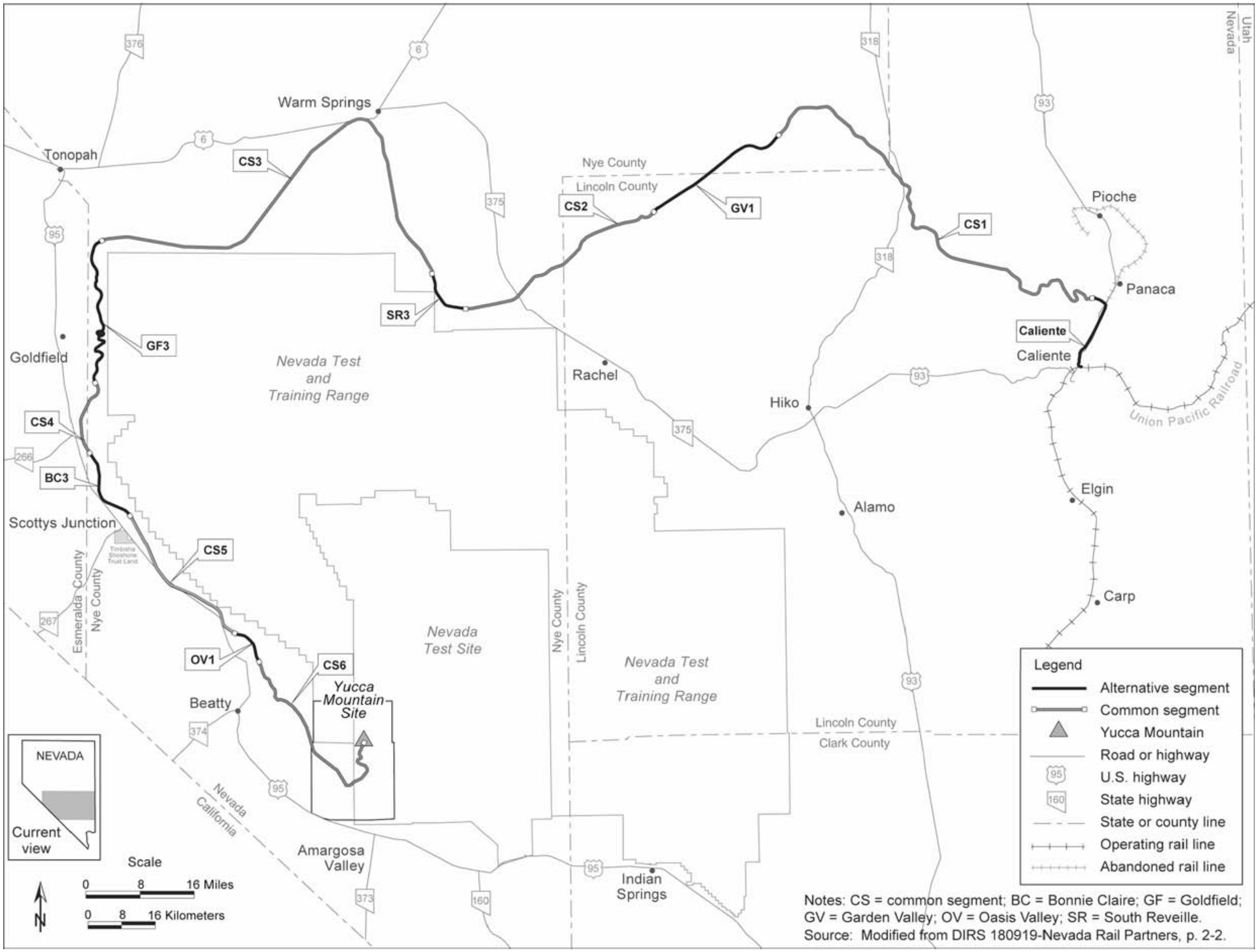


Figure F-21. Preferred Caliente rail alignment, combination of common segments and alternative segments.

F.4.2 SHARED-USE OPTION

The Shared-Use Option would involve the use of the DOE rail line for general freight such as mineral resources or oil that could be shipped by private companies. Construction-related impacts to floodplains and wetlands would be similar to those identified for the Proposed Action without shared use.

F.4.3 NO-ACTION ALTERNATIVE

Council on Environmental Quality regulations (40 CFR 1502.14) require that the alternatives analysis in an EIS include the alternative of no action. Under the No-Action Alternative in the Rail Alignment EIS, DOE would not select a rail alignment within the Caliente or Mina rail corridors for the construction and operation of a railroad. As such, the No-Action Alternative provides a basis for comparison with the Proposed Action.

In the event that DOE were not to select a rail alignment in the Caliente or Mina rail corridors, the future course that it would pursue to meet its obligations under the NWPA is uncertain. DOE recognizes that other possibilities could be pursued, including identifying and evaluating alignments in other corridors considered in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 6).

DOE would relinquish the public lands withdrawn from surface and mineral entry for purposes of evaluating the lands for the potential construction, operation, and maintenance of a railroad (70 *FR* 76854, December 28, 2005). These lands would then become available for other uses as determined by the BLM once it amended or revoked the withdrawal.

F.4.4 MITIGATION MEASURES

In accordance with 10 CFR 1022.12(a)(3), DOE must address measures to mitigate the adverse impacts of actions in a floodplain or wetlands, including but not limited to, minimum grading requirements, runoff controls, design and construction constraints, and protection of ecologically sensitive areas. Whenever possible, DOE would avoid disturbing floodplains and wetlands and would minimize impacts to the extent practicable, if avoidance was not possible. This section discusses the floodplain and wetland mitigation measures that would be considered in the vicinity of the proposed rail alignment and, where necessary and feasible, implemented during railroad construction, operations, and maintenance. In general, DOE would minimize impacts to floodplains and wetlands through the implementation of engineering design standards and best management practices.

DOE has identified several measures to help avoid, minimize, or mitigate potential adverse impacts to floodplains and wetlands under the Proposed Action and Shared-Use Option. DOE has designed the rail alignment segments to avoid direct and indirect impacts to water resources wherever practicable. Due to the nature of rail line design and the construction activities that would be required to implement the design, the rail line cannot avoid crossing floodplains and wetlands. The engineering design process would ensure that the engineered structures used to pass water runoff from one side of the rail line to the other would do so in a way that would minimize impacts to floodplains and wetlands. Such impacts would be limited mostly to the construction phase and would be subject to Clean Water Act regulations and permitting. In most cases DOE would minimize adverse impacts through the implementation of best management practices in concert with the permits and plans regulatory agencies would require.

F.4.4.1 Engineering Design Standards

Before any construction could begin, DOE would require pre-construction surveys to ensure that the work would minimize impacts to floodplains and wetlands. In addition, the site's reclamation potential would be determined during these surveys. If the surveys indicate that construction would threaten these resources, and modification or relocation of the proposed rail line and associated roads would not be reasonable, DOE would develop mitigation measures. DOE would incorporate mitigation measures developed during the pre-construction surveys into the final design of the proposed rail line and associated facilities.

DOE would minimize the disturbance of surface areas and vegetation and would maintain natural contours to the maximum extent feasible. DOE would expect to establish reclamation guidelines for site clearance, topsoil salvage, erosion and runoff control, recontouring, revegetation, siting of roads, and construction practices similar to that established for the repository (DIRS 102188-YMP 1995, pp. 2-1 to 2-14). DOE would stabilize slopes to minimize erosion and would avoid unnecessary off-road vehicle travel.

Although DOE would generally design rail line features to accommodate 100-year flows, the final design process may also consider a range of flood frequencies and include a cost-benefit analysis in the selection of a design frequency in accordance with standard rail line design guidelines and practices (DIRS 106860-AREA 1997, Volume 1, Section 3.3.2.2.c). DOE would analyze crossings on a case-by-case basis and propose culverts whenever feasible (DIRS 180918-Nevada Rail Partners 2007, p. ii). In areas where drainage structures would cross a FEMA Flood Zone A (such as a 100-year flood zone), DOE would design the bridge to comply with FEMA standards and appropriate county regulations. The FEMA standards require that floodway surcharge (the difference between the 100-year-flood elevation and the actual flood surface elevation) would not cause more than a 0.3-meter (1-foot) rise at any location. The FEMA standards have been designed to limit floodwater impacts to structures built in or adjacent to the floodplain (DIRS 180918-Nevada Rail Partners 2007, p. ii). By adhering to these standards, DOE would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains.

Where very wide and shallow depths of flow occur during the 100-year event, or the flow is divided into multiple natural channels that would cross the alignment, DOE would use a series of multiple culverts, potentially in concert with small bridges, to span the main flow channel where practicable. In locations where there are very high fill conditions, multiple culverts would be more practical and economical than constructing a bridge (DIRS 180918-Nevada Rail Partners 2007, p. ii). DOE would install culverts with riprap around the exposed ends and use other measures, as necessary, to protect the fill material from erosion. DOE would take similar actions as needed for bridges to protect the structures and to ensure disturbed areas are not subject to increased erosion.

F.4.4.2 Best Management Practices

A National Pollutant Discharge Elimination System General Construction Permit would be required for construction activities. In accordance with this permit, construction contractors would be required to prepare and submit a Stormwater Pollution Prevention Plan. The Stormwater Pollution Prevention Plan would be prepared consistent with State of Nevada and federal standards for construction activities and would detail the best management practices DOE would employ to minimize soil loss and degradation to nearby water resources. DOE would base the design of the best management practices program on practices listed in the *Best Management Practices Handbook* developed by the Nevada Division of Environmental Protection and the Nevada Division of Conservation Districts (DIRS 176309-NDEP 1994, all) and the *Storm Water Quality Manuals Construction Site Best Management Practices Manual* developed by the Nevada Department of Transportation (DIRS 176307-NDOT 2004, all). Table F-5 lists many of the categories of best management practices that would be considered for the construction and operation of the proposed rail line.

Table F-5. Best management practices (page 1 of 2).

Practice	Description
Road and construction site practices	
Development site plan	A site plan identifies the physical features of the site, the location of proposed development, and the location of temporary and/or permanent best management practices. By utilizing a development site plan, the proposed development can be situated to minimize impact to natural resources and the land, and to enable water-quality protection measures and runoff conveyance measures to be properly located.
Grading seasons and practices	The grading season is determined by the local climate conditions. All grading, clearing, and excavation work should be conducted during this period to avoid climatic conditions that could increase the chances for erosion. Grading and construction activities should be coordinated such that bare and disturbed soil exposure is minimized during the winter snow and rainy seasons.
Erosion and sediment controls	
Erosion and sediment control structures	Properly designed, installed, and maintained, erosion and sediment control structures will effectively reduce the transport of sediments, minimize erosion and the degradation of water resources, and reduce negative impacts to natural resources (vegetation and wildlife).
Runoff interceptor trench or swale	Properly designed, installed, and maintained, a runoff interceptor trench or swale will effectively convey surface runoff, minimize soil erosion resulting from surface runoff, and reduce the degradation of receiving water resources.
Siltation or filter berms	Siltation or filter berms capture and retain runoff from construction sites and allow sediments to settle out, and direct runoff water through filter berms at outlets to stabilized drainage ways.
Filter or silt fence	Filter or silt fences are constructed to intercept and capture sediment by decreasing the velocity of surface runoff.
Sediment basins	Sediment basins are effective in reducing water pollution by trapping sediment originating from construction sites and by providing basins for deposition and storage of silt, sand, gravel, stone, and other debris.
Soil stabilization practices	
Rock and gravel mulches	The application of gravel or crushed rock as a mulch is used to stabilize soils during construction activities for erosion control on a variety of surface disturbance areas.
Wood chip, straw, and black mulches	Wood chips, straw, and bark mulches are used as mulch to protect the soil surface from raindrop and irrigation impacts, and decrease runoff.
Jute and synthetic netting	The primary purpose of nettings is to anchor mulch in place on varying topography or in wind-prone areas. Netting provides stability to surface disturbances and reduces the soil erosion potential.
Slope stabilization practices	
Slope shaping	Slope shaping is comprised of designing and modifying cut or fill slopes to reduce the soil erosion and runoff potential. Activities include predisturbance planning and design, terraces, benches, serrations, and steps.

Table F-5. Best management practices (page 2 of 2).

Practice	Description
Slope stabilization practices (continued)	
Retaining structures	Retaining structures are walls comprised of wood, rock, concrete, or other material, constructed at the toe of a slope in order to protect the slope face or toe from scour and erosion from storm runoff.
Rock riprap	Rock riprap is a layer of loose rock placed over an erodible soil or surface disturbance in order to protect the soil surface, to provide for slope stabilization on steep slopes, and to reduce soil erosion within a project area.
Infiltration systems	
Infiltration trench or basin	A shallow rock- or gravel-filled trench located at the drip line of roofs or adjacent to other impervious surfaces such as paved driveways and parking areas can percolate runoff from impervious surfaces and prevent erosion.
Watershed management	
Stream protection and stabilization	Stabilization of stream channels and stream banks is an effective treatment to reduce sediment loading and control erosion and land damage.
Floodwater retarding structure	Floodwater retarding structures are installed to reduce flood damage downstream by controlling the release rate from flood flows of predetermined frequencies.
Floodwater diversion	Floodwater diversions will protect the land, surface improvements, and the watershed by reducing erosion and sediment delivery to receiving waters.
Mining (quarries)	
Excavation stabilization	Excavation stabilization of mined surfaces may prevent erosion, sedimentation, and the degradation of surface and ground water quality through the discharge of sediments or other pollutants into stream channels, drainage ways, or waters of the state.
Surface runoff management	Stormwater runoff management practices when designed, installed, and maintained properly, are effective methods to treat nonpoint source pollution and minimize impacts to surface and ground water quality.
Urban resource management	
Street runoff collection	Street runoff collection prevents erosion of roadside shoulders and adjacent roadway slopes from surface runoff.
Storm drainage structures	Storm drainage structures include pipes, channels, drop inlets, slotted drains, grease and oil traps, or other facilities used to collect and/or convey surface runoff. Their effectiveness depends on keeping them free from debris or filled with sediment.
Landscaping	Proper landscaping can stabilize disturbed sites in a manner that controls surface drainage and soil erosion.

Best management practices are structural and nonstructural controls that are used to control ***nonpoint source pollution*** such as sedimentation and stormwater runoff. Structural controls are best management practices that need to be constructed (such as detention or retention basins). Nonstructural controls refer to best management practices that typically do not require construction, such as planning, education, revegetation, or other similar measures. Sedimentation and stormwater runoff are typically addressed through the use of temporary and permanent best management practices. These include techniques such as grading that would induce positive drainage, installation of silt fences, and revegetation to minimize or prevent soil exposed during construction from becoming sediment to be carried offsite. DOE would implement, inspect, and maintain best management practices to minimize the potential for adversely affecting downstream water quality. Therefore, DOE expects impacts from erosion and sediment runoff associated with construction efforts to be small.

During large flood events, when water is held on the upstream side of the structure, it is possible that sediment could accumulate on the upstream side of the crossings. DOE would remove this material periodically so that future floods would have sufficient space to accumulate, rather than overflow the structures during successively smaller floods. Sediment removed from these areas would be removed by truck and disposed of appropriately or, depending on the location of the drainage channel, simply moved out of the drainage channel and left at the site. Under natural conditions this sediment would have continued downstream and been deposited as the floodwaters dispersed. Compared to the total amount of sediment that is moved by floodwater along the entire length of a wash, the amount deposited behind a crossing would be minor.

Storage of hazardous materials during the construction and operations periods would be in accordance with normal environmental regulatory requirements (for example, within secondary containment) and best management practices. As practicable, DOE would store hazardous materials outside of floodplains. Hazardous materials that would be most susceptible to accidental spills and releases would be the fuels and other petroleum products that would be required to support power and equipment needs for the construction and operation of the proposed rail line.

F.4.4.3 Regulatory Mitigation

If it is determined that the potential wetland areas along Meadow Valley Wash do qualify as jurisdictional wetlands, mitigation for their loss would be determined with the appropriate state and federal agencies. This might involve the enhancement of remaining wetlands or the development of replacement wetlands in other areas along Meadow Valley Wash or elsewhere in Nevada.

For surface-water resources, there are several actions DOE would take in accordance with regulatory requirements that would define mitigation measures during implementation of either the Proposed Action or the Shared-Use Option. These actions would include preparing plans and acquiring permits, as identified as follows in Sections F.4.4.3.1 through F.4.4.3.4.

F.4.4.3.1 Stormwater Discharge

Sediment is the primary pollutant generated at construction sites. Runoff from construction and industrial activities has the potential to generate large quantities of sediment and other contaminants if not properly addressed. In response to this common cause of water-quality impairment, the Environmental Protection Agency promulgated regulations requiring the permitting of stormwater-generated pollution under the National Pollutant Discharge Elimination System (Section 402 of the Clean Water Act). The Nevada Division of Environmental Protection has been delegated the authority to administer these federal regulations and has adopted state regulations to administer a National Pollutant Discharge Elimination System Stormwater program. A National Pollutant Discharge Elimination System General Construction

Permit would be required for construction activities associated with the Proposed Action or Shared-Use Option. In accordance with the National Pollutant Discharge Elimination System, DOE must do the following:

- Prepare a Stormwater Pollution Prevention Plan or plans to address construction of the proposed rail line, including (but not limited to) quarry sites, borrow pits, associated facilities, and labor camps.
- Obtain stormwater National Pollutant Discharge Elimination System permit(s) from the Nevada Bureau of Water Pollution Control, which may involve general and individual permits.
- As part of the National Pollutant Discharge Elimination System permit application, identify proposed measures, including best management practices, to control pollutants in stormwater discharges during and after construction, such as diversion, detention, erosion control, sediment traps, gravel construction entrances, covered storage, spill response, and good housekeeping.

F.4.4.3.2 Discharge of Dredged or Fill Materials

Jurisdictional waters of the United States, subject to regulation under Section 404 of the Clean Water Act, include interstate waters, intrastate waters with a nexus to interstate commerce, tributaries to such waters, and wetlands that are adjacent to waters of the United States. For purposes of this floodplain and wetlands assessment, DOE treated all wetlands equally whether or not they were jurisdictional or nonjurisdictional wetlands. Direct impacts to wetlands associated with the proposed rail alignment would result from temporary or permanent filling or draining of these resources. Indirect impacts would include potential degradation of water quality resulting from actions in and around these resources. Section 404 of the Clean Water Act established a program to regulate the discharge of dredged or fill material into jurisdictional waters, including wetlands. Construction activities, such as those proposed for the development of the rail alignment, that impact jurisdictional wetlands are regulated under this program.

DOE is considering complying with Section 404(r) of the Clean Water Act, which states that the discharge of dredged or fill material as part of the construction of a federal project specifically authorized by Congress is not prohibited or subject to regulation under Section 404 of the Clean Water Act so long as certain conditions are met. One of those conditions is to publish EIS information on the effects of such discharge, including an analysis of alternatives as required by Section 404(b)(1) of the Clean Water Act. The analysis in Sections 4.2.5 and 4.3.5 of the Rail Alignment EIS describes the effects of discharges to wetlands and other waters of the United States. If DOE determines that it will comply with Section 404(r), an alternatives analysis that meets the requirements of Sections 404(b)(1) and 404(r) will be published in the final Rail Alignment EIS. Otherwise, DOE would apply to the Army Corps of Engineers for a permit to fill jurisdictional waters.

DOE would minimize filling of wetlands by incorporating avoidance into engineering and design of the rail line to the maximum extent practicable. DOE would use a minimum-width footprint when practicable, which DOE would accomplish by increasing the slope of the roadbed or bridging across wetlands and not constructing access roads in wetlands. In the areas where wetlands could not be avoided altogether (such as the areas along the Caliente alternative segment), DOE would reduce the width of the construction right-of-way from 300 meters (1,000 feet) to 21 meters (70 feet) at a minimum. By incorporating avoidance of these resources into the engineering and design of the rail line, DOE would minimize adverse impacts to wetlands (and the functions served by wetlands).

F.4.4.3.3 Working in Waterways

According to Nevada Revised Statutes 445A.465, which discusses the prohibition on discharging pollutants into waters of the state without a permit, DOE would have to obtain a permit from the Nevada Division of Environmental Protection, Bureau of Water Pollution Control, to work in waterways. The application for this permit would have to include a description of best management practices DOE would propose to use in and along waterways to protect water quality; control erosion and sedimentation; protect and restore riparian areas; stabilize, protect, and rehabilitate stream banks; and control water pollution. In addition, DOE would have to perform construction activities when streambeds were at low flows or preferably dry, and preserve and restore existing drainage patterns to the extent practicable.

F.4.4.3.4 Flood Hazard Control

In areas where drainage structures would cross a FEMA Flood Zone A (that is, a 100-year flood zone), DOE would design the bridge to comply with FEMA standards and appropriate county regulations. The FEMA standards require that floodway surcharge (that is, the difference between the 100-year flood elevation and the actual flood surface elevation) not exceed 0.3 meter (1 foot) at any location. The FEMA standards have been designed to limit floodwater impacts to structures built in or adjacent to the floodplain (DIRS 180918-Nevada Rail Partners 2007, p. ii). By adhering to these standards, DOE would substantially limit the potential for adverse impacts to the population and resources located adjacent to floodplains. Other practices DOE would use to minimize impacts to floodplains include:

- Construct the proposed rail line in such a way as to maintain current drainage patterns to the extent practicable and not result in new drainage of wetland areas.
- Inspect all drainages, bridges, and culverts semi-annually, or more frequently, as seasonal flows dictate, for debris accumulation.
- Remove debris from drainage structures and properly dispose of debris in an upland area.
- Coordinate with the local floodplain administrators to ensure that new project-related stream and floodplain crossings were appropriately designed to minimize impacts.

F.5 Glossary

100-year flood	A flood event of such magnitude that it occurs, on average, every 100 years; this equates to a 1-percent chance of its occurring in a given year. A base flood may also be referred to as a 100-year storm. The area inundated during the base flood is sometimes called the 100-year floodplain.
50-year flood	A flood event of such magnitude that it occurs, on average, every 50 years; this equates to a 2-percent chance of its occurring in a given year.
accessible environment	For this ***environmental impact statement*** (EIS), all points on Earth outside the surface and subsurface area controlled over the long term for the ***repository***, including the atmosphere above the controlled area.
accident	An unplanned sequence of events that results in undesirable consequences. Examples in this Rail Alignment EIS include an inadvertent release of radiation from the casks or hazardous materials from their containers; train derailments; vehicular accidents; and construction-related accidents that could affect workers.
air quality	A measure of the concentrations of pollutants, measured individually, in the air.
alpha particle	A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium nucleus and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***
alternative	One of two or more actions, processes, or propositions, from which a decisionmaker will determine the course to be followed. The National Environmental Policy Act, as amended, states that in preparing an EIS, an agency "shall … (s)tudy, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources" [42 U.S.C. 4321, Title I, Section 102(E)]. The regulations of the Council on Environmental Quality that implement the National Environmental Policy Act indicate that the alternatives section is "the heart of the environmental impact statement (40 CFR 1502.14), and include rules for presentation of the alternatives, including no action, and their estimated impacts. The Nevada Rail Corridor SEIS analyzes one alternative to the ***Proposed Action***, the ***No-Action Alternative***. Under the Nevada Rail Corridor SEIS No-Action Alternative, the U.S. Department of Energy (DOE or the Department) would not select a rail alignment within the Mina rail corridor for the construction and operation of a railroad. As such, the No-Action Alternative provides a basis for comparison to the Proposed Action. The Rail Alignment EIS analyzes one alternative to the Proposed Action – the No-Action Alternative – and two implementing alternatives under the Proposed Action – the Caliente Implementing Alternative and the Mina Implementing Alternative – for constructing, operating, and possibly abandoning a ***railroad*** for the shipment of ***spent nuclear fuel*** and ***high-level radioactive waste*** for long-term ***disposal*** in a ***geologic repository*** at Yucca Mountain. Under the No-Action Alternative, DOE would not construct the proposed railroad along the Caliente ***rail alignment*** or the Mina rail alignment.

alternative segments	Geographic region of the ***rail alignment*** for which multiple routes for the ***rail line*** have been identified. In this Rail Alignment EIS, there are different alignments identified within the Caliente ***rail corridor*** and the Mina rail corridor that could minimize or avoid environmental ***impacts*** and reduce construction complexities.
atomic mass	The mass of a neutral atom, based on a relative scale, usually expressed in atomic mass units. See ***atomic weight.***
atomic nucleus	See ***nucleus***.
atomic number	The number of ***protons*** in an atom's ***nucleus***.
atomic weight	The relative mass of an atom based on a scale in which a specific carbon atom (carbon-12) is assigned a mass value of 12. Also known as relative ***atomic mass***.
ballast	The coarse rock that is placed under the ***railroad*** tracks to support the railroad ties and improve drainage along the ***rail line***.
barrier	Any material, structure, or condition (as a thermal barrier) that prevents or substantially delays the movement of water or ***radionuclides***.
berm	A mound or wall of earth.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a radioactive transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
boiling-water reactor (BWR)	A ***nuclear reactor*** that uses boiling water to produce steam to drive a turbine.
canister	An unshielded metal container used as: (1) a pour mold in which molten vitrified ***high-level radioactive waste*** can solidify and cool; (2) the container in which DOE and electric utilities place intact ***spent nuclear fuel***, loose rods, or nonfuel components for shipping or ***storage***; or (3) in general, a container used to provide ***radionuclide confinement***. Canisters are used in combination with specialized overpacks that provide structural support, ***shielding*** or confinement for storage, transportation, and ***emplacement***. Overpacks used for transportation are usually referred to as transportation ***casks***; those used for emplacement in a ***repository*** are referred to as ***waste packages***.
cask	A heavily shielded container that meets applicable regulatory requirements used to ship ***spent nuclear fuel*** or ***high-level radioactive waste***.
common segment	Geographic region of the ***rail alignments*** for which a single route for the ***rail line*** has been identified.
confinement	As it pertains to ***radioactivity***, the retention of ***radioactive*** material within some specified bounds. Confinement differs from containment in that there is no absolute physical ***barrier*** in the former.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called decay products.
disposal (of spent nuclear fuel and high-level radioactive waste)	The ***emplacement*** in a ***repository*** of ***spent nuclear fuel***, ***high-level radioactive waste***, or other highly ***radioactive*** material with no foreseeable intent of recovery, whether or not such emplacement permits the recovery of such waste, and the ***isolation*** of such waste from the ***accessible environment***.

dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.
environment	(1) Includes water, air, and land and all plants and humans and other animals living therein, and the interrelationship existing among these. (2) The sum of all external conditions affecting the life, development, and survival of an organism.
emplacement	The placement and positioning of ***waste packages*** in the ***repository***.
environmental impact statement (EIS)	A detailed written statement that describes: "...the environmental impact of the ***proposed action***; any adverse environmental effects which cannot be avoided should the proposal be implemented; ***alternatives*** to the proposed action; the relationship between local short-term uses of man's ***environment*** and the maintenance and enhancement of long-term productivity; and any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." Preparation of an EIS requires a public process that includes public meetings, reviews, and comments, as well as agency responses to the public comments.
exposure (to radiation)	The condition of being subject to the effects of or potentially acquiring a ***dose*** of ***radiation***. The incidence of radiation on living or inanimate material by ***accident*** or intent. Background exposure is the exposure to natural ionizing radiation. Occupational exposure is the exposure to ionizing radiation that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.
fission	The splitting of a ***nucleus*** into at least two other nuclei, resulting in the release of two or three ***neutrons*** and a relatively large amount of energy.
fission products	***Radioactive*** or nonradioactive atoms produced by the ***fission*** of heavy atoms, such as uranium.
fuel assembly	A number of fuel elements held together by structural materials, used in a ***nuclear reactor***; sometimes called a fuel bundle.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
geologic repository	A system for the ***disposal*** of ***radioactive*** waste in excavated geologic media, including surface and subsurface areas of operation, and the adjacent part of the geologic setting that provides ***isolation*** of the radioactive waste in a controlled area.
high-level radioactive waste	(1) The highly ***radioactive*** material that resulted from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing, and any solid material derived from such liquid waste that contains ***fission products*** in sufficient concentrations.
impact	For an EIS, the positive or negative effect of an action (past, present, or future) on the natural ***environment*** (land use, ***air quality***, water resources, geological resources, ecological resources, aesthetic and scenic resources) and the human environment (***infrastructure***, economics, social, and cultural).

infrastructure	Basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communication systems.
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
isolation	Inhibiting the transport of ***radioactive*** material so that the amounts and concentrations of this material entering the ***accessible environment*** stay within prescribed limits.
neutron	An atomic particle with no charge and an ***atomic mass*** of 1; a component of all atoms except hydrogen; frequently released as ***radiation***.
No-Action Alternative	Under the No-Action Alternative in the Nevada Rail Corridor SEIS, DOE would not construct and operate a railroad within the Mina rail corridor from Wabuska to Yucca Mountain. Under the No-Action Alternative the Rail Alignment ***EIS***, DOE would not implement the ***Proposed Action*** in the Caliente rail corridor or the Mina rail corridor.
nonpoint source pollution	Pollution does not come from a single source but from many unidentifiable sources. An example of nonpoint source pollution would be urban runoff of items like oil, fertilizers, and lawn chemicals. As rainfall or snowmelt moves over and through the ground, it picks up and carries away natural and human-made pollutants. These pollutants are eventually deposited into natural bodies of water, such as lakes, rivers, wetlands, coastal waters, and underground sources of drinking water.
nuclear reactor	A device in which a nuclear fission chain reaction can be initiated, sustained, and controlled to generate heat or to produce useful ***radiation***.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
pressurized-water reactor (PWR)	A nuclear power ***reactor*** that uses water under pressure as a coolant. The water boiled to generate steam is in a separate system.
Proposed Action	The activity proposed to accomplish a federal agency's purpose and need. An EIS analyzes the environmental ***impacts*** of a proposed action, which includes the project and its related support activities. The Proposed Action in the Nevada Rail Corridor SEIS, is to construct and operate a railroad to connect the Yucca Mountain repository to an existing rail line near Wabuska, Nevada (the Mina rail corridor). The Proposed Action in the Rail Alignment EIS, is to determine an alignment (within a corridor) and construct and operate a railroad in Nevada to transport spent nuclear fuel, high-level radioactive waste, and other Yucca Mountain project materials to a repository at Yucca Mountain.
proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all atomic nuclei.

radiation	Energy traveling through space. Radiation can be non-ionizing, like radio waves, ultraviolet radiation, or visible light, or ionizing, depending on its effect on atomic matter. As used in this Rail Alignment EIS "radiation" refers to ***ionizing radiation***. Ionizing radiation has enough energy to ionize atoms or molecules while non-ionizing radiation does not. Radioactive material is a physical material that emits ionizing radiation.
radioactive	Emitting ***radioactivity***.
radioactivity	(1) The spontaneous transformation of unstable atomic nuclei, usually accompanied by the emission of ionizing ***radiation*** (e.g., such as ***alpha***, ***beta***, or ***gamma rays***). (2) The property of unstable nuclei in certain atoms (of elements such as uranium) to spontaneously emit ionizing radiation during nuclear transformations.
radionuclide	See ***nuclide***.
rail alignment	An engineered refinement of a ***rail corridor*** in which DOE would identify the location of a rail line. A rail alignment is comprised of ***common segments*** and ***alternative segments***.
rail corridor	As used in this Rail Alignment EIS, a strip of land, 400 meters (0.25 mile) wide through which DOE would identify an alignment (***rail alignment***) for the construction of a ***rail line*** in Nevada to a ***geologic repository*** at Yucca Mountain.
rail line	An engineered feature incorporating the track, ties, ***ballast***, and ***subballast*** at a specific location.
railroad	A transportation system incorporating the rail line, operations support facilities, railcars, locomotives, and other related property and infrastructure.
reactor	See ***nuclear reactor***.
repository	See ***geologic repository***.
riprap	Broken rocks or chunks of concrete used as foundation material or to protect embankments and gullies to control water flow or prevent erosion.
roadbed	The earthwork foundation upon which the track, ties, ***ballast***, and ***subballast*** of a ***rail line*** are lain.
Shared-Use Option	An option under the ***Proposed Action***. DOE would allow commercial and other shippers to use the ***rail line*** for general freight shipments. General freight would include stone and other nonmetallic minerals, petrochemicals, waste materials (nonradioactive), or other commodities that private companies would ship or receive.
shielding	Any material that provides ***radiation*** protection.
spent nuclear fuel	Fuel that has been withdrawn from a ***nuclear reactor*** following ***irradiation***, the component elements of which have not been separated by reprocessing. For this project, this refers to (1) intact, nondefective ***fuel assemblies***, (2) failed fuel assemblies in ***canisters***, (3) fuel assemblies in canisters, (4) consolidated fuel rods in canisters, (5) nonfuel assembly hardware inserted in ***pressurized-water reactor*** fuel assemblies, (6) fuel channels attached to ***boiling-water reactor*** fuel assemblies, and (7) nonfuel assembly hardware and structural parts of assemblies resulting from consolidation in canisters.
storage	The collection and containment of waste or ***spent nuclear fuel*** in a way that does not constitute ***disposal*** of the waste or spent nuclear fuel for the purposes of awaiting treatment or disposal capacity.

subballast	A layer of crushed gravel that is used to separate the ***ballast*** and ***roadbed*** for the purpose of load distribution and drainage.
subgrade elevation	The elevation of the top of the ***subballast*** in the ***rail line***.
waste packages	Two thick metal cylinders, one nested within the other. The inner cylinder would be made of stainless steel to provide structural strength. The outer cylinder would be made of a nickel alloy that is highly resistant to corrosion.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.

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APPENDIX G

METHODOLOGY FOR ASSESSING IMPACTS TO GROUNDWATER

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ACRONYMS AND ABBREVIATIONS

DIRS	Document Input Reference System
DTN	Data Tracking Number
DOE	U.S. Department of Energy
DEIS	Draft Environmental Impact Statement
GIS	Geographic Information System
GNIS	Geographic Names Information System
NDWR	Nevada Division of Water Resources
NWIS	National Water Information System
USGS	U.S. Geological Survey

APPENDIX G

METHODOLOGY FOR ASSESSING IMPACTS TO GROUNDWATER

This appendix provides detailed information on the methods DOE used to assess potential impacts to groundwater provided in Sections 4.2.6 and 4.3.6 of the Rail Alignment EIS (DOE/EIS-0369).

Section G.3 defines terms shown in ***bold italics***.

This appendix describes:

- The general approach and assumptions the U.S. Department of Energy (DOE or the Department) used to identify existing groundwater resources and to assess potential impacts to those groundwater resources from the proposed groundwater withdrawal for construction and operation of the proposed rail line
- The methodology for determining the impact to the aquifer (at an existing groundwater resource feature) due to pumping at a specific well location or the location of a group of wells
- The aquifer types considered and the corresponding calculations employed for the proposed well locations where an assessment was performed

Section G.1 describes the methods DOE used to assess impacts to groundwater from railroad construction along either the Caliente rail alignment or the Mina rail alignment; Section G.1.3 describes the methods for determining potential impacts from railroad operations along either alignment. DOE used the same methods to assess potential impacts to groundwater resources under the Shared-Use Option for each alignment as described in Section G.2.

DOE performed calculations to quantitatively evaluate potential impacts to existing water wells and springs from withdrawing groundwater from proposed new wells that would support construction and operation of the proposed rail line. DOE has proposed many locations along the Caliente and Mina rail alignments for water wells. Each set of calculations evaluates impacts on the host aquifer from pumping of these wells. DOE has categorized wells into construction wells (Section G.1.2), which would be temporary, and operations wells (Section G.1.3), which would be permanent. DOE further categorized construction wells into: (1) construction water wells which would provide water during construction of the rail roadbed and to support water needs at construction camps (Section G.1.2.2), and to support water needs associated with construction of rail facilities (Section G.1.2.3); and (2) quarry wells (Section G.1.2.5), which would provide water to specific quarry sites. The evaluation of construction impacts includes a sensitivity analysis for locations along the Caliente rail alignment (Section G.1.2.4), which DOE conducted to identify favorable locations where increased productivity rates would not impact existing groundwater uses.

G.1 Construction Impacts Assessment

G.1.1 OVERVIEW OF GROUNDWATER ASSESSMENT METHODOLOGY AND ASSUMPTIONS

For assessing potential impacts to groundwater resources, DOE assumed the total duration of the construction phase would be 4 years, the shortest construction period being considered. Actual construction would occur during about the first 3 years, with the final year allocated to installation and testing of signal and communications equipment, and putting the rail line into service. DOE assumed this 4-year construction duration because it would require higher or the same groundwater withdrawal rates from the new proposed water wells than if a longer duration were assumed. This analysis approach is conservative and any impacts identified would include impacts under a longer (up to 10 years) construction duration.

DOE assumed that all of the water required for the Proposed Action would be obtained from the proposed new water wells. DOE also assumed that all of the groundwater required for rail roadbed construction activities within each hydrographic area that the Caliente rail alignment or Mina rail alignment would cross would be acquired within a 9-month period (DIRS 176189-Converse Consultants 2006, Section 2.1; DIRS 180888-Converse Consultants 2007, Section 2.1).

The construction impacts assessment involved calculating the approximate ***radius of influence*** of the ***cone of depression*** surrounding each proposed new water-supply well located in an area with existing wells or any known springs that could potentially be impacted. Section G.1.2.1 provides details regarding the approach that was used for identifying existing wells and known springs that could be located within the radius of influence of the cone of depression surrounding each proposed new water-supply well. The cone of depression generated by pumping groundwater from a well increases (approximately radially) in relation to its areal extent, and the magnitude of the drawdowns contained within it increase during the initial, transient period of operation. As the system approaches steady state, both the size of the cone of depression and the magnitude of drawdowns would be expected to expand to reach maximum (equilibrium) values within the specified pumping time frame (in this case, 9 months), unless there were barriers to flow that could affect the generally radial flow behavior surrounding a pumping well and these barriers were located within the radius of influence of that pumping well. The maximum impact of a well on the aquifer is achieved once steady-state conditions have developed. Therefore, DOE performed the impact evaluations using steady-state well formulae so that the likely maximum impacts could be assessed.

Vertical flow can also occur between aquifers. If a well is ***screened*** in a ***leaky aquifer***, part of the flow is derived from the horizontal flow in that aquifer, and part from the vertical flow from underlying or overlying aquifers, located below or above the aquifer in question. DOE neglected this phenomenon in the impact analyses because additional flow originating from other aquifers would decrease the calculated drawdown in the aquifer of interest. Therefore, DOE has conservatively estimated the impact of the well on the water-bearing zone.

DOE determined and evaluated a range of potential aquifer conditions. At several locations, DOE completed more than one calculation of the radius of influence to reflect different potential aquifer conditions (confined aquifer versus unconfined aquifer; alluvial aquifer versus fractured volcanic rock aquifer, etc.; see Section G.1.2.2) that might occur at the pumping location.

If a calculated radius of influence equaled or exceeded the distance separating the proposed well location and an existing well or spring, then DOE assumed there would be a hydrogeologic impact on that existing well or spring. The *Hydrogeologic DEIS Analysis Report, REV. 0, April 10, 2006* (DIRS 176189-

Converse Consultants 2006, all) describes the locations and characteristics of wells proposed for supplying water needed for rail roadbed earthwork compaction along the Caliente rail alignment. The *Hydrogeologic DEIS Analysis Report, REV. 0, April 27, 2007* (DIRS 180888-Converse Consultants 2007, all) describes the locations and characteristics of wells proposed for supplying water needed for rail roadbed earthwork compaction along the Mina rail alignment.

G.1.2 CONSTRUCTION WATER-SUPPLY WELLS

DOE performed calculations to evaluate the potential impacts of groundwater withdrawals from individual wells or groups of wells on nearby existing wells and springs. DOE varied the analytical methods used for the impacts analyses at the various locations to reflect the different aquifer conditions inferred to be present at each pumping site. The impacts analyses consisted of:

- Identifying the average and peak withdrawal rates of each proposed well or group of wells
- Identifying potential hydrogeologic conditions that could be present at each location and evaluating an appropriate calculation methodology for each potential condition
- Calculating the extent and magnitude of drawdowns that would be generated by the proposed well or an equivalent single well for a well cluster pumping at the specified average withdrawal rate (under the range of potential hydrogeologic conditions postulated)
- Identifying the location and characteristics of existing water wells and springs that might be impacted by the drawdown generated by the proposed groundwater withdrawals
- Estimating the potential reduction in well capacity or spring discharge, if any, that could occur as a result of the proposed groundwater withdrawals

G.1.2.1 Hydrogeologic Impacts Analysis Approach

DOE used the following approach to evaluate potential impacts on existing wells and springs from the proposed groundwater withdrawals from new water wells:

- Review the specified data regarding the proposed well locations, well construction details, estimated groundwater depths, and proposed groundwater withdrawal rates and timeframes. The references containing these data for the Caliente rail alignment include DIRS 176189-Converse Consultants 2006, all; DIRS 176168-Nevada Rail Partners 2006, Section 3.1.5; DIRS 180922-Nevada Rail Partners 2007, Section 3.1.5; DIRS 176172-Nevada Rail Partners 2006, Section 4.4; DIRS 180875-Nevada Rail Partners 2007, Section 4.4; and DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5. The references containing these data for the Mina rail alignment include DIRS 180888-Converse Consultants 2007, all; DIRS 180873-Nevada Rail Partners 2007, Section 2.1.5; and DIRS 180875-Nevada Rail Partners 2007, Section 4.4.
- Identify all the existing wells and springs in proximity to the proposed pumping well locations and their characteristics, use category, and permit status using report information (such as DIRS 176600-Converse Consultants 2005, all; DIRS 180887-Converse Consultants 2007, all) and information from on-line sources, including the Nevada Division of Water Resources (NDWR) water-rights and well-log databases, the U.S. Department of the Interior, U.S. Geological Survey (USGS), and National Water Information System (NWIS) (DIRS 176325-USGS 2006, all). DOE used the following Geographic Information System (GIS) datasets in the analyses:
  - GNIS-Nevada Springs. Data Tracking Number (DTN) MO0605GOISGNISN.000 (DIRS 176979)
  - USGS Existing Wells Location Information for the State of Nevada. DTN MO0607USGSWNVD.000 (DIRS 177294)

- Nevada Division of Water Resources Well Data. DTN MO0607NDWRWELD.000 (DIRS 177292)
- Two New Existing Wells within Dry Lake Valley. DTN MO0607PWMAR06D.000 (DIRS 177293)
- National Hydrological Dataset Point Information for the State of Nevada 2006. DTN MO0607NHDPOINT.000 (DIRS 177712)
- National Hydrological Dataset Waterbody Information for the State of Nevada 2006. DTN MO0607NHDWBDYD.000 (DIRS 177710)
- Converse Consultants 2007 (DIRS 182759)
- NDWR (DIRS 182898)
- NDWR (DIRS 182899)

The (location) coordinates assumed for most of these existing wells are based on the center of the 40-acre Quarter Quarter Section description provided on well logs that were submitted to the NDWR. Therefore, these wells could actually be anywhere within each described 40-acre Quarter Quarter Section of land.

- For initial screening purposes, if DOE identified an existing well or a spring within a 1.6-kilometer (1-mile) radius (buffer distance) of a proposed new water well, DOE selected that proposed well location as a candidate for conducting a groundwater hydrogeologic impacts evaluation. If DOE found no spring or existing well within this initial search radius, it extended the search distance outward from the proposed well location to identify the nearest spring or existing well and determined its hydrogeologic and construction characteristics (for the existing wells). If the nearest existing well or spring was farther away than the initial search distance of 1.6 kilometers, an impacts analysis was still performed if one was deemed appropriate for that location, provided the nearest existing well was found to be within a distance of 2.4 kilometers (1.5 miles) of the proposed pumping well location. The analysis was done taking into account the withdrawal rate at the proposed new well location and the annual duty for the nearest existing well if it had a formal appropriated water right. DOE searched the NDWR water-rights database and well-log databases to confirm the identity, use, water-rights status, if any, and appropriated annual duty and diversion rate, if applicable, associated with each existing well (or spring) within the final searched buffer distance.
- Existing wells and known springs were deemed significant, even if there was not an active water right associated with the well (provided that the well has a use that is listed as being other than the uses listed immediately below) or the spring. In addition to possibly being a source of water for human use, springs provide a water source for wildlife and form unique habitats within the desert ecosystem.
- DOE did not analyze impacts on existing wells that were found to have no productive use based on use category or status (that is, were confirmed to be groundwater exploration or test wells, thermal gradient test wells, or were dry). For example, DOE excluded from the list of wells of potential concern several existing wells cataloged in the USGS NWIS database that were confirmed to be either monitoring wells, thermal gradient or oil and gas testing wells, or hydrogeologic investigation wells and that have no associated productive (beneficial) use other than their potential future use as monitoring wells.
- DOE included wells with a designation of Domestic. The State of Nevada does not require a water-rights application or permit (formal appropriation) to drill a well for domestic purposes. However, DOE considered domestic wells in the impacts analyses.
- DOE reviewed available geologic and hydrogeologic information for known and potential aquifers in areas where existing wells or springs near proposed new pumping wells indicated that a quantitative analysis of hydrogeologic impacts was warranted. Information and data reviewed included well-log data (total well depth, lithologic units, depth to groundwater, pumping-test data, appropriated duty

balance, and diversion rate data, if applicable) for existing wells near proposed new well locations, published geologic and hydrogeologic reports, and groundwater resource appraisal reports. DOE used this information to identify appropriate analytical methods for quantitatively evaluating the drawdown effects from the proposed groundwater withdrawals on the aquifer in which the wells would be installed. The following references containing available geologic and hydrogeologic information for the study area were reviewed:

Caliente Rail Alignment

- DIRS 177524-Anning and Konieczki 2005
- DIRS 173179-Belcher 2004
- DIRS 176851-Brothers, Bugo, and Tracy 1993
- DIRS 176883-Brothers, Katzer, and Johnson 1996
- DIRS 176852-Drici, Garey, and Bugo 1993
- DIRS 116801-Driscoll 1986
- DIRS 176818-Eakin 1962
- DIRS 181909-Fridrich et al. 2007, all
- DIRS 129721-Geldon et al. 1998
- DIRS 106094-Harrill, Gates, and Thomas 1988
- DIRS 180775-Lopes et al. 2006
- DIRS 106695-Malmberg and Eakin 1962
- DIRS 103136-Prudic, Harrill, and Burbey 1993
- DIRS 169384-Reiner et al. 2002
- DIRS 176519-Rowley and Shroba 1991
- DIRS 176947-Rowley et al. 1994
- DIRS 176502-Rush 1964
- DIRS 176849-Rush 1968
- DIRS 176950-Rush and Everett 1966
- DIRS 174643-Seaber, Kapinos, and Knapp 1994
- DIRS 173842-Shannon & Wilson 2005
- DIRS 175986-Shannon & Wilson 2005
- DIRS 150228-Slate et al. 2000
- DIRS 176488-State of Nevada 2006
- DIRS 147766-Thiel Engineering Consultants 1999
- DIRS 172905-USGS 1995
- DIRS 176325-USGS 2006
- DIRS 176848-Van Denburgh and Rush 1974

Mina Rail Alignment

- DIRS 180760-Albers and Stewart 1981
- DIRS 177524-Anning and Konieczki 2005
- DIRS 173179-Belcher 2004

- DIRS 181394-Everett and Rush 1967
- DIRS 181909-Fridrich et al. 2007, all
- DIRS 129721-Geldon et al. 1998
- DIRS 106094-Harrill, Gates and Thomas 1988
- DIRS 180697-Huxel and Harris 1969
- DIRS 180775-Lopes et al. 2006
- DIRS 106695-Malmberg and Eakin 1962
- DIRS 180777-Mauer et al. 2004
- DIRS 103136-Prudic, Harrill, and Burbey 1993
- DIRS 169384-Reiner et al. 2002
- DIRS 176849-Rush 1968
- DIRS 180754-Rush et al. 1971
- DIRS 174643-Seaber, Kapinos, and Knapp 1994
- DIRS 173842-Shannon & Wilson 2005
- DIRS 175986-Shannon & Wilson 2005
- DIRS 180881-Shannon & Wilson 2007
- DIRS 150228-Slate et al. 2000
- DIRS 176488-State of Nevada 2006
- DIRS 180975-Stewart, Carlson, and Johannessen 1982
- DIRS 181896-Stoller-Navarro 2005
- DIRS 147766-Thiel Engineering Consultants 1999
- DIRS 172905-USGS 1995
- DIRS 176325-USGS 2006
- DIRS 180759-Van Denburgh and Glancy 1970

- DOE completed quantitative analyses to calculate the estimated lateral extent of the drawdown cone of depression that would be induced in the aquifer surrounding each proposed new water-well location (or well cluster) during pumping at the water-well location(s) at the prescribed withdrawal rate. DOE performed quantitative analyses using one or more sets of analytical equations to correspond to one or more sets of assumptions. The analyses were designed to cover the range of possible aquifer conditions that might be encountered at the proposed well locations. For those proposed new well locations that were evaluated due to the presence of a nearby existing well with a water right, results of these analyses were combined with an analysis undertaken to quantitatively evaluate the radius of influence that might be induced by pumping at that existing well. DOE compared the results of the radius-of-influence calculations for both the proposed new location and the existing well to determine whether the drawdown cones of depression from the two well locations could contact each other. Analytical results demonstrated that such conditions (that is, that the radii of influence would intersect each other, based on the assumptions made for analysis) would occur only in a few cases. These cases of likely impact to existing groundwater were a result of high average groundwater withdrawal rates prescribed at a proposed new well location (see the sensitivity analysis cases described in Section G.1.2.4), unfavorable hydrogeologic conditions in the area, the proximity of the nearest existing well to the proposed well location, or a very large appropriated annual duty for the existing well. Sections G.1.2.2 and G.1.2.4 provide details regarding the calculation methods and assumptions.

Tables G-1 and G-2 list proposed new well locations for the Caliente and Mina rail alignments for which DOE performed hydrogeologic impacts analyses.

Table G-1. Proposed new well locations pumped at specified average (base-case) groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Caliente rail alignment (page 1 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
ClV1	204	Clover Valley	Eccles/common segment 1
ClV2	204	Clover Valley	Eccles/common segment 1
PanV1	203	Panaca Valley	Eccles/common segment 1
PanV4	203	Panaca Valley	Eccles/common segment 1
PanV23	203	Panaca Valley	Eccles/common segment 1
PanV2/PanV24	203	Panaca Valley	Eccles/common segment 1
PanV6/PanV3	203	Panaca Valley	Eccles/common segment 1
PanV25/PanV26	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV7/PanV8	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV9/PanV10/PanV11/PanV12	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV13/PanV15	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
DLV3	181	Dry Lake Valley	Common segment 1
DLV4	181	Dry Lake Valley	Common segment 1
PahV1/PahV2/PahV3	208	Pahroc Valley	Common segment 1
PahV7/PahV8/PahV9	208	Pahroc Valley	Common segment 1
GV2	172	Garden Valley	Garden Valley 2
GV10	172	Garden Valley	Garden Valley 1
RrV5	173A	Railroad Valley South	Comment segment 2/South Reveille 3/common segment 3
RrV6/RrV11	173A	Railroad Valley South	Common segment 2/South Reveille 2/common segment 3 Common segment 2/South Reveille 3/common segment 3
RrV8	173A	Railroad Valley South	Common segment 2/South Reveille 3/common segment 3
HC4	156	Hot Creek Valley	Common segment 3
HC5/HC7	156	Hot Creek Valley	Common segment 3
SCV3	149	Stone Cabin Valley	Common segment 3
ASV6	142	Alkali Spring Valley	Goldfield 4
SaF1/SaF2	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF4	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5

Table G-1. Proposed new well locations pumped at specified average (base-case) groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Caliente rail alignment (page 2 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
SaF5/SaF9	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5 Bonnie Claire 2/common segment 5
SaF7/SaF11	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5 Bonnie Claire 2/common segment 5
OV9	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV24/OV25/OV26	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV12/OV18/OV19/OV20/OV21	228	Oasis Valley	Common segment 5/Oasis Valley 3/common segment 6
OV3/OV4/OV5/OV13	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6 Common segment 5/Oasis Valley 3/common segment 6
OV14/OV16/OV6/OV8	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6

Table G-2. Proposed new well locations pumped at the maximum groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Mina rail alignment (page 1 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
WLA-3a	110A	Walker Lake Valley	Department of Defense Branchline North/Schurz alternative segment 1/Department of Defense Branchline South
WLc-2a	110C	Walker Lake Valley	Department of Defense Branchline South/Mina common segment 1
CSM-2a	118	Columbus Salt Marsh	Mina common segment 1
CSM-3a	118	Columbus Salt Marsh	Mina common segment 1
SSa-2	121A	Soda Springs Valley East	Mina common segment 1
SSa-3	121A	Soda Springs Valley East	Mina common segment 1
SSa-4	121A	Soda Springs Valley East	Mina common segment 1
SSb-2	121B	Soda Springs Valley West	Mina common segment 1
BSa-1a	137A	Big Smoky Valley – Tonopah Flat	Mina common segment 1/Montezuma alternative segment 1; Mina common segment 1/Montezuma alternative segment 2
BSa-2a	137A	Big Smoky Valley – Tonopah Flat	Mina common segment 1/Montezuma alternative segment 2
BSa-3a	137A	Big Smoky Valley – Tonopah Flat	Mina common segment 1/Montezuma alternative segment 2
AS-1b	142	Alkali Spring Valley	Montezuma alternative segment 2

Table G-2. Proposed new well locations pumped at the maximum groundwater withdrawal rates for which DOE performed groundwater impacts analyses – Mina rail alignment (page 2 of 2).

Proposed new well	Hydrographic area number	Hydrographic area name	Alternative segment/common segment
AS-2b	142	Alkali Spring Valley	Montezuma alternative segment 2
ASV6	142	Alkali Spring Valley	Montezuma alternative segment 2
Cl-1a	143	Clayton Valley	Montezuma alternative segment 1
Cl-8a	143	Clayton Valley	Montezuma alternative segment 1
Cl-9a	143	Clayton Valley	Montezuma alternative segment 1
Li-3a	144	Lida Valley	Montezuma alternative segment 1
SaF4	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF5/SaF9	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
SaF7/SaF11	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
OV24/OV25/OV26	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV12/OV18/OV19/OV20/OV21	228	Oasis Valley	Common segment 5/Oasis Valley 3/common segment 6
OV3/OV4/OV5/OV13	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6, common segment 5/Oasis Valley 3, common segment 6
OV9	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV14/OV16/OV6/OV8	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6

G.1.2.2 Hydrogeologic Impacts Calculation Methods

DOE performed calculations using one or more sets of analytical equations reflecting one or more sets of assumptions made regarding the hydrogeologic conditions present at the analysis location. These calculations were designed to cover the range of possible aquifer conditions that might be encountered at the proposed new well locations. Applicable aquifer conditions varied according to well location, proposed well depth, and the available geologic and hydrogeologic information for each area. Types of aquifers considered for the various proposed locations included alluvial valley-fill aquifers, alluvial valley-fill aquifers with transecting faults, and faulted and/or fractured consolidated rock aquifers. Types of aquifer conditions assumed to exist at the various well locations for either the Caliente or the Mina rail alignment included:

- Infinite-extent unconfined aquifer
- Infinite-extent confined aquifer
- Semi-infinite-extent unconfined aquifer
- Semi-infinite-extent confined aquifer
- Carbonate and volcanic rock aquifers
- Limited-extent unconfined aquifer

A particular pumping well location could have calculations for more than one type of aquifer condition depending on the assumptions made due to varying geologic information from different reports. For these locations with more than one potential type of aquifer condition, the results from the calculations for the different types of aquifer conditions served to identify the range and extent of possible impacts to the aquifer as a result of pumping groundwater. Sections G.1.2.2.1 through G.1.2.2.6 describe the analytical methods DOE utilized.

Hydrogeologic impacts analysis calculations were generally performed for those proposed construction wells that are intended to supply water for rail roadbed construction; development and operation of construction camps; and development and operation of potential quarries. Water consumption rates during the period of use of construction camps during the peak output year have been estimated at approximately 76 liters (20 gallons) per minute, which is equivalent to approximately 110,000 liters (28,800 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-4*)*. Methodologies and approaches used for evaluating impacts from wells intended to support the first two of these activities are provided in Sections G.1.2.2.1 through G.1.2.2.6 and Section G.1.2.4. Section G.1.2.3 provides a discussion of the approach used for evaluating potential impacts from groundwater withdrawals for wells used to support construction of rail facilities. Section G.1.2.5 provides a discussion of the approach used for evaluating potential impacts from groundwater withdrawals for wells used to support development and operation of proposed quarries.

G.1.2.2.1 Infinite-Extent Unconfined Aquifer

For the case of an unconfined aquifer, the governing equation describing the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer is (DIRS 105038-Bear 1979, eq. 8-24):

$$H_0^{\,2} - h^2 = \frac{Q_w}{\pi K}\ln\left(\frac{R}{r}\right)$$

The terms are:

H_0 undisturbed saturated thickness, [Distance or Length (L)],

h saturated thickness at distance “r” from the well, [L],

K hydraulic conductivity, [Length/Time (L/T)], where T is time

Q_w withdrawal rate, [Volume (L^3)/T],

R radius of influence of the well, [L], and

r radial distance from the well, [L].

The saturated thickness (h) at distance “r” from the well, or h(r), is calculated as follows (DIRS 105038-Bear 1979, eq. 8-4 and Figure 8-4):

$$h(r) = \sqrt{H_0^{\,2} - \frac{Q_w}{\pi K}\ln\left(\frac{R}{r}\right)}$$

The drawdown “s” at distance “r” from the well (DIRS 105038-Bear 1979, Figure 8-4), or s(r), is calculated using the expression for h(r),

$$s(r) = H_0 - h(r) = H_0 - \sqrt{H_0^{\,2} - \frac{Q_w}{\pi K}\ln\left(\frac{R}{r}\right)}$$

When the hydraulic head at the face of the well is set to a given value ($h(r{=}r_w) = h_w$), the well capacity is obtained from the following relationship (DIRS 105038-Bear 1979, eq. 8-23):

$$H_0^{\,2} - h_w^{\,2} = \frac{Q_w}{\pi K}\ln\left(\frac{R}{r_w}\right) \qquad \text{or} \qquad Q_w = \frac{\pi K (H_0^{\,2} - h_w^{\,2})}{\ln\left(\frac{R}{r_w}\right)}$$

The drawdown "s_w" at the face of a well is a factor in both the capacity of the well and the extent of the well's radius of influence. This drawdown is generally not equal to the drawdown observed within the casing of the pumping well because of various head losses that take place near the well and within the well screened interval (perforated interval in well casing) and the sand pack (interval in the well bore annular space backfilled with sand). The magnitude of these losses depends mostly on the quality of well construction and characteristics of the water in the aquifer, and is difficult to estimate beforehand. Examples discussed in the literature (such as DIRS 116801-Driscoll, 1986, pp. 554 to 569) discuss aggregate well and head losses for typical wells resulting in effective well efficiencies from on the order of 50 to 85 percent. DOE assumed (conservatively) for these calculations that the useful drawdown, that is, the drawdown at the face of the well, would be equal to 85 percent of the maximum drawdown that could occur within the well casing. This assumption is based on engineering judgment. For an unconfined aquifer, the theoretical maximum drawdown within a well is equal to the undisturbed saturated thickness minus the length of the well screen ($s_{max} = H_0 - L$), assuming that the bottom of the screen is located at the bottom of the aquifer and that the screen is not exposed during well operation (these are typical practices when a well is screened in an unconfined aquifer). It is also assumed that the screen is long enough to accommodate the pump. The maximum useful drawdown (at the well face) is then:

$$s_w = 0.85\ (H_0 - L)$$

The radius of influence is defined as the distance from the well where the drawdown becomes insignificant and can be neglected. For wells deriving most of their groundwater flow from water from recharge in the area immediately surrounding the well, this radius of influence can be estimated based on mass balance considerations. However, this scenario is likely not applicable in much of the study area, where ***evapotranspiration*** rates generally exceed precipitation rates and/or recharge rates to aquifers are very low (in lower-elevation valley bottom areas) (DIRS 176502-Rush 1964, Table 10; DIRS 103136-Prudic, Harrill, and Burbey 1993, p. 2; DIRS 180759-Van Denburgh and Glancy 1970, p. 17 and Table 6; DIRS 169384-Reiner et al. 2002, Table 5). For wells assumed to derive most of their flow from the horizontal movement of water within the aquifer, as is typically the case in this analysis, empirical formulae were developed to estimate the radius of influence. Two such formulae are presented (DIRS 105038-Bear 1979, eqns. 8-11 and 8-12); note that units are meters and seconds and that s_w is the drawdown at the face of withdrawal well ($s_w = H_0 - h_w$):

$$R = 3{,}000\ s_w\ K^{1/2} \qquad \text{and} \qquad R = 575\ s_w\ (H_0\ K)^{1/2}$$

DOE used the second of these two formulae in this analysis, because it is expressed in terms of aquifer transmissivity "H_0 K" and can be directly applied to cases involving both confined and unconfined aquifers. The first formula uses the hydraulic conductivity, which in the case of a confined aquifer, would have to be calculated by assuming a given thickness of the permeable zone, which may be unknown.

An example of a proposed water-supply area where DOE assumed an infinite-extent, unconfined alluvial aquifer case is well location SCV3 in the Stone Cabin Valley hydrographic area along proposed Caliente common segment 3. The SCV3 location lies in an area underlain by alluvial valley fill. The nearest mapped rock units are at least several miles from the proposed well site; therefore, an infinite-extent, alluvial aquifer is assumed.

Another example of a proposed water-supply well location where DOE assumed an infinite-extent unconfined aquifer is the proposed well location Cl-1A southwest of the community of Silver Peak in hydrographic area 143 (Clayton Valley) along the Mina rail alignment. This well location would be southwest of an existing well field that services Silver Peak. This well location and the corresponding analysis is a special case in that the proposed withdrawal rate at the Cl-1A well location is approximately 1,300 liters (350 gallons) per minute (gpm) or less. This withdrawal rate is higher than the anticipated withdrawal rate for other proposed new water-supply wells along the Mina rail alignment because groundwater underlying much of Clayton Valley is extremely brackish (DIRS 180760-Albers and Stewart 1972, p. 2) as a result of an existing mineral processing operation in the valley. Therefore, locations that could serve as sources of better-quality groundwater for use in rail roadbed construction and for supplying water for a proposed construction camp in this vicinity are very limited in this area.

G.1.2.2.2 Infinite-Extent Confined Aquifer

If the producing zone in the host aquifer occurs below a relatively thick, impermeable layer, such as a layer of clay, then the system could behave as a confined aquifer. For a confined aquifer, the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer can be written as follows (DIRS 105038-Bear 1979, eq. 8-6):

$$s = \frac{Q_w}{2\pi T} \ln\left(\frac{R}{r}\right)$$

where the terms are:

T transmissivity T = H_0 K (undisturbed saturated thickness times the hydraulic conductivity) [L^2/T; where T is time].

s drawdown, [L],

Q_w withdrawal rate, [L^3/T],

R radius of influence of the well, [L], and

r radial distance from the well, [L].

For drawdown at the well face, the expression for well capacity becomes (DIRS 105038-Bear 1979, eq. 8-4):

$$Q_w = \frac{s_w 2\pi T}{\ln\left(\frac{R}{r_w}\right)}$$, where T is transmissivity

The formula for the radius of influence used in these calculations for a confined aquifer is the same as that used for the unconfined case. As for the case of an unconfined aquifer, DOE assumed for these calculations that the useful drawdown (that is, the drawdown at the face of the well) would be equal to 85 percent of the maximum drawdown that could occur within the well casing. In the confined case, the theoretical maximum drawdown within the well is the distance between the static hydraulic head to the top of the permeable zone ($s_{max} = \varphi_0 - EL_{top}$). The maximum useful drawdown is then:

$$s_w = 0.85\ (\varphi_0 - EL_{top})$$

An example of a proposed water supply area where DOE assumed an infinite-extent confined alluvial aquifer case consists of the proposed set of new well locations HC5 and HC7 in the Hot Creek Valley hydrographic area along the Caliente rail alignment. The proposed well locations are considered infinite-extent confined because location HC5/HC7 is described as being mapped on alluvial valley-fill materials, the estimated total depth of the wells is 150 meters (500 feet), and it was considered possible that a relatively impermeable geologic layer, such as a clay unit, might be present above the targeted aquifer, which could lead to confined conditions.

G.1.2.2.3 Semi-Infinite-Extent Unconfined Aquifer

DOE assumed a semi-infinite-extent confined alluvial aquifer case for some proposed well locations where a single (linear) geologic boundary exists adjacent to the proposed well location(s) and assumed that this boundary might act as a no-groundwater-flow feature (flow barrier) that could affect groundwater flow characteristics in the aquifer surrounding the pumping well location(s). Geologic boundaries considered as representing potential no-flow boundaries include faults offsetting a geologic unit of likely low permeability (low hydraulic conductivity) from a geologic unit of likely higher permeability (higher hydraulic conductivity) or an unfaulted geologic contact between two such different geologic units. For these cases, the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer can be calculated using the same formulae as for the infinite-extent unconfined aquifer described in Section G.1.2.2.1. However, in these cases, to account for this assumed adjacent no-flow boundary, the system is modeled by increasing the withdrawal rate in the pumping well by a factor of two to simulate the adjacent boundary. The “method of images” is used in this case to account for the possible no-flow boundary adjacent to the proposed well (DIRS 105038-Bear 1979, p. 356).

To simulate a no-flow boundary, an image pumping well is placed opposite the real pumping well on the other side of the boundary. The system simulating the pumping well and the boundary therefore consists of the real well and an image well, both equal in strength. Strictly speaking, a semi-infinite aquifer has two boundaries, and the far boundary should be treated in the same way. However, in most cases, this far boundary would be a great enough distance from the proposed well (in other words, the far boundary would lie beyond the radius of influence for the proposed pumping well) that the effects of this far boundary on the proposed pumping well would be negligible and can be ignored. Because the proposed well location is adjacent to one boundary and far enough away from the other boundary, a semi-infinite aquifer is considered. One can assume that in relation to the adjacent boundary, the proposed well is close enough to this no-flow boundary that the distance between it and its reflection (image well) across that boundary is negligible. Recall that the image well is equal in strength to the real well. Therefore, the system can be approximated by keeping only the real pumping well and increasing its extraction rate by a factor of two, which is the same as placing the image well right at the same location of the real well.

To solve for the radius of influence, the infinite-extent aquifer formula, unconfined in this case, can be used, but the pumping rate substituted in the equation must equal the actual pumping rate multiplied by two. Note that assuming an impervious boundary is conservative. In reality, geological boundaries would not be completely impervious and would provide some flow. This is especially true for cases where a fault occurs in alluvial valley-fill deposits. In such cases, the faulted zone/fault boundaries would not likely be completely impermeable to flow. This flow across the boundary would lessen the impact of the proposed well on the aquifer. Therefore, the assumption that such faults would act as completely impermeable barriers to flow is conservative; that is, this assumption would result in the determination of a greater amount of impact than might actually occur.

An example of a new well location where DOE assumed a semi-infinite-extent unconfined alluvial aquifer case is proposed new well location RrV8 (a quarry well) in the Railroad Valley South hydrographic area along the Caliente rail alignment. The proposed well location is situated in a valley-fill alluvial aquifer adjacent to mapped volcanic rock units. Section G.1.2.5 describes the methodology and approach used in the hydrogeologic impacts calculation performed for this location.

G.1.2.2.4 Semi-Infinite-Extent Confined Aquifer

DOE assumed a semi-infinite-extent confined alluvial aquifer case for some proposed new well locations where the same conditions occur that are described in Section G.1.2.2.3 except that the host aquifer is assumed to be confined rather than unconfined in nature. For the case of a semi-infinite-extent confined aquifer, the relationship between the withdrawal rate of a well and the hydraulic head in the aquifer can be calculated using the same formulae as for the infinite-extent confined aquifer described in Section G.1.2.2.2. However, as in the semi-infinite-extent unconfined aquifer case, DOE assumed that a (linear) no-flow boundary exists and that this no-groundwater flow feature lies adjacent to the proposed withdrawal well. To simulate the no-flow boundary, the “method of images” is used (DIRS 105038-Bear 1979, p. 356). Section G.1.2.2.3 provides a more detailed explanation concerning the use of “method of images” for a semi-infinite aquifer case. Because the no-flow boundary is adjacent to the pumping well location, the system is approximated by a real well and an image well, both at the same location and extracting groundwater at the same rate. Therefore, the formula for an infinite-extent confined aquifer is applicable, provided the pumping rate used in the formula is double the actual pumping rate (to account for the image well).

An example of a new well location where DOE assumed a semi-infinite-extent confined alluvial aquifer case is proposed new location PanV6/PanV3 in the Panaca Valley hydrographic area. The proposed well location is mapped in alluvial valley fill, and is adjacent to rock units variously characterized as “tuffaceous sedimentary rocks” or lakebed deposits (Panaca Formation). The lithologic makeup of these rock materials and available published information suggest that these rock materials might be either relatively permeable or relatively impermeable, depending on location. Based on this condition and the existing available hydrogeologic information for the area surrounding the proposed PanV6/PanV3 location, DOE assumed the host aquifer for well location PanV3/PanV6 to be a horizontal alluvial aquifer, semi-infinite in extent, and confined.

G.1.2.2.5 Carbonate and Volcanic Rock Aquifers

The hydrogeologic characteristics of carbonate rock aquifers and volcanic rock aquifers vary depending on their location within the areas that either the Caliente rail alignment or the Mina rail alignment would cross. Depending on factors such as the degree of fracturing or faulting, and degree of welding, volcanic rocks along the proposed rail alignments might be either relatively permeable to relatively impermeable, or even moderately permeable (transmissive) with respect to groundwater flow. Carbonate rock aquifers present within some areas of the proposed rail alignments are generally assumed to be relatively permeable due to fracturing and openings caused by dissolution (see DIRS 103136-Prudic, Harrill, and Burbey 1993, p. 13). In the hydrogeologic impact calculations, for those cases where the aquifer was assumed to be comprised of carbonate rock or permeable volcanic rock, DOE treated the aquifer as an equivalent porous media and used the same formulae as for the infinite-extent unconfined or confined aquifer cases (Sections G.1.2.2.1 and G.1.2.2.2 above).

DOE assumed a volcanic rock aquifer case at proposed new well location ASV6 in the Alkali Spring Valley hydrographic area. This proposed well location is in an area of mapped volcanic rock units and alluvial fan deposits with the target aquifer being a fractured volcanic rock unit, assumed to be overlain by a layer of alluvial fan materials (DIRS 176189-Converse Consultants 2006, Appendix B). An example of a new well location where DOE assumed a carbonate rock aquifer is proposed new location DLV4 for the Caliente rail alignment in the Dry Lake Valley hydrographic area. The proposed well location is in an area underlain by alluvial valley fill; however, a carbonate rock aquifer underlying the alluvial materials is assumed to be host aquifer for the well based on the characteristics of other wells installed in this area (DIRS 176189-Converse Consultants 2006, Appendix B).

G.1.2.2.6 Limited-Extent Unconfined Aquifer

DOE assumed a limited-extent unconfined aquifer case for some locations where multiple potential no-flow boundaries are located adjacent to the proposed new well location(s). A limited-extent aquifer case was assumed for proposed new well locations OV3, 4, 5, and 13 in the Oasis Valley hydrographic area (area 228). The Oasis Valley hydrographic area calculations assumed a wedge-shaped alluvial aquifer of limited extent because of the presence of different rock units along the sides of the wedge-shaped alluvium. In this case, it was assumed that the two lateral boundaries of the alluvial aquifer could represent geologic contacts with relatively impermeable volcanic rocks. At Oasis Valley, the source of water to Upper Oasis Valley Ranch Springs downgradient of the proposed well locations was assumed to be groundwater underflow derived from upgradient areas, possibly with some vertical inflow component.

DOE intended the approach taken in the limited-extent unconfined aquifer calculations to be very conservative, because the lateral boundaries likely are not true no-flow boundaries. Available information suggests that at both locations there is likely to be some hydraulic connection between the alluvium and adjacent rock units, which would support an assumption that at least some groundwater underflow from adjacent rock units to the alluvial aquifer would occur (see DIRS 169384-Reiner et al. 2002, pp. 8 to 10 for the case of the Oasis Valley calculations).

At Oasis Valley, DOE assumed an upper-bound limiting pumping rate at the proposed wells that would not affect discharge rates at existing springs downgradient of the proposed new well locations. To evaluate the potential impact of such pumping on existing spring discharges, two criteria must be considered: the radius of influence and the relative percentage of the withdrawal rate to total aquifer discharge. In this evaluation, DOE assumed the total discharge from springs to be similar to the aquifer discharge, which is a conservative assumption because the total spring discharge would represent the lowest possible aquifer discharge (given that evapotranspiration is a significant component of aquifer discharge). Because DOE assumed a limited-extent aquifer, it was necessary to establish an upper bound for the pumping rate to ensure that the proposed groundwater withdrawal would not impact aquifer conditions enough to alter water levels throughout the aquifer. In this calculation, DOE estimated that the maximum pumping rate at the proposed groundwater pumping wells should be at least an order of magnitude (a factor of 10) lower than the total discharge from the limited-extent aquifer (assumed to be the total discharge rate from the springs in the alluvium). With this constraint, DOE then calculated a radius of influence for each proposed new well location and compared these calculated radii of influence to the distances separating each proposed new well location and the nearest existing spring to show that these calculated radii of influence would be valid and representative indicators of the extent of impact at each proposed pumping location, and demonstrate that existing springs should not be affected by the proposed groundwater withdrawals.

G.1.2.2.7 Treatment of Faults and Major Fracture Systems

For a selected set of new groundwater withdrawal well locations, the proposed new well was determined to be located in the vicinity of one or more faults or extensive fracture systems or was found to be specifically targeted for installation directly within a major fault zone or an extensive fracture zone (DIRS 176189-Converse Consultants 2006, Appendix B). For such cases, additional evaluations of hydrogeologic data and/or additional analyses were performed.

In cases where a proposed well was determined to be oriented lateral to a mapped fault trace or fracture zone trace, the fault or fracture zone was treated as a potential no-flow barrier if it was located sufficiently close to the proposed new well to be within the region of influence from pumping at that well location. In such cases, the calculations included a specific method (method of images as described in Section G.1.2.2.3) to simulate the potential effects of the fault or fracture zone on groundwater flow behavior.

Hydraulic tests performed in faulted and fractured consolidated rock aquifers at a few wells in the region of the Nevada Test Site and Yucca Mountain indicate that high-permeability zones associated with faults are capable of acting as conduits for transmitting hydraulic responses from pumping wells over larger-scale (on the order of kilometers) distances if the pumping well draws its water from the fault zone. These effects have been observed for both faulted and fractured volcanic rock and faulted and fractured carbonate rock aquifers (DIRS 181896-Stoller-Navarro 2005, Section 2.0; DIRS 129721-Geldon et al. 1998, pp. 23 to 24 and p. 31). Results from pump tests conducted at these wells often indicate that very complex hydrogeologic conditions, including heterogeneous hydraulic rock properties, the presence of complex structural systems controlling flow, and other non-isotropic conditions, exist at these test sites. For these reasons, where a proposed new well was initially identified as targeting a specific fault or fracture system that might be capable of acting as a high-permeability conduit, DOE identified the locations of existing wells and springs up to 10 kilometers (6.2 miles) away from each such proposed well. In these cases, DOE reviewed available data on existing wells and springs and locations of known (mapped) fault and fracture zone traces within the 10-kilometer radius surrounding each new well location and compared these with the locations of the proposed well to estimate the likelihood of a hydraulic connection occurring between the proposed well and existing wells and springs beyond a distance of 2.4 kilometers (1.5 miles) but within the approximately 10-kilometer distance. If sufficient evidence was found that a proposed new well would likely intercept a fault/fault zone, and that an existing well or spring within the 10-kilometer search distance could likely be hydraulically connected to the proposed withdrawal well withdrawal zone, potential impacts to the nearest such well or spring caused as a result of the proposed withdrawal were assessed. Tables G-3 and G-4 summarize those proposed new well locations for the Caliente and Mina rail alignments, respectively, where a fault or fault zone was initially targeted as a potential water-bearing zone for a new well.

G.1.2.3 Groundwater Withdrawals for Construction of Rail Facilities and Sidings

Water needs and required groundwater well withdrawal rates associated with construction of rail facilities and sidings are small compared to the amount of water required to support construction of the rail line. Construction of the Cask Maintenance Facility would require approximately 4,400 cubic meters (approximately 3.6 acre-feet, or 1.176 million gallons) of water, with construction estimated to occur over approximately 2 years (DIRS 104508-CRWMS M&O 1999, Table III-2). The amount of water needed to construct the other facilities (Staging Yard, Maintenance-of-Way Facilities, and the Rail Equipment

Table G-3. Proposed new well locations where a fault or fault zone was initially identified as a targeted water-bearing zone – Caliente rail alignment.

Well location identification	Rail line segment
PanV14/PanV16	Common segment 1
DLV2, DLV3, DLV4, and DLV6	Common segment 1
PahV1 and PahV2	Common segment 1
PahV5 and PahV8	Common segment 1
StF10	Goldfield alternative segments
LV5/LV13	Goldfield alternative segments
LV8/LV19	Goldfield alternative segments
OV7/OV15	Common segment 6
OV22/OV23	Common segment 6

Table G-4. Proposed new well locations where a fault or fault zone was initially identified as a targeted water-bearing zone – Mina rail alignment.

Well location identification	Rail line segment
BSa-3a	Mina common segment 1/Montezuma alternative segments 2 and 3
WLa-1c	Department of Defense Branchline North/Schurz alternative segment 4/Department of Defense Branchline South
CSM-2a	Mina common segment 1
As-2a and AS-3a	Montezuma alternative segment 1
OV7/OV15	Common segment 6
OV22/OV23	Common segment 6

Maintenance Yard) would range from approximately 14,000 to 200,000 cubic meters, which is equivalent to 11.5 to 161.1 acre-feet, or 3.75 to 52.5 million gallons (DIRS 180873-Nevada Rail Partners 2007,Table 2-2; DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). When compared to the total amount of water needed for railroad construction, and compared to existing groundwater resources in the respective hydrographic areas where the facilities would be constructed, the direct short-term impacts to groundwater resources in the respective hydrographic areas due to water withdrawals associated with construction of facilities and sidings would be small and long term. Direct and indirect impacts on groundwater resources also would be small. For this reason, DOE did not perform quantitative impact analyses for water wells that would be used (for example, at proposed base-case withdrawal rate) solely to support construction of these facilities and sidings (DIRS 176189-Converse Consultants 2006, Appendixes A and B; DIRS 180888-Converse Consultants 2007, Appendixes A through X).

G.1.2.4 Sensitivity Analysis

G.1.2.4.1 Caliente Rail Alignment

The productivity of the proposed wells would vary depending on a number of variables, including aquifer depth, aquifer lithology, permeability, well efficiency, degree of cementing or fracturing present in the host aquifer, the presence or absence of nearby faults or flow boundaries, or other factors. Therefore, it might be necessary to use one or more highly productive wells rather than all proposed wells within each hydrographic area. Higher withdrawal rates at one or more highly productive wells could help fulfill more of the required water demand within a hydrographic area if other wells had lower-than-expected productivities. It should be noted that the temporary nature of the construction water wells would require that short-term higher withdrawal rates be only temporarily imposed. This factor would help reduce potential long-term impacts of increased withdrawal at the applicable higher-productivity locations.

To allow for possible uncertainties in future well productivities and withdrawal rates, DOE considered the possibility of using more highly productive wells and performed sensitivity analyses to evaluate the degree of increased impacts expected to result from the imposition of higher (in other words, higher short-term or peak) withdrawal rates at such more productive water-well locations. For planning purposes, DOE assumed that a maximum withdrawal rate of 0.014 cubic meter (0.5 cubic foot) per second (approximately 852 liters [225 gallons] per minute) might, at least in theory, be imposed at any of the proposed new well locations (with the exception of proposed quarry wells, as described in Section G.1.2.5). Table G-5 lists the proposed new well locations where DOE performed sensitivity analysis calculations. The methodologies and analytical equations used for completing these sensitivity analyses are the same as described in Section G.1.2.2.

Table G-5. Proposed new well locations pumped at higher groundwater withdrawal rates (sensitivity analysis) for which DOE performed groundwater impacts analyses – Caliente rail alignment.

Name of proposed well	Hydrographic area number	Hydrographic area name	Alternative segment/ common segment
ClV2	204	Clover Valley	Eccles/common segment 1
PanV1	203	Panaca Valley	Eccles/common segment 1
PanV4	203	Panaca Valley	Caliente/common segment 1
PanV5	203	Panaca Valley	Caliente/common segment 1
PanV2/PanV24	203	Panaca Valley	Eccles/common segment 1
PanV6/PanV3	203	Panaca Valley	Eccles/common segment 1
PanV25/PanV26	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV7/PanV8	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV9/PanV10/PanV11/PanV12	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
PanV13/PanV15	203	Panaca Valley	Eccles/common segment 1 Caliente/common segment 1
DLV3	181	Dry Lake Valley	Common segment 1
DLV4	181	Dry Lake Valley	Common segment 1
PahV1/PahV2/PahV3	208	Pahroc Valley	Common segment 1
PahV7/PahV8/PahV9	208	Pahroc Valley	Common segment 1
GV2	172	Garden Valley	Garden Valley 2
GV10	172	Garden Valley	Garden Valley 1
RrV5	173A	Railroad Valley South	Common segment 2/South Reveille 3/common segment 3
RrV6/RrV11	173A	Railroad Valley South	Common segment 2/South Reveille 2/South Reveille 3/common segment 3
HC4	156	Hot Creek Valley	Common segment 3
HC5/HC7	156	Hot Creek Valley	Common segment 3
SCV3	149	Stone Cabin Valley	Common segment 3
SaF1/SaF2	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF4	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5
SaF5/SaF9	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
SaF7/SaF11	146	Sarcobatus Flat	Bonnie Claire 3/common segment 5, Bonnie Claire 2/common segment 5
OV9	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV24/OV25/OV26	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6
OV12/OV18/OV19/OV20/OV21	228	Oasis Valley	Common segment 5/Oasis Valley 3/common segment 6
OV14/OV16/OV6/OV8	228	Oasis Valley	Common segment 5/Oasis Valley 1/common segment 6

DOE evaluated potential impacts on existing wells and existing springs caused by these higher-withdrawal-rate wells by evaluating the size of the radius of influence induced by pumping at the hypothetical higher withdrawal rate. DOE applied the same types of equations to the nearest existing well with a water right located nearest to each higher-withdrawal-rate well to calculate the estimated radius of influence induced by pumping at the existing well. The geology and hydrogeology associated with existing and proposed wells were evaluated to identify the appropriate flow equations in the same manner as described in Sections G.1.2.2.1 and G.1.2.2.2. In these sensitivity analysis calculations, pumping-rate assumptions used for existing wells were derived from annual duty (appropriated annual duty) and diversion rate data contained in the NDWR Water Rights Database.

G.1.2.4.2 Mina Rail Alignment

Sensitivity analyses were not required for well locations proposed for the Mina rail alignment. Calculations performed for evaluating groundwater impacts for the proposed Mina well locations initially assumed a maximum pumping rate expected to be applied at each location, approximately 852 liters (225 gallons) per minute, which is identical (with the exception of proposed new well location Cl-1a, where a withdrawal rate of approximately 1,300 liters [350 gallons] per minute or less was assumed) to the potentially higher withdrawal rate value used in each sensitivity analysis calculation completed for the Caliente alignment well locations.

G.1.2.5 Quarry Water Wells

G.1.2.5.1 Caliente Rail Alignment

The construction impacts assessments also included the evaluation of the potential impacts from pumping at new water wells proposed to support quarry operations along the Caliente rail alignment. DOE considered the potential for impacts to occur resulting from proposed groundwater withdrawals from the proposed quarry water well locations for both the Caliente and Mina rail alignments. Based on the review of the available information, DOE completed impacts analysis calculations for the following proposed quarry well locations:

- One water well (PanV23) associated with a potential quarry northwest of the community of Caliente in hydrographic area 203 in Lincoln County
- Up to two water wells (RrV8 and RrV10) associated with a potential quarry northeast of the South Reveille alternative segments 2 and 3 in hydrographic area 173A in Nye County
- Up to two water wells (AsV6 and AsV7) associated with a potential quarry in hydrographic area 142 in Nye County

Each quarry would operate for approximately 2 years following an initial startup period. Water consumption rates during the period of use of quarries have been estimated at approximately 90.8 liters (24 gallons) per minute, which is equivalent to approximately 131,000 liters (34,560 gallons) per day (DIRS 180888-Converse Consultants 2007, Table 2-4). The *Hydrogeologic DEIS Analysis Report, REV. 0, April 10, 2006* (DIRS 176189-Converse Consultants 2006, all) provides details pertaining to the characteristics and use of the water wells that would be associated with these potential quarry sites. DOE performed impacts analysis calculations for potential quarry wells PanV23, RrV8, and AsV6. An example of the methodology used for a quarry well impact calculation (for proposed well RrV8) is summarized below.

For proposed well site RrV8, DOE proposes a 90- to 120-meter (300- to 400-foot)-deep quarry well and anticipates that this well would be used to supply water at a withdrawal rate of 91 liters (24 gallons) per minute over approximately a 2-year period following an initial startup period (DIRS 176189-Converse

Consultants 2006, Appendix A). Based on geologic information for this area, the well would likely be screened in an alluvial aquifer adjacent to volcanic rock units. Available published information suggests that the volcanic rock materials might be either relatively permeable or relatively impermeable, depending on location. DOE assumed a semi-infinite-extent unconfined alluvial aquifer wherein the adjacent volcanic unit (lava-flow unit) was assumed to be an essentially impermeable rock unit. Based on hydrogeologic information for the area surrounding the proposed RrV8 well location, the host aquifer for the well location RrV8 was assumed to be a horizontal alluvial aquifer and unconfined. The semi-infinite aquifer case is considered to be conservative because the adjacent volcanic rock unit is not likely to be completely impermeable.

Because the potential quarry sites are typically located in bedrock-dominated terrain, wells installed near the quarry sites would be expected to be lower-productivity wells and, therefore, groundwater withdrawal rates at quarry water wells would not be expected to vary significantly from the specified average withdrawal rate of 91 liters (24 gallons) per minute. Therefore, DOE did not perform additional sensitivity analyses for the quarry water wells to assess any increased impacts that might result from imposing higher withdrawal rates at these well sites.

G.1.2.5.2 Mina Rail Alignment

The construction impacts assessments also included the evaluation of the potential impacts from pumping at new water wells proposed to support quarry operations along the Mina rail alignment. DOE evaluated impacts from one proposed quarry water well, WLc-2a, associated with a potential quarry in Garfield Hills in hydrographic area 110C in Mineral County. Each quarry used to support construction of the Mina alignment would operate for approximately 2 years following an initial startup period. The *Hydrogeologic DEIS Analysis Report, REV. 0, April 27, 2007* (DIRS 176189-Converse Consultants 2007, all) provides details pertaining to the characteristics and use of the water wells that would be associated with these potential quarry sites. Section G.1.2.5.1 provides an example of the methodology used for a quarry well impact calculation (for a proposed quarry well at location RrV8 along the Caliente rail alignment).

G.1.3 OPERATIONS IMPACTS ASSESSMENT

G.1.3.1 Caliente Rail Alignment

G.1.3.1.1 Overview

The operations impacts assessment included estimating groundwater-supply impacts associated with operation of the rail line and railroad construction and operations support facilities.

G.1.3.1.2 Facility Operations

Permanent facilities considered include the Staging Yard, the Maintenance-of-Way Facility, the Maintenance-of-Way Headquarters Facility, the Rail Equipment Maintenance Yard, the Cask Maintenance Facility, Facilities at the Interface with the Union Pacific Railroad Mainline, and rail sidings. These would be permanent facilities corresponding to an assumed railroad operations phase of up to 50 years.

G.1.3.1.3 Evaluation of Potential Hydrogeologic Impacts

Details on the water requirements activity and groundwater impacts at the rail operations facilities are provided in the *Facilities–Design Analysis Report Caliente Rail Corridor, Task 10: Facilities, Rev. 03* (DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). These facilities would require only limited amounts of water, with water required for operations estimated to range from approximately 9,500 to

23,000 liters (2,500 to 6,000 gallons) per day at the facilities, which is equivalent to approximately 6 to 16 liters (1.7 to 4.2 gallons) per minute. Operations water requirements were derived from estimated staffing and shift projections, a 190-liter per day (50-gallon per day) per capita use ratio, estimated shop process needs, and a multiplier of 1.5 to account for miscellaneous water needs (DIRS 180873-Nevada Rail Partners 2007, Section 3.1.5; DIRS 180919-Nevada Rail Partners 2007, Section 3.1.5). Water needed for meeting emergency water storage capacity requirements (for fire safety) are estimated to range from approximately 379,000 to 833,000 liters (100,000 to 220,000 gallons). Water needs for meeting water storage requirements at each facility could be readily met using a new low-productivity well. Because the well withdrawal rates (approximately 16 liters [4.2 gallons] per minute or less) required to support operation of these railroad operations support facilities are relatively low (DIRS 180919-Nevada Rail Partners 2007, Table 3-B), the magnitude of impacts on the host aquifers for the individual facility water-supply wells would be expected to be small. For this reason, DOE did not perform quantitative impacts analyses for water wells that would be used (for example, at proposed base-case withdrawal rate) solely to support operation of these facilities.

G.1.3.2 Mina Rail Alignment

G.1.3.2.1 Overview

The operations impacts assessment included estimating groundwater-supply impacts associated with operation of the rail line and railroad construction and operations support facilities.

G.1.3.2.2 Facility Operations

Permanent facilities considered include the Staging Yard at Hawthorne in hydrographic area 110C, the Maintenance-of-Way Facility at either Silver Peak in hydrographic area 143 or Klondike in hydrographic area 142, the Rail Equipment Maintenance Yard in hydrographic area 227A, and proposed sidings in several hydrographic areas. These would be permanent facilities corresponding to an assumed railroad operations period of up to 50 years.

G.1.3.2.3 Evaluation of Potential Hydrogeologic Impacts

Similar to the case for the Caliente rail alignment, DOE did not perform quantitative impact analyses for water wells that would support facilities operations or sidings. The reason for not performing quantitative analyses is the same as for the Caliente alignment – because required well withdrawal rates for wells supporting operations of facilities and sidings are very small, the magnitude of short-term or long-term impacts on the host aquifer for the individual facility water wells would be small.

G.2 Shared-Use Option

G.2.1 CONSTRUCTION IMPACTS ASSESSMENT – CALIENTE RAIL ALIGNMENT

Under the Shared-Use Option, additional commercial access sidings would be constructed as a third track alongside passing sidings. However, the total length of the additional sidings would be relatively short in comparison to the total length of the rail line. The water requirement for construction of the rail line under the Shared-Use Option would only increase by approximately 150,000 cubic meters (122 acre-feet), or approximately 2 percent, compared to the total estimated likely water demand of 7.52 million cubic meters (6,100 acre-feet) for construction of the rail line without shared use.

For purposes of this analysis, DOE assumed that the commercial access sidings would be in the same hydrographic areas the Caliente rail alignment would cross. Therefore, additional impacts to groundwater features in these areas would likely be small, given that the additional water requirement under the Shared-Use Option represents only a small portion of the total water demand for construction of the rail line without shared use. The overall impacts to groundwater resources in these areas would be similar to the impacts described in Section G.1.2.3.

Commercial-use facilities under the Shared-Use Option would likely be constructed close to the DOE-owned and -operated rail facilities and so would likely overlie the same hydrographic areas as the DOE facilities. Therefore, additional impacts to groundwater features in these areas as a result of construction of facilities under the Shared-Use Option would also be small. The overall impacts would be similar to the impacts described in Section G.1.2.3.

G.2.2 OPERATIONS IMPACTS ASSESSMENT – CALIENTE RAIL ALIGNMENT

Groundwater impacts for railroad operations along the Caliente rail alignment under the Shared-Use Option would be similar to those identified in Sections G.1.3.1 and G.1.3.2. Impacts to groundwater from operation of additional sidings would be small. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

Commercial-only facilities would require water for daily operations. Water demand to operate these facilities has not yet been identified, but DOE assumes it would be small. Therefore, additional impacts to groundwater features would likely be small, and the overall impacts would be similar to those described in Section G.1.3.

G.2.3 CONSTRUCTION IMPACTS ASSESSMENT – MINA RAIL ALIGNMENT

Under the Shared-Use Option, additional commercial access sidings would be constructed as a third track alongside passing sidings. However, the total length of the additional sidings would be relatively short in comparison to the total length of the rail line. The water requirement for the construction of the rail line under the Shared-Use Option would only increase by approximately 147,000 cubic meters (119 acre-feet), or approximately 2 percent, compared to the total estimated likely water demand of 7.34 million cubic meters (5,950 acre-feet) for construction of the rail line without shared use.

For purposes of this analysis, DOE assumed that the commercial access sidings would be in the same hydrographic areas the Mina rail alignment would cross. Therefore, additional impacts to groundwater features in these areas would likely be low, given that the additional water requirement under the Shared-Use Option represents only a small portion of the total water demand for construction of the rail line without shared use. The overall impacts to groundwater resources in these areas would be similar to the impacts described in Section G.1.2.3.

Commercial-use facilities under the Shared-Use Option would likely be constructed close to the DOE-owned and -operated rail facilities and would likely overlie the same hydrographic areas as the DOE facilities. Therefore, additional impacts to groundwater features in these areas would also be small. The overall impacts would be similar to the impacts described in Section G.1.2.3.

G.2.4 OPERATIONS IMPACTS ASSESSMENT – MINA RAIL ALIGNMENT

Groundwater impacts for railroad operations along the Mina rail alignment under the Shared-Use Option would be similar to those identified in Sections G.1.3.1 and G.1.3.2. Impacts to groundwater from operation of additional sidings would be small. There would be no continued need for water along the additional sidings, and possible changes to recharge, if any, would be the same as those at the completion of construction.

Commercial-only facilities would require water for daily operations. Water demand to operate these facilities has not yet been identified, but DOE assumes it would be small. Therefore, additional impacts to groundwater features would likely be small, and the overall impacts would be similar to those described in Section G.1.3.

G.3 Glossary

aquitard	A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores groundwater.
cone of depression	The lowering of the water table in a cone-shaped depression around a pumped well.
evapotranspiration	The combined process of evaporation and transpiration. Evaporation is water loss to the atmosphere from sources such as soil, canopy interception, and water bodies; transpiration refers to the movement of water vapor from a plant to the air through the plant's stomata or leaves.
leaky aquifer	An aquifer that has an ***aquitard*** either above or below that allows water to leak into or out of the aquifer depending on the direction of the hydraulic gradient.
radius of influence	The distance from the well where the drawdown becomes insignificant and can be neglected.
screened	The portion of a well that is screened is the interval in the well where the casing contains slots to let in the water from the primary (most productive) water-bearing zone or zones.

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147766	Thiel 1999	Thiel Engineering Consultants 1999. Data Assessment & Water Rights/Resource Analysis of: Hydrographic Region #14 Death Valley Basin. Reno, Nevada: Thiel Engineering Consultants. ACC: MOL.19990218.0214.
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176325	USGS 2006	USGS (U.S. Geological Survey) 2006. "Water Resources of the United States." National Water Information System Web Site. Reston, Virginia: U.S. Geological Survey. Accessed February 1, 2006. ACC: MOL.20060301.0385. URL: http://www.usgs.gov/

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176848	Van Denburgh and Rush 1974	Van Denburgh, A.S. and Rush, F.E. 1974. Water–Resources Appraisal of Railroad and Penoyer Valleys, East–Central Nevada. Water Resources – Reconnaissance Series Report 60. Carson City, Nevada: State of Nevada, Department of Conservation and Natural Resources. TIC: 217169.

APPENDIX H

BIOLOGICAL RESOURCES

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ACRONYMS AND ABBREVIATIONS

BLM	Bureau of Land Management
DOE	U.S. Department of Energy
FWS	U.S. Fish and Wildlife Service
GPS	Global Positioning System
NDOW	Nevada Department of Wildlife
NNHP	Nevada Natural Heritage Program
HMA	herd management area

APPENDIX H

BIOLOGICAL RESOURCES

This appendix supports the descriptions of the affected environment for biological resources in Chapter 3 and the impacts analyses in Chapter 4 of the Rail Alignment EIS (DOE/EIS-0369). It describes the field survey methods and other technical data that support the biological resource analysis described in those chapters.

H.1 Introduction

Sections H.2 through H.5 of this appendix summarize the research and field methods the U.S. Department of Energy (DOE) used to compile information necessary to assess potential impacts on biological resources from implementation of the Proposed Action along either the Caliente rail alignment or the Mina rail alignment, and presents the information resulting from those varied efforts. Generally, this information is organized by biological resource.

This appendix summarizes information from previous studies and documents such as the *Environmental Baseline File for Biological Resources* (DIRS 104593-CRWMS M&O 1999, all), applicable BLM resource management plans, conservation plans for various species or communities, and other similar documents. Additionally, the appendix summarizes information obtained from BLM institutional knowledge (such as noxious and invasive weed locations and wild horse and burro herd management areas), Nevada Department of Wildlife institutional knowledge (including big game species distributions and habitat requirements), Nevada Natural Heritage Program occurrence database (DIRS 182061-NNHP 2005, all) of protected and sensitive species, the Southwest Regional Gap Analysis Project (SWReGAP) data of land cover (DIRS 174324-NatureServe 2004, all), and other similar data. The appendix also includes descriptions of the methods DOE used during field observations for vegetation, special status species, game species, and wild horses and burros. Figure H-1 shows survey locations along the Caliente rail alignment; Figure H-2 shows field observation points along the Mina rail alignment.

H.2 Vegetation

H.2.1 METHODS

H.2.1.1 Research

Prior to field surveys, DOE identified existing information regarding the occurrence and distribution of plant communities within the Caliente rail alignment and Mina rail alignment study areas (8 kilometers [5 miles] on either side of the centerline of the proposed rail alignment; a total width of 16 kilometers [10 miles]). This effort included literature searches and consultations with federal and state agencies including the U.S. Bureau of Land Management (BLM), the U.S. Fish and Wildlife Service (FWS), the Nevada Natural Heritage Program (NNHP), the Nevada Department of Wildlife (NDOW), and the Nevada Division of Forestry.

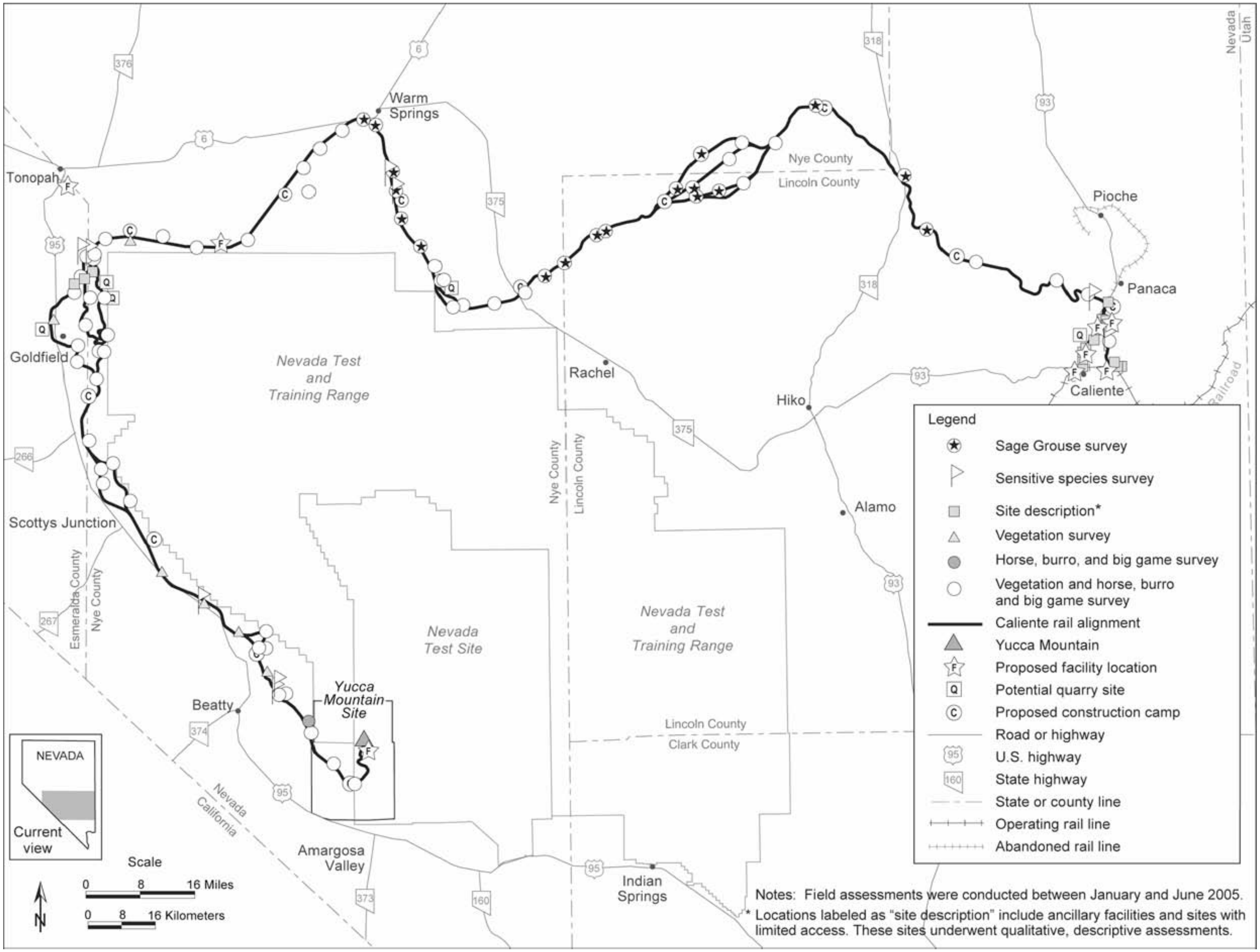

Figure H-1. Survey locations for biological resources along the Caliente rail alignment.

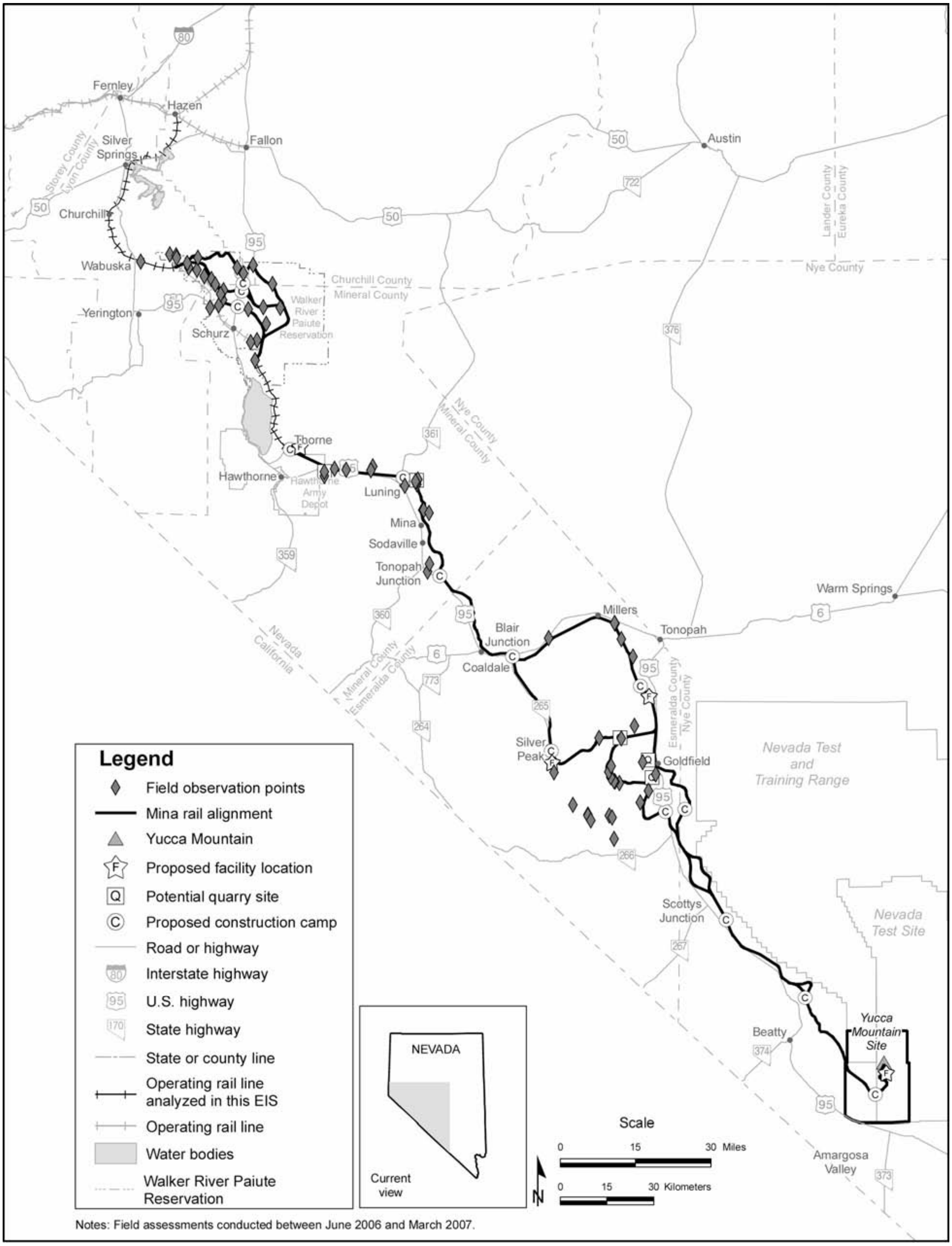

Figure H-2. Field observation points for biological resources along the Mina rail alignment.

DOE also obtained spatial data, in digital and print form, from the BLM, the Nevada Department of Wildlife, the Nevada Natural Heritage Program, the University of Nevada, Reno, and other sources, for computer-based and paper-based evaluation of biological resources within the study area. DOE assessed plant communities within the study area of the rail alignments and rail line construction and operations support facilities using the 2004 SWReGAP (DIRS 174324-NatureServe 2004). The SWReGap is a multi-institutional cooperative mapping and assessment of biodiversity within Arizona, Utah, Nevada, New Mexico, and Colorado and provides digital land-cover maps that contain plant community distribution data. This dataset also provides information about the existing natural vegetation to the level of dominant or codominant plant species, public and private land ownership, and management and conservation land status. DOE overlaid this information, in conjunction with digital, orthographically corrected, aerial photos (DIRS 174497-Keck Library 2004, all), onto maps of the two rail alignments and associated facilities and used to it identify unique vegetation communities within the study area (such as sagebrush and riparian), and identified areas where there could be sensitive species.

DOE then conducted field surveys in the study area along the proposed Caliente and Mina rail alignments to characterize the existing SWReGAP (DIRS 174324-NatureServe 2004) land-cover analyses in locations that closely represent the land-cover types. DOE also surveyed areas that are considered unique relative to the region, such as riparian habitat, playas, and sand dunes. Locations were also chosen to provide a relatively consistent survey among alternative segments, in order to adequately compare the alternative segments for the impact analysis.

H.2.1.2 Field Surveys

Caliente Rail Alignment

Field surveys for the proposed Caliente alignment included 72, 200-meter (660-foot)-long vegetation transects in which plant species were formally identified and the composition of plant communities was quantitatively assessed. The vegetation transects were located at various intervals along the entire proposed Caliente rail alignment, including all common segments and all alternative segments.

In addition to quantitative assessments, qualitative field observations were made at many of the sites where formal transect-based surveys were conducted and at other locations where no transects were established, including areas where limitations such as private property prevented access. These qualitative site descriptions typically consisted of a visual assessment of vegetation, landform, land use and level of disturbance, physical relationship to the proposed rail alignment, and the presence of water or evidence of the influence of water on the habitat.

DOE performed vegetation surveys along the proposed Caliente rail alignment from February 4 through March 11, 2005, from May 5 through May 7, 2005, on June 7 and 8, 2005, and from January 23 through January 27, 2006. Before conducting the 2005 vegetation surveys, and periodically throughout the course of the 2005 field surveys, Dr. Kent Ostler, an expert in regional plant ecology, provided survey personnel with guidance in the field regarding regional plant ecology and identification (DIRS 174634-Thebeau and Huenefeld 2005, p. 2). Surveys conducted in 2006 were performed by a qualified biologist following the same research methods and field survey protocols as outlined in this appendix.

DOE conducted vegetation sampling along a transect or straight line of 200 meters (660 feet) parallel to the proposed location of the rail alignment. The bearing or direction of each transect was determined using a geographic positioning system receiver or a compass. After establishing the starting point and the bearing of a transect, a 1-square-meter (11-square-foot) plot was sampled every 20 meters (66 feet), resulting in 10 sample plots or quadrats. In most cases, a wooden stake was driven into the ground to semi-permanently mark the location of the start and end of a transect. Photos and geographic positioning system location surveys were taken at the beginning and end of each transect.

Field personnel recorded vegetation survey data on the two-page data sheet used for vegetation assessments shown in Figure H-3. Trees, shrubs, cacti, invasive and noxious plants, and most grasses were identified by genus or species, whereas non-weed forb species were recorded as forbs, and lumped together. For each species identified within the quadrat, field personnel estimated the percent of the quadrat covered by that species and recorded that information on data sheets. Field personnel also recorded the percent cover for dead plant material, mosses, rock, and cryptobiotic soil crust (a crust formed by cyanobacteria, lichens, and mosses over the surface of the soils). The total percent cover in a quadrat could add to more than 100 due to overlap. Field personnel collected samples and took photographs of unrecognized plant species for subsequent identification. General descriptions of the landform, the slope, aspect, land use of the site (grazing, mining, wilderness), and the type of plant community present on the site were also recorded. The general description was used to identify the presence of indicator or key species present but occurring scattered and outside of transects. Such species included Joshua tree (*Yucca brevifolia*), Utah juniper (*Juniperus osteosperma*), and singleleaf pinyon (*Pinus monophylla*).

Mina Rail Alignment

DOE performed field surveys along the proposed Mina rail alignment and associated facility and quarry locations during three separate field visits: June 12 through 15, 2006; December 11 through 13, 2006; and March 26-29, 2007. Surveys consisted of a visual assessment of vegetation, land use, disturbance, water resources, and potential habitat for wildlife and special status species within the study area.

General field observation points were taken at locations along the alignment where there was an obvious change in the landscape and/or land-cover type, and at "micro-site" locations. Micro-sites are small vegetative or physically dissimilar areas that occur within a larger continuous community type (such as rock outcrops, playas, vegetated sand dunes [Figure H-2]).

A list of special status species was provided by the Nevada Natural Heritage Program Database (DIRS 182061-NNHP 2005, all). These historical occurrences were overlaid on topographic maps of the project area and assessed in the field for the potential occurrence of special status species. Habitat assessment points were documented using Global Positioning System (GPS), photography, and data forms.

The assessment included identifying all plant species present and determining community type based on primary and secondary composition of plant species. In addition, the assessment used general observations of the landscape, including slope, aspect, elevation, land use, and any wildlife observations.

Special status species and any areas determined to be micro-sites were used to establish the specific survey locations along the proposed rail alignment and quarry sites.

H.2.1.3 Impact Analysis

DOE assessed potential adverse impacts on vegetation communities as a result of the Proposed Action described in Chapter 2 of the Rail Alignment EIS, which were based on the review of SWReGAP data and field observations. Direct long-term impacts include the loss of vegetation and fragmentation of vegetation communities and were assessed using Geographic Information System vegetation and construction datasets, and a Geographic Information System process called Intersect was used to quantify the amount of specific land-cover types that would be removed in relation to rail line, facility, and quarry footprints. Indirect short-term impacts were assessed using the same methods, however calculations for

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:		LOCATION:	TRANSECT BEARING:
	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):					
TRANSECT START PHOTO:			TRANSECT END PHOTO:			
SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvuial Fan Slope Cliff/Scarp Other		LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other		
SW REGAP CLASS:						
ESTIMATED DOMINANT SPECIES:						

	NAME/CODE	EXTENT*	WAYPOINT	UTM N	UTM E	PDOP	WAAS	ELEVATION
Sensitive Species 1							yes / no	
Sensitive Species 2							yes / no	
Sensitive Species 3							yes / no	
* Categories for sens spp and inv/nox spp extent: Solitary, Few Clumped, Few Scattered, Many Clumped, Many Scattered, Dense, Other								
Invasive/Nox Species 1							yes / no	
Invasive/Nox Species 2							yes / no	
Invasive/Nox Species 3							yes / no	

NOTES:

Figure H-3. Vegetation data sheet (page 1 of 2).

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:					LOCATION:				TRANSECT BEARING:
QUADRAT NUMBER	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**NOTES/PHOTOS**
SPECIES											
Forbs											
Litter											
Crypto											
Bare											
NOTES:											

Figure H-3. Vegetation data sheet (page 2 of 2).

short-term impacts included the area from the toe of slope to the edge of the construction right-of-way and is outside of the rail line, facility, and quarry footprints. They are considered short-term impacts because DOE would minimize disturbance within the construction right-of-way and would mitigate or restore disturbed areas not used during the operations phase.

The magnitude of impact was determined based on the SWReGAP dataset. A small impact to vegetation would neither destabilize nor noticeably alter a specified land-cover type and would not affect the overall function or viability of the plant community. A moderate impact would noticeably alter a specific land-cover type, but not destabilize or affect important attributes of that land-cover type. An indication of a moderate impact pertains to a land-cover type that is uncommon within the Mojave and Great Basin Deserts, such as riparian vegetation. A large impact would significantly alter or destabilize the land-cover type. However, no large impacts were found to occur in the analysis.

H.2.2 VEGETATION COMMUNITIES

The vegetation communities present along the Caliente and Mina rail alignments are indicative of the Great Basin and the Mojave Deserts. Table H-1 lists the land-cover types and vegetation communities identified as potentially occurring within the Caliente rail alignment and Mina rail alignment regions of influence as described in the Southwest Regional Gap Analysis Project databases and confirmed by field surveys.

Table H-1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 1 of 5).

Land-cover type	Characteristic plant species and distribution
Agriculture	This land-cover type includes row crops, irrigated pasture and hay fields, dry farm crops.
Barren	This land-cover type includes barren soil or rock with less than 5 percent vegetative cover.
Developed, Medium - High Intensity	Developed, Medium Intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surface accounts for 50 to 79 percent of the total cover. These areas most commonly include single-family housing units. Developed, High Intensity: Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.
Developed, Open Space - Low Intensity	Open Space: Includes areas with a mixture of some construction materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes. Developed, Low Intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover. These areas most commonly include single-family housing units.
Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland	This land-cover type occurs in mountain ranges from about 1,220 to more than 2,135 meters (4,000 to more than 7,000 feet). This type often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. The variety of plant associations connected to this type reflects elevation, stream gradient, floodplain width, and flooding events. Dominant trees may include white fir, thinleaf alder, water birch, narrowleaf cottonwood, balsam poplar, Fremont cottonwood, red willow, Gooding's willow, and Douglas fir. Dominant shrubs include silver sagebrush, Redosier dogwood, narrowleaf willow, arroyo willow, Lemmon's willow, or yellow willow.

Table H-1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 2 of 5).

Land-cover type	Characteristic plant species and distribution
Great Basin Pinyon-Juniper Woodland	This land-cover type occurs on dry mountain ranges and is typically found at lower elevations ranging from 1,600 to 2,600 meters (5,200 to 8,500 feet). These woodlands occur on warm, dry sites on mountain slopes, mesas, plateaus, and ridges. Woodlands dominated by a mix of singleleaf pinyon and Utah juniper, and woodlands dominated solely by either species comprise this land-cover type. Associated species include shrubs such as desert mahogany, green manzanita, low sagebrush, black sagebrush, Great Basin sagebrush, mountain mahogany, littleleaf mountain mahogany, blackbrush, Gambel oak, scrub oak, bunch grasses needle-and-thread, Idaho fescue, bluebunch wheatgrass, Great Basin wild rye, and mutton grass.
Great Basin Xeric Mixed Sagebrush Shrubland	This land-cover type occurs in the Great Basin on dry flats and plains, alluvial fans, rolling hills, rocky hill slopes, saddles, and ridges at elevations between 1,000 to 2,600 meters (3,300 to 8,500 feet). Sites are dry, often exposed to desiccating winds, with typically shallow, rocky, non-saline soils. Shrublands are dominated by black sagebrush (mid and low elevations), low sagebrush (higher elevation), and may be codominated by Wyoming big sagebrush or yellow rabbitbrush.
Inter-Mountain Basins Big Sagebrush Shrubland	This widespread land-cover type occurs throughout much of the intermountain west and is found at slightly higher elevations farther south. Soils are typically deep with minimal salt, and often with a microphytic crust. This system is dominated by perennial grasses and forbs (greater than 25 percent cover) with big basin sagebrush, big sagebrush, Wyoming big sagebrush, threetip sagebrush, and/or antelope bitterbrush dominating or codominating the open to moderately dense (10 to 40 percent cover) shrub layer.
Inter-Mountain Basins Big Sagebrush Steppe	This land-cover type occurs throughout much of the Columbia Plateau and northern Great Basin and Wyoming, and is found at slightly higher elevations farther south. Soils are typically deep and non-saline, often with a microphytic crust. This shrub-steppe is dominated by perennial grasses and forbs with basin big sagebrush, big sagebrush, Wyoming big sagebrush, threetip sagebrush, and/or desert bitterbrush dominating or codominating the open to moderately dense shrub layer. Shadscale saltbush, yellow rabbitbrush, rubber rabbitbrush, horsebrush, or prairie sagewort may be common, especially in disturbed stands. Associated grasses include Indian ricegrass, plains reedgrass, thickspike wheatgrass, Idaho fescue, rough fescue, prairie junegrass, Sandberg bluegrass, and bluebunch wheatgrass. Common forbs are spiny phlox, sandworts, and milkvetches.
Inter-Mountain Basins Cliff and Canyon	This land-cover type is found from foothills to subalpine elevations and includes barren and sparsely vegetated landscapes of steep cliff faces, narrow canyons, and smaller rock outcrops of various bedrock types. Also included are unstable slopes with accumulations of broken rock (known as talus or scree) that typically occur below cliff faces. Widely scattered trees and shrubs may include white fir, twoneedle pinyon, limber pine, singleleaf pinyon, Juniper, big sagebrush, desert bitterbrush, curl-leaf mountain mahogany, Mormon tea, oceanspray, and other species often common in adjacent plant communities.
Inter-Mountain Basins Greasewood Flats	This land-cover type occurs throughout much of the western United States in intermountain basins. It typically occurs near drainages on stream terraces and flats or may form rings around playas. Sites typically have saline or salty soils, a shallow water table, and may flood intermittently, but remain dry for most growing seasons. This system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or codominated by greasewood. Fourwing saltbush, shadescale saltbush, or winterfat may be present to codominant.

Table H 1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 3 of 5).

Land-cover type	Characteristic plant species and distribution
Inter-Mountain Basins Mixed Salt Desert Scrub	Includes shrublands of typically saline basins, lower mountain slopes, and plains across the intermountain western United States. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more saltbush (*Atriplex*) species such as shadescale saltbush, fourwing saltbush, cattle saltbush, or spinescale saltbush.
Inter-Mountain Basins Playa	This ecological system is composed of barren and sparsely vegetated playas (generally less than 10 percent plant cover) found in the intermountain western United States. Salt crusts are common throughout, with small saltgrass beds in depressions and sparse shrubs around the margins. These systems are intermittently flooded. The water is prevented from filtering through the soil by an impermeable soil layer and is left to evaporate. Soil salinity varies greatly with soil moisture and greatly affects species composition. Characteristic species may include iodinebush, greasewood, spiny hopsage, Lemon's alkaligrass, basin wildrye, saltgrass, and saltbush.
Inter-Mountain Basins Semi-Desert Grassland	This widespread land-cover type occurs throughout the intermountain western United States on dry plains and mesas, at approximately 1,450 to 2,320 meters (4,800 to 7,600 feet) in elevation. These grasslands occur in a wide range of landscape locations and on varied soil types. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or codominated by Indian ricegrass, three-awns, blue grama, needle-and-thread grass, Torrey's muhly, or James's galleta, and may include scattered shrubs and dwarf-shrubs of species of sagebrush, saltbush, blackbrush, jointfir, snakeweed, or winterfat.
Inter-Mountain Basins Semi-Desert Shrub Steppe	This land-cover type occurs throughout the intermountain western United States, typically at lower elevations on alluvial fans and flats with moderate to deep soils. This semi-arid shrub-steppe is typically dominated by grasses (greater than 25 percent cover) with an open shrub layer, but includes sparse mixed shrublands without a strong grass layer. Characteristic grasses include Indian ricegrass, blue grama, inland saltgrass, needle-and-thread grass, James's galleta, Sandberg bluegrass, and alkali sacaton. The shrub layer is often a mixture of shrubs and dwarf-shrubs including fourwing saltbush, sand sagebrush, Greene's rabbitbrush, yellow rabbitbrush, jointfir, rabbitbrush, broom snakeweed, and winterfat.
Inter-Mountain Basins Wash	This barren and sparsely vegetated (generally less than 10 percent plant cover) land-cover type is restricted to intermittently flooded streambeds and banks that are often lined with *Sarcobatus vermiculatus*, rabbitbrush, Apache plume and/or silver sagebrush (in more northern and wetter stands). Spiny hopsage may also dominate in the Great Basin. Shrubs often form a continuous or intermittent linear canopy in and along drainages but do not extend out into flats.
Invasive Annual and Biennial Forbland	This land-cover type occurs in areas dominated by the invasive thistles (*Salsola* spp.), Mexican fireweed (*Kochia scoparia*), and halogeton (*Halogeton glomeratum*).
Invasive Annual Grassland	This land-cover type occurs in areas dominated by species of oats (*Avena* spp.), brome (*Bromus* spp.), and Mediterranean grasses (*Schismus* spp.).
Mojave Mid-Elevation Mixed Desert Scrub	This land-cover type represents the extensive desert scrub in the transition zone above creosote-burrobush desert scrub and below the lower montane woodlands (700 to 1,800 meters [2,300 to 5,900 feet] elevations) that occurs in the eastern and central Mojave Desert, around elevations of 700 to 1,800 meters. It is also common on lower slopes in the transition zone into the southern Great Basin. The vegetation in this land-cover type is quite variable. Codominant species include blackbrush, Eastern Mohave buckwheat, Nevada jointfir, spiny hopsage, spiny menodora, beargrass, buckhorn cholla, Mexican bladdersage, Parish's goldeneye, Joshua tree, or Mohave yucca.

Table H 1. Southwest Regional Gap Analysis Project land-cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 4 of 5).

Land-cover type	Characteristic plant species and distribution
North American Arid West Emergent Marsh	This land-cover type is found throughout much of the arid and semi-arid regions of western North America. Natural marshes may occur in depressions in the landscape (ponds), as fringes around lakes, and along slow-flowing streams and rivers (such riparian marshes are also referred to as sloughs). Marshes are frequently or continually inundated, with water depths up to two meters. Water levels may be stable, or may fluctuate one meter or more over the course of the growing season. Marshes have distinctive soils that are typically mineral, but can also accumulate organic material. Soils have characteristics that result from long periods of anaerobic conditions in the soils. The vegetation is characterized by herbaceous plants that are adapted to saturated soil conditions. Common emergent and floating vegetation includes species of bulrush, cattail, rush, pondweed, knotweed, pond-lily, and canarygrass. This system may also include areas of relatively deep water with floating-leaved plants and submergent and floating plants.
North American Warm Desert Bedrock Cliff and Outcrop	This ecological system is found from subalpine to foothill elevations and includes barren and sparsely vegetated landscapes (generally less than 10 percent plant cover) of steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous, sedimentary, and metamorphic bedrock types. Also included are unstable scree and talus slopes that typically occur below cliff faces. Species present are diverse and may include elephant tree, ocotillo, Bigelow's nolina, teddybear cholla, and other desert species, especially succulents. Lichens are predominant lifeforms in some areas. May include a variety of desert shrublands less than 0.02 square kilometer (5 acres) in size from adjacent areas.
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	This ecological system occurs in mountain canyons and valleys of southern Arizona, New Mexico, and adjacent Mexico and consists of mid- to low-elevation (1,100 to 1,800 meters [3,300 to 5,900 feet]) riparian corridors along perennial and seasonally intermittent streams. The vegetation is a mix of riparian woodlands and shrublands. Dominant trees include narrowleaf cottonwood, Rio Grande cottonwood, Fremont cottonwood, Arizona sycamore, Arizona walnut, velvet ash, and wingleaf soapberry. Shrub dominants include narrowleaf willow, plum, Arizona alder, and mule's fat. Vegetation is dependent upon annual or periodic flooding and associated sediment scour and annual rise in the water table for growth and reproduction.
North American Warm Desert Playa	This land-cover type is composed of barren and sparsely vegetated dry lakes (generally less than 10 percent plant cover) found across the warm deserts of North America. Playas form with intermittent flooding, followed by evaporation, leaving behind a saline or salty residue. Salt crusts are common, with small saltgrass beds present in depressions and sparse salt-tolerant shrubs around the margins. Soils often include an impermeable layer of clay. Large desert playas tend to be defined by vegetation rings formed in response to salinity. Given their common location in wind-swept desert basins, dune fields often form downwind of large playas. Species may include iodinebrush, seepweed, inland saltgrass, common spikerush, ricegrass, dropseed, crinklemat, or saltbush.
Sonora-Mojave Creosotebush-White Bursage Desert Scrub	This land-cover type forms the vegetation matrix in broad valleys, lower bajadas (masses of gravel and sand deposited by streams as they emerge from narrow mountain valleys), plains, and low hills in the Mojave and lower Sonoran deserts. This desert scrub is characterized by a sparse to moderately dense layer (2 to 50 percent cover) of small-leaved, drought-tolerant, and broad-leaved shrubs. Creosote and burrobush are typically dominants, but many different shrubs, dwarf-shrubs, and cacti may be present or form typically sparse understories.

Table H-1. Southwest Regional Gap Analysis Project land cover types within the Caliente rail alignment and Mina rail alignment study areas[a,b,c] (page 5 of 5).

Land-cover type	Characteristic plant species and distribution
Sonora-Mojave Mixed Salt Desert Scrub	This land-cover type includes extensive open-canopied shrublands of typically salty basins in the Mojave and Sonoran deserts. Stands often occur around playas. Substrates are generally fine-textured, saline soils. Vegetation is typically composed of one or more saltbush species such as fourwing saltbush or cattle saltbush along with other species of saltbush. Species of iodinebush, pickleweed, seepweed, or other salt-loving plants are often present to codominant. Grasses may include alkali sacaton or inland saltgrass at varying densities.

a. Species and distribution description are derived from DIRS 174324-NatureServe 2004, all, and field studies.
b. Sources: DIRS 174399-MO9901COV97208.000; DIRS 174324-NatureServe 2004, all; DIRS 174324-NatureServe 2004, all.
c. To convert meters to feet, multiply by 3.2808.

H.2.3 NOXIOUS WEEDS AND INVASIVE SPECIES

There are numerous species considered to be noxious weeds or invasive species present in the region. Table H-2 lists such species, including their scientific name and general habitat requirements. Several of these species have been designated by the State of Nevada as noxious. For these species, the table displays the Nevada Department of Agriculture noxious weed category, and discusses primary habitat characteristics associated with each species. These categories are defined as follows:

- Category A, weeds not found or that are limited throughout the state and are controlled wherever they are found
- Category B, weeds in scattered populations in some counties in Nevada and that are actively excluded where possible
- Category C, weeds that are widespread in many counties in Nevada

Table H-2. Noxious weeds and invasive species[a] (page 1 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
African mustard	*Malcolmia africana*	--	Found in disturbed areas and desert shrubland at elevations between 1,250 and 2,000 meters (4,100 to 6,600 feet).
Asian mustard	*Brassica tournefortii*	--	Found along roadsides and washes and in open areas below 800 meters (2,600 feet) in elevation. It is likely that the species will be designated as noxious by the state of Nevada in the near future.
Common crupina	*Crupina vulgaris*	A	Prefers well-drained, sandy, or loamy soils, and southern slopes on steep canyon grasslands. Also, it commonly grows along field edges, and in improved pastures, hayfields, and grass seed fields. It frequently infests gravel pits, roadsides, railroad embankments, and other rights-of-way. No information has been found that indicates it is or is not in Nevada.
Dalmation toadflax	*Linaria dalmatica*	A	Commonly found in cultivated fields, roadsides, railways, waste areas, clearcuts, overgrazed pastures and rangeland, and in plant communities that are typically open or disturbed. Neither Dalmation nor yellow toadflax (*Linaria vulgaris*) occur as frequently in intact wild lands and natural areas.

Table H-2. Noxious weeds and invasive species[a] (page 2 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
Downy brome/ cheatgrass	*Bromus tectorum*	--	Grows in many climatic conditions. It is found primarily in locations that receive 15 to 56 centimeters (6 to 22 inches) of precipitation. Cheatgrass will grow in almost any type of soil. Research shows that it is most often found on coarse-textured soils and does not grow well on heavy, dry, or saline soils. Cheatgrass has been found growing in eroded soil areas and areas low in nitrogen. It grows in a narrow range of soil temperatures. It has been found in Nye and Esmeralda Counties (DIRS 174674-Carpenter and Murray [n.d.], all).
Dyer's woad	*Isatis tinctoria*	A	Found on disturbed and undisturbed sites, roadsides, railroad rights-of-way, fields, pastures, grain and alfalfa fields, forests, and rangeland. The species can grow on dry, rocky, or sandy soils.
Hoary cress/ Whitetop	*Cardaria draba*	C	Grows well in many environments, but they commonly grow in disturbed, alkaline soils with moderate moisture or acidic soils with limited moisture. They grow well in sub-irrigated pastures, hay fields (especially alfalfa), rangeland meadows, along roadsides, ditch banks, and in many other unshaded disturbed areas. They are aggressive invaders in much of Nevada because their seeds germinate and plants grow in moderately salty soils.
Halogeton	*Halogeton glomeratus*	--	An annual that is often found along rail roadbeds, roads, trails, and other places where the soil has been disturbed, in areas that have been overgrazed or burned over, and on dry lake beds. It can tolerate very saline soils. It cannot effectively compete with healthy native vegetation, but can form dense stands where native vegetation is sparse (DIRS 174505-Torell, Young, and Kvasnicka 2005, p. 1-3).
Houndstongue	*Cynoglossum officinale*	A	Can survive hot, dry summers, as well as cold winters. It is found on a variety of soils from well-drained, relatively coarse, alkaline soils to clay subsoil. It is tolerant of shade and prospers in wetter grasslands. It is found on roadsides, meadows, and disturbed places. Houndstongue has been found in Elko County, Nevada and can quickly spread to other areas of the state.
Klamath weed/ common St. Johnswort/ goatweed	*Hypericum perforatum*	A	A large, bushy plant that prefers dry, sandy, or gravelly soils and open, sunlit areas. It can be found in pastures, pinyon-juniper woodlands, foothill forests, waste places, and along roadsides. It may dominate a site as a monoculture. Klamath weed spreads by seed and by creeping horizontal stems that root when they touch the ground (DIRS 174671-Graham & Johnson [n.d.], all).
London rocket/ Tumbling mustard	*Sisymbrium irio*	--	Is common in irrigated cropland and orchards, and disturbed areas such as roadsides, fence lines, and ditches below 800 meters (2,600 feet) elevation.

Table H-2. Noxious weeds and invasive species[a] (page 3 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
Medusahead	*Taeniatherum caput-medusae*	B	Invades grasslands, oak savannah, oak woodland, and chaparral communities. It grows in a wide range of climatic conditions. Clay or clay-loam soils with at least 25.4 centimeters (10 inches) of rainfall annually are most susceptible to invasion. However, medusahead has been found on coarse-textured soils, as well.
Musk thistle	*Carduus nutans*	B	Musk thistle is found in saline soils in low valleys to acidic soils at 3,048 meters (1,000 feet). It prefers moisture and sunlight, and it often grows in pastures, construction sites, ditches, and rangeland (DIRS 174670-Kadrmas and Johnson [n.d.], all).
Perennial pepperweed/Tall whitetop	*Lepidium latifolium*	C	Infests wet sites along streams, rivers, and wetlands. It is found in riparian areas of the entire western United States. Tall whitetop is very tolerant of salty soils and adapts well to many sites under adverse conditions. It is found in native hay meadows, abandoned agricultural lands, pastures, hayfields, residential areas, and along roadsides.
Purple loosestrife	*Lythrum salicaria*	A	Moist soils, especially on the fringes of water bodies and is potentially found around Meadow Valley Wash and the Amargosa River areas.
Red brome	*Bromus rubens*	--	A cool-season annual bunchgrass that commonly grows in open, disturbed areas below 1,524 meters (5,000 feet) elevation. It is less frost-tolerant than the closely related cheatgrass, and is more common in the Mojave region that in the Great Basin. It can form extensive monocultures, which, as the fine textured plants dry in the summer, dramatically increases the frequency of wildfires (DIRS 174673-Newman 1992, all).
Russian knapweed	*Acroptilon repens*	B	Common along roadsides, riverbanks, irrigation ditches, pastures, waste places, clearcuts, and croplands. Russian knapweed does not establish readily in healthy, natural habitats. It typically invades disturbed areas, forming dense single-species stands. Once established, Russian knapweed inhibits the growth of nearby plants to spread outward into undisturbed areas. Specimens have been found in Nye, Clark, and Esmeralda Counties.
Russian olive	*Elaeagnus angustifolia*	--	Invasive in many states and typically inhabits disturbed areas. It fixes nitrogen and can therefore persist in poor soils. It is drought and salt tolerant. In the Great Basin it grows at elevations of 240 to 600 meters (790 to 2,000 feet). It has been found in Meadow Valley Wash.

Table H-2. Noxious weeds and invasive species[a] (page 4 of 4).

Common name(s)	Scientific name	Noxious weed category[b]	Habitat[c]
Russian thistle	*Salsola spp.*	--	An annual that grows along fence lines, crop margins, and roadsides, in areas that have been overgrazed, and other places where the native vegetation has been disrupted. Its seeds are spread when the plant dies in the autumn and breaks free from its roots, allowing it to tumble freely in the wind (hence, the common name, "tumble weed"). Like halogeton, it can not effectively compete with intact communities of native vegetation (DIRS 174498-Taylor 1992, p. 66).
Saltcedar	*Tamarix ramosissima*	C	Requires a large amount of groundwater, and is most common in riparian areas and areas with a seasonally-high water table. The amount of water used by the species can lower the water table that supplies springs and shallow wells. It is extremely salt tolerant and accumulate salts in its deciduous leaves, which, when dropped, create soil conditions beneath the plant that are too salty for most other species to grow.
Scotch thistle	*Onopordum acanthium*	B	An invasive weed that infests disturbed and neglected lands. It prefers sites near ditch banks and rivers but also infests pastureland, crops, rangeland, and roadsides. Although scotch thistle prefers disturbed areas with high soil moisture, drier areas do not limit its invasive nature. It commonly invades overgrazed lands, rangeland, pastures, roadsides, and construction sites.
Spotted knapweed	*Centaurea maculosa*	A	Found in rangelands that have disturbed soils and that receive less than 20 centimeters (7.9 inches) of precipitation annually. Spotted knapweed is believed to produce a substance that retards the growth of other nearby species (DIRS 174672-Graham & Johnson [n.d.], all).
Yellow starthistle	*Centaurea solstitalis*	A	Found in rangelands that receive less than 38 centimeters (15 inches) of annual precipitation, grows in disturbed areas such as roadside ditches and construction areas, and is also found on rangelands and hay pastures. It has been observed in Clark County (DIRS 174669-Johnson et al. [n.d.]).
Yellow toadflax/ Butter-n-eggs	*Linaria vulgaris*	A	Commonly found in cultivated fields, roadsides, railways, waste areas, clearcuts, overgrazed pastures and rangeland, and in plant communities that are typically open or disturbed. It is not found as frequently in intact wild lands and natural areas.

a. Source: DIRS 130301-Hickman 1993, all.

b. Nevada Department of Agriculture noxious weed category definitions: A = weeds not found or limited in distribution throughout the state, controlled wherever found; B = weeds established in scattered populations in some counties of the state, actively excluded where possible; C = weeds currently established and generally widespread in many counties of the state (DIRS 174543-NDOA 2005, all).

c. To convert meters to feet, multiply by 3.2808; to convert centimeters to inches, multiply by 0.3937.

H.3 Wildlife

H.3.1 METHODS

H.3.1.1 Research

DOE gathered information regarding wildlife potentially found within the study area of the Caliente rail alignment and Mina rail alignment from reviews of BLM resource management plans, field guides, NatureServe database, discussion with and acquisition of GIS data from federal and state agencies (BLM, NDOW), and field observations. Using the information gathered from these sources, DOE developed general descriptions and locations of the wildlife communities relative to the proposed alignments, including sage-grouse habitat and mule deer, elk, and antelope winter and summer range.

H.3.1.2 Field Surveys

DOE did not perform field surveys specifically to characterize the wildlife communities along the Caliente and Mina rail alignments. Wildlife observed during the surveys discussed in Section H.3.1.2 were documented and included in the field notes and data sheets. All surveys were conducted during daylight hours; therefore, field personnel would not have observed species that are exclusively nocturnal, but they recorded signs or other indicators of the presence of these species.

H.3.1.2.1 Sage-Grouse Habitat Quality Surveys

DOE performed field surveys in habitat for greater sage-grouse (*Cetrocercus urophasianus*) and other sage-dependent species. To assess the quality of sagebrush (*Artemisia* ssp.) habitat, the percentage of sagebrush cover and sagebrush height were measured along 18, 50-meter (160-feet) transects along the rail alignments within sage-grouse population management units. DOE performed assessments of sagebrush habitat for potential suitability as winter habitat for sage-grouse from February 27, 2005 through March 9, 2005, along the Caliente rail alignment.

At sites predetermined for sage-grouse habitat surveys, a sage-grouse habitat transect was set up as an extension of the previously completed vegetation survey, in the same direction and along the same bearing. A 50-meter (160-foot) tape measure was staked and stretched out along the alignment from the predetermined transect start point. A digital photo was taken, Universal Transverse Mercator coordinates collected and recorded, and a wooden stake driven into the ground at the beginning and end of transects. On data sheets, a sample of which is presented in Figure H-4, sagebrush canopy cover (by species of sagebrush, *Artemisia* spp.) was recorded using the line-intercept method that required measuring the amount of live sagebrush that occurs along the line created by the tape measure. Gaps in live canopy of less than 5 centimeters (2 inches) were ignored. Additionally, at each 5-meter (16-foot) increment along the tape, starting at the 5-meter (16-foot) point, the height and species of the nearest sagebrush plant were recorded.

Sage-grouse habitat quality surveys were not performed for the Mina alignment since there is no designated sage-grouse habitat within the study area.

H.3.1.2.2 Big Game Surveys

For big game surveys, the appropriate BLM or Nevada Department of Wildlife management unit was identified and overlain on the proposed rail alignment study area. DOE conducted big game surveys in areas where the proposed rail alignment and documented big game habitat would intersect. Field study included the survey of 66, 800-meter (2,600-foot) transects along the length of the proposed rail alignment to identify signs of habitat use by big game species. An 800-meter transect was chosen to take into consideration indirect impacts, which is 500 meters (1,640 feet) beyond the 300-meter (1,000-foot)-wide proposed construction right-of-way. Rather than attempt to describe population sizes or habitat quality, these field surveys were designed specifically to determine use of the areas near the proposed rail alignment by game species. DOE conducted field surveys, which included track and pellet counts, to verify use of the area and identify important migration corridors. Section H.5 provides additional information on the big game surveys (methods and equipment).

H.3.2 WILDLIFE COMMUNITIES

Sections 3.2.7 and 3.3.7 of the Rail Alignment EIS describe the wildlife species potentially occurring within the Caliente and Mina rail alignments regions of influence, respectively. However, in several cases, the list of species in several groups of wildlife were too numerous and the data too extensive to include in those sections. Therefore, the information is included in this appendix.

Table H-3 lists the game species identified in the Nevada Administrative Code Sections 503.020, 503.045, 503.060 and their occurrence in the biological resources study area for the Caliente and Mina rail alignments. Table H-4 lists bird species and their occurrence within the study area for the Caliente and Mina rail alignments. Table H-5 lists the protection status, a description of preferred habitat, and the probability of occurrence for 23 bat species potentially found along the Caliente and Mina rail alignments. Table H-6 lists amphibians and reptiles potentially found along the Caliente and Mina rail alignments, including their protection status and a description of preferred habitat.

H.3.3 IMPACT ANALYSIS

DOE assessed potential adverse impacts on wildlife as a result of the Proposed Action described in Chapter 2 of the Rail Alignment EIS, based on the review of Nevada Department of Wildlife datasets, review of BLM resource management plans, and field observations. Direct long-term impacts include the loss of and fragmentation of habitat and potential death of individuals. Indirect short-term impacts include avoidance, change in movement patterns, and potential contamination of water resources in the event of derailment. The potential for impacts on game species, including mule deer, elk, antelope, and sage-grouse, were determined based on the location of the rail line, facilities, and quarries in relation to their identified habitat range. In addition, DOE used the SWReGAP data and field observations to determine the likelihood of an occurrence of a particular species based on its known preferred habitat and the vegetation community present.

The magnitude of impact was determined based on the type of habitat (such as crucial winter range, yearlong, migratory corridor) through which the rail line would pass. A small impact to wildlife would neither destabilize nor noticeably alter the species' habitat or population. A moderate impact would noticeably alter a species' habitat or population, but would not destabilize it. A large impact would significantly alter or destabilize a species' habitat and population. However, no large impacts were found to occur in the analysis.

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:		LOCATION:	TRANSECT BEARING:
	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):					
TRANSECT START PHOTO:			TRANSECT END PHOTO:			
SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvuial Fan Slope Cliff/Scarp Other		LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other		
SW REGAP CLASS:						
ESTIMATED DOMINANT SPECIES:						

Big sagebrush intercepts (include units)	Total	% Cover

Big Sagebrush Height at: (ARTRT)	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m

Other sagebrush spp. intercepts (include units)	Total	% Cover

Other Sagebrush Height at:	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m

Figure H-4. Data sheet for assessing sage-grouse habitat quality.

Table H-3. Nevada game species[a] and their occurrence in the biological resources study areas for the Caliente and Mina rail alignments (page 1 of 2).

Common name	Scientific name	Occurrence within the study area[b] Caliente rail alignment	Mina rail alignment
Game mammals			
Pronghorn antelope	*Antilocapra americana*	Present	Present
Black bear	*Ursus americanus*	Absent	Absent
Mule deer	*Odocoileus hemionus*	Present	Present
Mountain goat	*Oreamnos americanus*	Absent	Absent
Mountain lion	*Felis concolor*	Present	Present
Moose	*Alces alces*	Absent	Absent
Peccary	*Pecari angulatus*	Absent	Absent
Cottontail rabbit	*Sylvilagus* spp	Present	Present
Pygmy rabbit	*Sylvilagus idahoensis*	Present	Absent
Snowshoe rabbit	*Lepus americanus*	Absent	Absent
Black-tailed jackrabbit	*Lepus californicus*	Present	Present
Bighorn sheep	*Ovis canadensis*	Present	Present
Elk	*Cervus elaphus*	Present	Present
Upland and migratory game birds			
Blue grouse	*Dendragapus obscurus*	Absent	Absent
Ruffed grouse	*Bonasa umbellus*	Absent	Absent
Sage-grouse	*Centrocercus urophasianus*	Potentially present	Potentially present
Sharp-tailed grouse	*Tympanuchus phasianellus*	Absent	Absent
Chukar	*Alectoris chukar*	Present	Present
Gray (Hungarian) partridge	*Perdix perdix*	Absent	Absent
Snow partridge	*Tetrogallus himalayensis*	Absent	Absent
Ring-necked pheasant	*Phasianus colchicus*	Present	Present
White-wing pheasant	*Phasianus colchicus*	Absent	Absent
Northern bobwhite quail	*Colinus virginianus*	Absent	Absent
California quail	*Callipepla californicus*	Absent	Absent
Gambel's quail	*Callipepla gambelii*	Present	Present
Mountain quail	*Oreortyx pictus*	Absent	Absent
Scaled quail	*Callipepla squamata*	Absent	Absent
Wild turkey	*Meleagris gallopavo*	Present	Present
American crow	*Corvus brachyrhynchos*	Present	Present
Ducks, geese, and swans	Family *Anatidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas
Wild doves and pigeons	Family *Columbidae*	Present	Present
Cranes	Family *Gruidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas
Rails, coots, and gallinules	Family *Rallidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas

Table H-3. Nevada game species[a] and their occurrence in the biological resources study areas for the Caliente and Mina rail alignments (page 2 of 2).

Common name	Scientific name	Occurrence within the study area[b]	
		Caliente rail alignment	Mina rail alignment
Woodcocks and snipes	Family *Scolopacidae*	Present only in wetland/marsh areas	Present only in wetland/marsh areas
Game fish			
Bonneville cutthroat trout	*Oncorhynchus clarki utah*	Absent	Absent
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Absent	Present
Snake River cutthroat trout	*Oncorhynchus clarki bouvieri*	Absent	Absent
Salmon	*Oncorhynchus* ssp.	Absent	Absent
Atlantic salmon	*Salmo salar*	Absent	Absent
Brook trout	*Salvelinus fontinalis*	Absent	Absent
Brown trout	*Salmo trutta*	Absent	Present
Bull trout	*Salvelinus confluentis*	Absent	Absent
Lake trout	*Salvelinus namyaycush*	Absent	Absent
Rainbow trout	*Oncorhynchus mykiss*	Absent	Present
Redband trout	*Oncorhynchus mykiss gibbsi*	Absent	Absent
Mountain whitefish	*Prosopium williamsoni*	Absent	Present
Black bullhead	*Ameiurus melas*	Absent	Absent
Brown bullhead	*Ameiurus nebulosus*	Absent	Absent
Channel catfish	*Ictalurus punctatus*	Absent	Present
White catfish	*Ameiurus catus*	Absent	Present
Striped bass	*Morone saxatilis*	Absent	Absent
White bass	*Morone chrysops*	Absent	Present
Largemouth black bass	*Micropterus salmoides*	Absent	Present
Smallmouth black bass	*Micropterus dolomieu*	Absent	Absent
Spotted bass	*Micropterus punctulatus*	Absent	Present
Black crappie	*Pomoxis nigromaculatus*	Absent	Absent
White crappie	*Pomoxis annularis*	Absent	Present
Sacramento perch	*Archoplites interruptus*	Absent	Absent
Yellow perch	*Perca flavescens*	Absent	Present
Bluegill sunfish	*Lepomis macrochirus*	Absent	Present
Green sunfish	*Lepomis cyanellus*	Absent	Absent
Redear sunfish	*Lepomis microlophus*	Absent	Absent
Walleye	*Stizostedion vitreum*	Absent	Present

a. Source: Nevada Administrative Code Sections 503.020, 503.045, and 503.060.
b. Sources: DOE field surveys; DIRS 182061-NNHP 2005; BLM RMPs (DIRS 174518-BLM 2005; DIRS 103079-BLM 1998; DIRS 173224-BLM 1997; DIRS 179560-BLM 2001).

Table H-4. Non-game bird species and their potential occurrence in the biological resources study areas for the Caliente and Mina rail alignments[a] (page 1 of 3).

Common name	Scientific name	Description	Potential occurrence Caliente	Potential occurrence Mina
Northern goshawk	*Accipiter gentilis*	Feeds on small mammals, nests in large tree limbs or crotch of tree.	Low	Low
Tricolored blackbird	*Agelaius tricolor*	Found in riparian habitat and grasslands; nests in marsh thickets.	None	None
Sage sparrow	*Amphispiza belli*	Prefers sagebrush or shadscale scrub; nests in depression on ground or in shrub.	High	High
Golden eagle	*Aquila chrysaetos*	Found in high deserts shrub habitat and montane; feeds on small mammals, birds, fish, insects; nests usually in tall trees or cliffs.	Low	Low
Long-eared owl	*Asio otus*	Nests in woodlands and hunts in open grasslands.	Low	Low
Western burrowing owl	*Athene cunicularia hypugaea*	Found in grassy shrub-steppe and juniper-pinyon woodlands; feeds on small mammals, frogs, birds; nests in abandoned burrows on ground.	Moderate	Low
Juniper titmouse	*Baeolophus griseus*	Found in pinyon-juniper woodlands; nests in tree cavities.	None	Low
Ferruginous hawk	*Buteo regalis*	Prefers open grassland and shrub-steppe communities; nests in various sites including trees, cliffs, power poles, and hillsides.	Moderate	Moderate
Red-tailed hawk	*Buteo jamaicensis*	Found in open shrub-steppe and montane; feeds on small mammals, birds, reptiles, insects; nests in tree branches.	High	High
Swainson's hawk	*Buteo swainsoni*	Feeds on reptiles, rodents, birds, insects; nests in tree or bush, power pole or cliff.	High	High
Western snowy plover	*Charadrius alexandrinus nivosus*	Found in sandy areas, salt flats, and shorelines; eats insects and aquatic invertebrates.	Low	High
Mountain plover	*Charadrius montanus*	Prefers grasslands, plowed fields, and sandy deserts; nests on ground in short grass or bare ground.	Low	Low
Black tern	*Chlidonia niger*	Found in desert marshlands.	Low	Low
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Found in thick riparian habitats or forests; nests in cottonwood trees.	Low	Low
Yellow warbler	*Dendroica petechia*	Found in riparian communities; nests in tree or shrub branches.	Low	Low
Southwestern willow flycatcher	*Empidonax traillii extimus*	Found in thick riparian areas with mature willow.	Low	Low

Table H-4. Non-game bird species and their potential occurrence in the biological resources study areas for the Caliente and Mina rail alignments [a] (page 2 of 3).

Common name	Scientific name	Description	Potential occurrence Caliente	Potential occurrence Mina
Prairie falcon	*Falco mexicanus*	Found in grasslands, alkali meadows and lower elevation montane; feeds on mammals, birds, insects; nests in high ledges.	Moderate	Moderate
Peregrine falcon	*Falco peregrinus*	Nests in high cliffs near water; feeds on mostly fish and waterfowl.	None	Low
Common loon	*Gavia immer*	Lakes with deep and shallow areas.	None	None
Common yellowthroat	*Geothlypis trichas*	Found in marshes, riparian areas; nests in cattails, brush, or grasses near water.	None	Low
Greater sandhill crane	*Grus Canadensis tabida*	Marsh areas or agricultural fields.	None	None
Pinyon jay	*Gymnorhinus cyanocephalus*	Prefers pinyon-juniper woodlands; nests in colonies.	None	Low
Bald eagle	*Haliaeetus leucocephahis*	Feeds on fish, small mammals, birds; nests near rivers and lakes in tall trees.	None	Low
Harlequin duck	*Histriontcus histrionicus*	Lakes.	None	None
Yellow-breasted chat	*Icteria virens*	Found in woodlands, scrub, fence rows; nests in bushes or trees in dense vegetation.	None	Low
Loggerhead shrike	*Lanius ludovicianus*	Found in shrub-steppe and pinyon-juniper woodlands; nests in bush or tree.	High	High
Long-billed curlew	*Numenius americanus*	Found in grasslands and wet meadows; nests on ground in short grasslands.	Moderate	Low
Macgillivray's warbler	*Oporornis tolmiei*	Prefers shrubby riparian woodlands; nests on ground.	None	Low
Flammulated owl	*Otus flammeolus*	Found in pinyon-juniper woodlands; feeds on insects.	Low	Moderate
Osprey	*Pandion haliaetus*	Near lakes and rivers with fish; nests in tall trees, power poles, towers.	None	Low
American white pelican	*Pelicanus erythrorhynchos*	Rivers, lakes, reservoirs.	None	None
Vesper sparrow	*Pooecetes gramineus*	Found in prairies, dry shrublands, sagebrush communities; nests on ground.	Moderate	Moderate
White-faced ibis	*Plegadis chihi*	Marshes, ponds, rivers; nests in low trees, bulrushes, or on a floating mat.	None	Low
Phainopepla	*Phainopepla nitens*	Found in pinyon-juniper or shadscale scrub; feeds on insects or berries.	Low	Low
Yuma clapper rail	*Rallus longirostris yumaensis*	Freshwater habitats with bulrushes and cattails.	None	Low
Red-naped sapsucker	*Sphyarpicus nuchalis*	Found mostly in montane forests or riparian woodlands; nests in dead trees.	Low	Low

Table H-4. Non-game bird species and their potential occurrence in the biological resources study areas for the Caliente and Mina rail alignments[a] (page 3 of 3).

Common name	Scientific name	Description	Potential occurrence Caliente	Potential occurrence Mina
Sage thrasher	*Oreoscoptes montanus*	Found in sagebrush shrub communities; feeds on insects on the ground; nests in sagebrush or on ground in concealed nests.	High	High
Crissal thrasher	*Toxostoma crissale*	Found in desert scrub, tall riparian brush or chaparral; nests in low tree or shrub.	Low	Low
Orange-crowned warbler	*Vermivora celata*	Found in low elevation shrub communities; nests on ground.	Low	Low
Lucy's warbler	*Vermivora luciae*	Found in deserts or riparian woodlands; nests in tree cavity.	Low	Low
Gray vireo	*Vireo vivinior*	Found in shrub-steppe and pinyon-juniper woodlands.	Moderate	Moderate
Wilson's warbler	*Wilsonia pusilla*	Prefers open areas in moist woodlands or thickets; nests on ground at base of shrub.	Low	Low

a. Sources: DIRS 182061-Hopkins 2006, all; DIRS 181899-USAF 2007, p. 40; DIRS 174518-BLM 2005, p. 3.6-10; DIRS 103079-BLM 1998; DIRS 182067-List Serve 2007; DIRS 174412-Ryser 1985, all.

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 1 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Antrouzous pallidus	Pallid bat	Nevada protected, BLM-sensitive	Statewide, year-round resident, records in vicinity of alignment, especially around the Yucca Mountain repository area.	High	High
Choeronycteris mexicana	Mexican long-tongued bat	Unprotected	Known only from one individual found in Las Vegas. Extreme northern edge of range. Prefers desert canyons with riparian vegetation.	Low	None
Corynorhinus townsendii	Townsend's big-eared bat	Nevada sensitive, BLM-sensitive	Statewide, year-round resident; highly dependent on caverns and mines, susceptible to disturbance.	High	High
Eptesicus fuscus	Big brown bat	BLM-sensitive	Statewide, year-round resident; tolerant of and uses human-built structures.	High	None

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 2 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Euderma maculatum	Spotted bat	Nevada threatened, BLM-sensitive	Scattered across Nevada, typically at higher elevations; roosts in cliff faces. Only Nevada mammal classified as threatened.	Moderate	Moderate
Eumops perotis californicus	Greater western mastiff bat	Nevada sensitive, BLM-sensitive	Only one dead specimen found in Las Vegas; occurs in various habitats ranging from desert scrub to montane coniferous forests; typically roosts in cliff crevices and boulder cracks, does not appear to hibernate.	Low	None
Idionycteris phyllotis	Allen's lappet-browed bat	Nevada protected, BLM-sensitive	Recorded only in Clark County, but may occur as far north as southern Lincoln and Nye Counties. Probable resident that migrates from higher summer elevations to lower winter elevations; typically roosts in tree cavities, but has been observed in mines and caverns.	Low	Low
Lasionycteris noctivagans	Silver-haired bat	BLM-sensitive	A forest-associated species, more common in mature forests; found primarily at higher latitudes and altitudes in coniferous and mixed deciduous/coniferous forests of pinyon-juniper, subalpine fir, white fir, limber pine, aspen, cottonwood, and willow. Probably a transient spring and fall migrant.	Low	Low
Lasiurus blossevillii	Western red bat	Nevada sensitive, BLM-sensitive	Forest-dwelling, thought to be a transient, very rare in Nevada, only two records until 1999 and development of acoustic detecting equipment. Three acoustical records have occurred since.	Low	Low
Lasiurus cinereus	Hoary bat	BLM-sensitive	Rare in Nevada, thought to be primarily a summer migrant, tree roosting.	Low	Low
Lasiurus xanthinus	Western yellow bat	Unprotected	Closely associated with fan-palms, found in palm groves in upper Moapa Valley. May be expanding its range due to use of palms in urban landscaping.	Low	None
Macrotus californicus	California leaf-nosed bat	Nevada sensitive, BLM-sensitive	No observations have occurred north of Clark County.	Low	None

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 3 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Myotis califorincus	California myotis	BLM-sensitive	Resident throughout Nevada, widespread and locally common; will roost anywhere from caves to buildings to exfoliating tree bark. Found in habitats from desert scrub to forests.	High	High
Myotis ciliolabrum	Small-footed myotis	BLM-sensitive	Statewide resident; tends to prefer mid to high elevations in southern Nevada. Roosts in trees, mines, and caves. Inhabits a variety of habitats including desert scrub, grasslands, sagebrush steppe, blackbrush, greasewood, pinyon-juniper woodlands, pine-fir forests, agriculture, and urban areas.	High	High
Myotis evotis	Long-eared myotis	BLM-sensitive	Year-round, high elevation forest-dwelling resident. In southern part of Nevada found only in ponderosa forests. Roosts in hollow trees, under exfoliating bark, crevices in small rock outcrops, and occasionally in mines, caves, buildings, and bridges.	Low	Low
Myotis lucifugus	Little brown myotis	BLM-sensitive	Probably a year-round resident, found in the northern part of Nevada in high elevation coniferous forests. Must be close to water; day roosts in hollow trees, rock outcrops, buildings, and occasionally mines and caves. One of the species most commonly found in human structures.	Low	Low
Myotis thysanodes	Fringed myotis	Nevada protected, BLM-sensitive	Year-round resident of southern and central Nevada. Widespread but rare. Roost and nursery areas are easily disturbed; roosts in mines, caves, trees, and buildings.	Moderate (historic occurrence in Beatty area)	Moderate (historic occurrence in Beatty area)
Myotis velifer	Cave myotis	BLM-sensitive	Only recorded in one location in extreme southern Nevada at the Lake Mead National Recreational Area. Typically roosts in caves and bridges, commonly observed using swallow nests.	Low	None

Table H-5. Bat species' protection status and occurrence along the Caliente and Mina rail alignments[a] (page 4 of 4).

Scientific name	Common name	Protection status	Description	Probability of occurrence along Caliente rail alignment	Probability of occurrence along Mina rail alignment
Myotis volans	Long-legged myotis	BLM-sensitive	Probable resident found throughout Nevada, but more commonly in the north and central portions. Appears to prefer pinyon-juniper, Joshua tree woodlands, and montane coniferous forest habitats. Not found in low desert. Roosts in hollow trees and hibernates in caves and mines, but also uses rock crevices, caves, mines, and buildings.	Moderate (historic occurrence in Beatty area)	Moderate (historic occurrence in Beatty area)
Myotis yumanensis	Yuma myotis	BLM-sensitive	Tends to occur in the western and southern portions of Nevada, but recent records from eastern Nevada indicate it might be more widespread. Inhabits various habitats including sagebrush, salt desert scrub, agriculture, playa, and riparian habitats. One of few bat species that thrive in urban environments.	Low	Low
Nyctinomops macrotis	Big free-tailed bat	BLM-sensitive	Observed only in Clark County. Appears to be a transient, but has been commonly seen in the fall along the Muddy River basin.	Low	Low
Pipestrellus hesperus	Western pipistrelle	BLM-sensitive	Resident found throughout Nevada but is more prevalent in the south and west areas of the state. Prefers desert habitats of blackbrush, creosote, salt desert shrub, and sagebrush. In the summer, roosts in crevices, snags, under rocks, or in buildings. Hibernates in caves and mines in the winter.	High	High
Tadarida braziliensis	Brazilian free-tailed bat	Nevada protected, BLM-sensitive	A summer resident scattered across Nevada but commonly found in the southern portion. A ubiquitous colonial rooster, will use cliff faces, mines, caves, buildings, bridges, and hollow trees. Some summer colonies have up to 100,000 bats.	High	High

a. Source: DIRS 181865-Bradley et al. 2006, all.

Table H-6. Reptile and amphibian species occurrence along the Caliente and Mina rail alignments.[a]

Scientific name	Common name	Protection status	Description
Amphibians			
Ambystoma tigrinum	Tiger salamander	None	Found in ponds, reservoirs, streams, and stock ponds in deserts, sagebrush areas, grasslands, and mountain meadows.
Bufo boreas nelsoni	Amargosa toad	BLM-sensitive	Found in or near springs and wet meadows. Takes shelter under shrubs, woody material, and rocks, and may be found in rodent burrows.
Bufo cognatus	Great Plains toad	None	Found in streams, marshes, irrigation ditches, flooded fields, and adjacent creosote bush desert or sagebrush areas.
Bufo microscaphus	Southwestern toad	BLM-sensitive	May be found in cottonwood-willow associations, creeks, pools, irrigation ditches, flooded fields, and reservoirs.
Bufo punctatus	Red-spotted toad	None	Found in rocky, desert streams and adjacent open grassland and scrubland.
Bufo woodhousei	Woodhouse's toad	None	Found in grasslands, floodplains, and sagebrush flats and sandy areas near streams, marshes, and irrigation ditches.
Rana catesbeiana	Bullfrog	None	Found in ponds or slow moving streams with thick aquatic vegetation.
Rana pipiens[b]	Northern leopard frog	Nevada protected	Found in banks and shallow portions of marshes, ponds, lakes, reservoirs, beaver ponds, streams, and other bodies of permanent water. Also found in irrigation ditches and wet meadows.
Hyla regilla	Pacific treefrog	None	Found in grasslands, woodlands, farmlands, and desert areas in ponded wetlands, reservoirs, roadside ditches, and slow streams.
Scaphiopus intermontanus	Great Basin spadefood	None	Found in wet areas within pinion-juniper woods and sagebrush flats.
Reptiles			
Gopherus agassizii	Desert tortoise	Threatened	Found in desert shrubland habitat in the Mojave Desert.
Sauromalus obesus[b]	Common chuckwalla	None[c]	Found in rocky areas (rocky outcrops, lava flows, and rocky hillsides) within the Great Basin, Mohave, and Sonoran Deserts.

a. Source: DIRS 174414-Stebbins 2003, pp. 152, 204, 209, 211, 212, 213, 214, 215, 223, and 241.
b. Recorded only along the Mina rail alignment.
c. Being considered for a status change to "species of concern" in Nevada.

H.4 Special Status Species

H.4.1 METHODS

H.4.1.1 Research

DOE obtained information on federally and state-protected species from the Nevada Natural Heritage Program (DIRS 182061-NNHP 2005, all), an element occurrence database that maintains an inventory on the locations, biology, and conservation status of all threatened, endangered, sensitive, and at-risk species and biological communities in the state. DOE obtained additional information through discussions with resource management agencies and reviewing BLM resource management plans and similar documents. DOE consultation with the FWS provided a list of species protected under the Endangered Species Act that could occur along the Caliente and Mina rail alignments. Using the information gathered from these sources, DOE mapped species locations within the study area, and used the information for on-site verification investigations in 2005 (Caliente rail alignment) and 2007 (Mina rail alignment) and for the assessment of potential impacts.

H.4.1.2 Field Surveys

DOE conducted field surveys for sensitive plant species, sage-grouse habitat quality, and big game habitat use along the Caliente rail alignment in 2005 and along the Mina rail alignment in 2007 to support the evaluations of potential impacts of the proposed project on these resources. Section H.4.1.2.1 describes the methods DOE used for these surveys.

H.4.1.2.1 Sensitive Plant Species Surveys

DOE performed surveys for sensitive plant species along the Caliente rail alignment from May 6 through May 16, 2005 and along the Mina rail alignment during the field surveys described in Section H 2.1.2. DOE used the same field equipment described for the previous vegetation surveys for the sensitive plant species surveys. Field personnel used a datasheet to record the data gathered during these surveys (see Figure H-5).

Transects were centered along the rail alignments at the point closest to the known sensitive species location, as documented by the Nevada Natural Heritage Program element occurrence database (DIRS 182061-NNHP 2005, all). Locations of the start and end of the transect were recorded using a geographic positioning system unit, and the transect was photographed and staked. Two teams of two biologists examined the area for presence of the species in question; the two teams went in opposite directions with each team member walking 30 meters (100 feet) from the rail alignment centerline for 1 kilometer (0.6 mile). They covered a total distance of 2 kilometers (1.2 miles) in search of the target species or indicative habitat or sign. After reaching the end point of the transect, the biologists spread out an additional 30 meters from their original line and walked the transect back to the starting point. This approach resulted in a 2-kilometer (1.2-mile)-long, 180-meter (590-foot)-wide transect being inspected. When target species were located, the habitat and associated plant community surrounding the target species were documented to evaluate for uniqueness. The locations of locally rare or sparsely distributed species were determined and recorded using a geographic positioning system receiver, and photographed. For species that were locally common, individual plants were counted and their distribution was assessed and recorded on the data sheets shown in Figure H-3.

H.4.1.3 Impact Analysis

Potential adverse impacts on special status species as a result of the proposed actions provided in Chapter 2 were assessed based on the review of the NNHP dataset, review of BLM resource management plans, and field observations. Direct long-term impacts include the loss of and fragmentation of special status species suitable habitat and potential death of individuals. Indirect impacts include potential avoidance and/or displacement of animal species during construction and disturbance from passing trains. The potential for impacts on special status species was determined based on the location of the documented occurrence within the study area and in relation to the rail line, facilities, and quarries. In addition, DOE used the SWReGAP data and field observations to determine the likelihood of an occurrence of a particular species based on its known preferred habitat and the vegetation community present.

The magnitude of impact was determined based on the type of habitat. A small impact to a special status species would neither destabilize nor noticeably alter the species' habitat or population. A moderate impact would noticeably alter a species' habitat or population, but would not destabilize it. A large impact would significantly alter or destabilize a species' habitat and population. However, no large impacts were found to occur in the analysis.

H.5 Wild Horses, Burros, and Big Game Species

H.5.1 METHODS

H.5.1.1 Research

Before beginning fieldwork, DOE identified any existing information regarding the occurrence and distribution of herd management areas and big game habitats within the region of influence of the proposed rail alignment. These efforts included literature searches and consultations with land management agencies and authorities, including the BLM and the Nevada Department of Wildlife.

H.5.1.2 Field Surveys

DOE performed surveys along the Caliente rail alignment from February 4 through March 11, 2005, from May 5 through May 10, 2005, and on June 7 and 8, 2005, to assess relative use of areas by horses, burros, and big game. DOE performed surveys along the Mina rail alignment during the field surveys described in Section H 2.1.2.

DOE performed observational sampling along linear transects. Transect dimensions were 800 meters (2,600 feet) long, unless blocked by terrain, by 120 meters (390 feet) wide. The sampling interval was continuous, with three observers spaced 30 meters (100 feet) apart. At the beginning of each transect, the type of BLM or Nevada Department of Wildlife management unit (for example, wild horse and burro herd management area, game habitat) potentially affected was determined, the locations of the start and end of the transect were recorded using a geographic positioning system receiver, and the transect was photographed and staked as described above. Field notes concerning the surrounding terrain and special habitat features, such as water sources or fences, were recorded on the data sheets for horse and burro and big game habitat use surveys shown in Figure H-6.

The bearing of the transect was determined as described for vegetation surveys in Section H.2.1.2. Transects were walked by teams of three biologists, one walking along the center line of the proposed rail alignment, with each of the others 30 meters (100 feet) to either side. When only two biologists were available for surveys, this fact was noted on the data sheet and resultant data were interpreted to adjust for the decrease in area covered. Observers documented the presence of any visible large ungulates, wild horses, or burros, and their estimated distance from the transect. Notes were also recorded regarding the presence of small or nongame wildlife species, including birds, rabbits, foxes, coyotes, badgers, reptiles, and amphibians, or evidence of habitat use by these species, such as scat, owl pellets, or burrows.

Track counts were conducted in which discrete sets of mule deer, pronghorn antelope, bighorn sheep, wild horse, or burro tracks were identified and counted. Sets of animal tracks that crossed the path of more than one observer were counted only once. Areas of high track density were noted and roughly delineated using waypoints identified by a geographic positioning system to assist in determining migration routes and forage areas.

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:		LOCATION:	TRANSECT BEARING:
	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):					

TRANSECT START PHOTO:	TRANSECT END PHOTO:

SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvuial Fan Slope Cliff/Scarp Other	LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other

SW REGAP CLASS:

ESTIMATED DOMINANT SPECIES:

	NAME/CODE	EXTENT*	WAYPOINT	UTM N	UTM E	PDOP	WAAS	ELEVATION
Sensitive Species 1							yes / no	
Sensitive Species 2							yes / no	
Sensitive Species 3							yes / no	
Sensitive Species 4							yes / no	
Sensitive Species 5							yes / no	
Sensitive Species 6							yes / no	
Sensitive Species 7							yes / no	
Sensitive Species 8							yes / no	
* Categories for sens spp and inv/nox spp extent: Solitary, Few Clumped, Few Scattered, Many Clumped, Many Scattered, Dense, Other								
Invasive/Nox Species 1							yes / no	
Invasive/Nox Species 2							yes / no	
Invasive/Nox Species 3							yes / no	

NOTES:

Figure H-5. Data sheet for sensitive plant species survey.

Pellet counts were conducted in which individual piles of large ungulate, wild horse, or burro scat that appeared to be less than 3 months old (based on degree of weathering), were identified and counted. Bighorn sheep, pronghorn antelope, and mule deer scat were sometimes difficult to differentiate by appearance alone. In these cases, the species was determined by examining other evidence (habitat, terrain, tracks, known distribution information). In the case of wild horses, stallion piles, which consist of two or more depositions of scat, were counted separately from single depositions resulting from mares and subordinate stallions. In some cases, burro scat was difficult to differentiate from foal and yearling horses and a determination of species was based on other evidence, such as the presence of other horse scat or tracks. Evidence of commercial sheep grazing activities was noted where present, because these operations can hinder the assessment of deer and antelope tracks and pellets.

H.5.2 HERD MANAGEMENT AREAS (HMAs)

The Caliente rail alignment and the Mina rail alignment each would cross a number of herd management areas. Section H.5.2.1 describes herd management areas the Caliente rail alignment would cross; Section H.5.2.2 describes herd management areas the Mina rail alignment would cross. The primary sources for information about each area listed are the BLM Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, all) and additional information DOE gathered from herd management plans and evaluations, as indicated in the descriptions.

H.5.2.1 Caliente Rail Alignment

H.5.2.1.1 Miller Flat and Little Mountain Herd Management Areas

The Miller Flat HMA and Little Mountain HMA are in Lincoln County, Nevada, approximately 3.2 kilometers (2 miles) northeast of the City of Caliente and, combined, are approximately 580 square kilometers (140,000 acres) in size. Both the Caliente and the Eccles alternative segments would cross the Little Mountain HMA. Each herd management area has an appropriate management level of nine to 15 horses. A 2004 census (DIRS 174047-Bennet 2005, p. 2) indicates that there are 40 horses in the Little Mountain HMA and 35 horses in the Miller Flat HMA. The herds move from Miller Flat to Little Mountain in the winter and move back to Miller Flat during the summer. The 2005 Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-6) indicates that forage, water, space, and habitat in these herd management areas are inadequate and recommends removing the horses and eliminating the HMA status. Permanent water sources consist of nine small springs on both private and public lands primarily in the Miller Flat HMA, Clover Creek, and water troughs installed for livestock. Only two small springs are available to horses and burros within the Little Mountain HMA, so the resident horses and burros are forced to travel to the Miller Flat HMA for water (DIRS 173057-BLM [n.d.], all).

H.5.2.1.2 Highland Peak Herd Management Area

Caliente common segment 2 would cross the Highland Peak HMA, which covers 550 square kilometers (140,000 acres) to the west of Panaca. The primary water source is in the central portion of the HMA at Bennett Springs, but several small springs are also found on the Highland Peak Range (DIRS 173059-BLM n.d., all). The appropriate management level for the Highland Peak HMA is 364 horses; however, the current population (2007) is approximately 150 horses (DIRS 174047-Bennet 2005, p. 2). Field observations from the winter of 2005 suggest that the eastern end of common segment 1 also supports a very high level of use by horses, and the portion of the segment at Bennett Pass shows evidence of seasonal horse use, which was confirmed during the May 2005 field effort, during which 35 horses were counted in the pass. The Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-6) lists the habitat of this HMA as inadequate in the winter and does not rate the forage, space, and

TRANSECT ID:	DATE (mm/dd/yy):	RECORDER:	OBSERVERS:		LOCATION:	TRANSECT BEARING:
	GPS FILENAME - START:					
Coordinates	WAYPOINT	UTM N	UTM E	PDOP	WAAS USED?	ELEVATION
START TRANSECT					yes / no	
END TRANSECT					yes / no	
	GPS FILENAME - END (if different):		TRANSECT LENGTH: meters			
SLOPE:	ASPECT:	LANDFORM (elaborate in Notes section): Valley Flat Toe Slope/Alluvial Fan Slope Cliff/Scarp Other		LAND USE: Wilderness Mining Recreation Grazing Transportation Plowed Fields Urban/Developed Other		
ESTIMATED PLANT COMMUNITY:				MANAGEMENT UNIT (if applicable):		
	STALLION PELLET	MARE PELLET	TRACK COUNT			
HORSE						
	PELLET COUNT					
BURRO						
MULE DEER						
BIGHORN						
PRONGHORN						
Wildlife observed/distance from transect:						
Notes:						
Photo, transect start:						
Photo, transect end:						
Photo, supplemental 1:						
Photo, supplemental 2:						

Figure H-6. Data sheet for assessing horse, burro, and big game habitat use.

genetic viability of the HMA; the Plan recommends that this HMA be combined with the Dry Lake and Rattlesnake HMAs.

H.5.2.1.3 Rattlesnake Herd Management Area

The Rattlesnake HMA, covering approximately 290 square kilometers (71,000 acres), is approximately 27 kilometers (17 miles) west of the City of Caliente in the Dry Lake Valley. Caliente common segment 1 would cross a small portion of the northeast corner of the HMA. The HMA has an appropriate management level of one horse to account for incidental use by wild horses from the Dry Lake HMA to the north during years with exceptionally high snowfall. The primary water sources include three springs, small ephemeral reservoirs, and cattle troughs. The 2003 census found no resident horses (DIRS 174332-BLM n.d., all; DIRS 174047-Bennet 2005, p. 2). The 2005 Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-7) lists the habitat as inadequate during the summer months and does not rate the forage, water, space, and genetic viability of the HMA. The Draft Ely District Resource Management Plan recommends that this HMA be combined with the Dry Lake and Highland Peak HMAs.

H.5.2.1.4 Dry Lake Herd Management Area

The Dry Lake HMA is in Lincoln County west of the town of Pioche and encompasses approximately 2,000 square kilometers (490,000 acres). Common segment 1 would cross the Dry Lake HMA in Dry Lake Valley and in the North Pahroc Range. The appropriate management level for this HMA is 94 horses. In August 2003, 23 horses were removed from the HMA, and the BLM population estimate is 72 horses. Primary water sources for the HMA are artesian springs and freshwater seeps in the Schell Creek, Pahroc, Bristol, and Fairview Mountain Ranges (DIRS 182069-Nevada Bureau of Land Management 2007, all; DIRS 174047-Bennet 2005, all). The 2005 Draft Ely District Resource Management Plan (DIRS 174518-BLM 2005, p. 3.8-6) rates forage, water, space, habitat, and genetic viability as adequate, and recommends that this HMA be combined with the Rattlesnake and Highland Peak HMAs.

H.5.2.1.5 Seaman Herd Management Area

Common segment 1 would cross the Seaman HMA, which is approximately 56 kilometers (35 miles) south of Lund in both Nye and Lincoln Counties. It encompasses approximately 1,350 square kilometers (338,400 acres) and is currently being managed for a target population of 159 horses (DIRS 174333-BLM n.d., all). A 2004 population estimate indicates that there are 99 horses using the HMA (DIRS 174047-Bennet 2005, p. 2). The resident horses' summer range is in the Seaman and Grant Mountains in the western portion of the herd management area, and their winter range is in the Coal and White River Valleys. Water sources are very limited (rated as marginal in the 2005 Draft Ely District Resource Management Plan) and emergency removal of horses is anticipated in dry years (DIRS 174333-BLM [n.d.], all). Space is rated as adequate, but habitat is rated as inadequate due to the lack of summer habitat. Forage and genetic viability is unrated in the 2005 Draft District Resource Management Plan, but the Plan recommends removing the herd and eliminating the herd management area status of the land (DIRS 174518-BLM 2005, p. 3.8-7).

H.5.2.1.6 Reveille Herd Management Area

The Reveille HMA is 80 kilometers (50 miles) east of Tonopah and 19 kilometers (12 miles) south of Warm Springs. Common segment 3 would cross this HMA. The HMA covers 510 square kilometers (130,000 acres) and is currently managed for a target population of 138 horses. The 2006 BLM census flight located 78 wild burros in the area (DIRS 182310-Dwyer 2007, all). A significant portion of the Reveille herd has established residency outside the boundaries of the HMA, suggesting that the current target population might not be appropriate for the available habitat (DIRS 173060-BLM [n.d.], all; DIRS 174046-Bennet 2005, all).

H.5.2.1.7 Stone Cabin Herd Management Area

The Stone Cabin HMA is 45 kilometers (28 miles) east of Tonopah and encompasses approximately 1,600 square kilometers (404,000 acres). Caliente common segment 3 would cross this HMA, which is of historic significance to wild horse management. The first wild horse roundup approved by the U.S. Congress occurred here after the passage of the Wild Free-Roaming Horse and Burro Act of 1971 (Public Law 92-195). It is also the historic home of the “Stone Cabin Grey” wild horse type; however, recent horse gathers and drought have reduced the number of horses with “Stone Cabin Grey” characteristics to only a few individuals (DIRS 174330-BLM [n.d.], all). The appropriate management level is 364 horses, and the current population as of 2007 is approximately 150 horses (DIRS 182310-Dwyer 2007, all). DOE field personnel observed evidence of a high level of use by horses during the 2005 field surveys near common segment 3 in the northern portion of Stone Cabin Valley. Personnel observed a herd of at least 12 horses several times from U.S. Highway 6 in Stone Cabin Valley within approximately 3 kilometers (1.9 miles) of the Caliente rail alignment. Personnel also observed 12 horses approximately 1 kilometer (0.62 mile) south of the Caliente rail alignment in this area.

H.5.2.1.8 Saulsbury Herd Management Area

The Saulsbury HMA is 26 kilometers (16 miles) east of Tonopah and is separated into two parcels totaling 570 square kilometers (140,000 acres), with an interconnecting segment of U.S. Forest Service land. Common segment 3 would cross the southern extent of this HMA. The area was intended to be managed under a Memorandum of Understanding between the U.S. Forest Service and the BLM, but it is currently managed as smaller individual units by the agency of jurisdiction. The appropriate management level is 40 horses, and the population as of 2007 is approximately 30 horses (DIRS 182310-Dwyer 2007, all). The resident horses spend their time in both administrative areas (DIRS 174329-BLM [n.d.], all; DIRS 174046-Bennett 2005, all).

H.5.2.1.9 Goldfield Herd Management Area

The Goldfield HMA is east of the community of Goldfield in Nye and Esmeralda Counties. Goldfield alternative segments 1, 3, and 4 along the Caliente rail alignment would cross this HMA. There is a potential quarry site in the northeastern portion of the HMA, adjacent to Goldfield alternative segment 3. The area encompasses 260 square kilometers (64,000 acres) and is in a transitional zone between the Mojave and Great Basin Deserts vegetation types. It provides suitable habitat only for burros, although the appropriate management level is 125 horses and 50 burros. The 2004 population estimate was 15 burros, although unofficial sightings suggest as many as 20. The BLM gathered and removed all resident wild horses in 1995, 1996, and 1997 (DIRS 173062-BLM [n.d.], all; DIRS 174046-Bennet 2005, p. 2). During the 2005 surveys, one burro was observed and evidence of habitat use by burros was noted near the northern end of common segment 4.

H.5.2.1.10 Montezuma Peak Herd Management Area

Goldfield alternative segment 4 would cross the Montezuma Peak HMA, which is west of the community of Goldfield. There is a potential quarry site in the eastern portion of the HMA, adjacent to Goldfield 4. The Montezuma Peak HMA encompasses 305 square kilometers (75,500 acres). The appropriate management level is 157 horses. The 2006 BLM census flight located 58 horses, 18 burros, and 3 mules (DIRS 182310-Dwyer 2007, all; DIRS 173061-BLM [n.d.], all; DIRS 174046-Bennet 2005, all).

H.5.2.1.11 Stonewall Herd Management Area

The Stonewall HMA is west of Lida Junction and south of Goldfield in Nye County. Caliente common segment 4 and both the Bonnie Claire alternative segments would cross the HMA, which encompasses 100 square kilometers (25,000 acres) and provides suitable habitat only for burros, although the appropriate management level is for 50 horses and 25 burros (DIRS 182310-Dwyer 2007, all). A 2006 partial BLM census flight located 17 burros around the Stonewall Falls area. Other sightings have indicated that some of the 34 resident burros from the adjoining Goldfield HMA wander through the Stonewall HMA (DIRS 173063-BLM [n.d.], all; DIRS 174046-Bennet 2005, p. 2). Observations made during the 2005 field surveys along Bonnie Claire alternative segment 2 suggest that burros occasionally use the area. Along Bonnie Claire alternative segment 3, within the Stonewall HMA, field observations suggest a relatively high level of past and present use of this area by burros. Field personnel noted signs of limited use of the area by horses near the northern end of Bonnie Claire 3, and noted evidence of habitat use by burros near the southern end of common segment 4.

H.5.2.1.12 Bullfrog Herd Management Area

The Bullfrog HMA surrounds the town of Beatty in Nye County. Common segment 6 would cross this HMA, which encompasses 520 square kilometers (130,000 acres) and is suitable habitat only for wild burros. Only a portion of the HMA has had an appropriate management level established, which was for 183 burros and 12 horses. The 2006 BLM census flight located 32 burros, though the population is estimated to be approximately 70 (DIRS 182310-Dwyer 2007, all). The burro population in the area is estimated to be 34. Unofficial sightings suggest the presence of wild horses and additional burros (DIRS 173064-BLM 2007, all; DIRS 174046-Bennett 2005, all). During the 2005 field surveys, personnel observed several herds of approximately 13 burros each near common segment 6 in the Crater Flat area. Field personnel noted evidence of burros consistently along common segment 6 south of Beatty Wash, with higher levels of use within the Bullfrog HMA.

H.5.2.2 Mina Rail Alignment

H.5.2.2.1 Horse Mountain Herd Management Area

The Horse Mountain HMA is located at the northern boundary of the Walker River Paiute Reservation in Lyon and Churchill counties. Schurz alternative segment 6 would run adjacent to the southern periphery of the HMA, but would not intersect. The Horse Mountain HMA encompasses approximately 193 square kilometers (47,691 acres). In 2000, there was an estimated population of 95 wild horses in this area and no burros (DIRS 182310-Dwyer 2007, all). Currently, there are no known herds that occupy the Horse Mountain HMA, due to modifications or diversions of water resources that once supported herds (DIRS 181843-Axtell 2007).

H.5.2.2.2 Pilot Mountain Herd Management Area

The Pilot Mountain HMA is located in Mineral and Esmeralda Counties, extending from the Monte Cristo mountain range in the southern boundary of the HMA, and continuing northwest along the Pilot Mountain range to the Gabbs Valley Range. The Pilot Mountain HMA is large, encompassing 1,937 square kilometers (478,641 acres). Mina common segment 1 follows the southwestern boundary of the HMA, but would not intersect any of the designated wild horse and burro habitat. The 2006 estimated population of Pilot Mountain HMA is approximately 286 horses (DIRS 182310-Dwyer 2007, all). There are no known burros (DIRS 181843-Axtell 2007).

H.5.2.2.3 Silver Peak Herd Management Area

The Silver Peak HMA is located in Esmeralda County, directly west of Silver Peak and Montezuma alternative segment 1. The proposed rail alignment would not intersect the designated Silver Peak HMA, but would occur adjacent to the eastern boundary. The Silver Peak HMA is approximately 970 square kilometers (239,691 acres). In 2006, all horses were removed from the HMA due to recurrent drought, starvation, and genetics issues (DIRS 182310 Dwyer 2007, all).

H.5.2.2.4 Goldfield Herd Management Area

The Goldfield HMA is located in Esmeralda and Nye Counties, east of the town of Goldfield. Montezuma alternative segment 2 would intersect this HMA. A 2006 BLM census flight located six horses and no burros; however, burro tracks and scat are evident throughout the HMA. Numbers fluctuate dramatically due to burro movement into the Nevada Test Site. There is an estimated population of about 20 to 30 burros in the Goldfield HMA (DIRS 182310-Dwyer 2007, all).

H.5.2.2.5 Montezuma Peak Herd Management Area

The Montezuma Peak HMA is within the Montezuma Range and borders the Goldfield HMA to the east and the Palmetto HMA to the southwest. Montezuma alternative segments 1, 2, and 3 would intersect or run adjacent to the designated HMA. The Montezuma Peak HMA is about 310 square kilometers (76,602 acres) with an estimated 146 wild horses and 10 burros (DIRS 181843-Axtell 2007). However, a 2006 BLM census flight located 58 horses and 18 burros (DIRS 182310-Dwyer 2007, all). During the December 2006 and March 2007 field surveys, several wild horses were observed in the area near the proposed North Clayton quarry site on the west facing side of the Montezuma Range.

H.5.2.2.6 Stonewall Herd Management Area

The Stonewall HMA is west of Lida Junction and south of Goldfield in Nye County. Caliente common segment 4 and both the Bonnie Claire alternative segments would cross the HMA, which encompasses 100 square kilometers (25,000 acres) and provides suitable habitat only for burros, although the appropriate management level is for 50 horses and 25 burros. Annual counts have not recorded any resident animals, but subsequent sightings have indicated that some of the 34 resident burros from the adjoining Goldfield HMA wander through the Stonewall HMA (DIRS 173063-BLM [n.d.], all; DIRS 174048-Bennet and Thebeau 2005, all). Observations made during the 2005 field surveys along Bonnie Claire alternative segment 2 suggest that burros occasionally use the area. A partial 2006 census flight located 17 burros in the area around Stonewall Fall. Along Bonnie Claire alternative segment 3, within the Stonewall HMA, field observations suggest a relatively high level of past and present use of this area by burros. Field personnel noted signs of limited use of the area by horses near the northern end of Bonnie Claire 3, and noted evidence of habitat use by burros near the southern end of common segment 4.

H.5.2.2.7 Bullfrog Herd Management Area

The Bullfrog HMA surrounds the town of Beatty in Nye County. Common segment 6 would cross this HMA, which encompasses 520 square kilometers (130,000 acres) and is suitable habitat only for wild burros. Only a portion of the HMA has had an appropriate management level established, which was for 183 burros and 12 horses. The burro population in the area is estimated to be 34. A 2006 BLM census flight located 17 burros around the Stonewall Falls area (DIRS 182310-Dwyer 2007, all). Unofficial sightings suggest the presence of wild horses and additional burros (DIRS 173064-BLM 2007, all; DIRS 174046-Bennet 2005, all). During the 2005 field surveys, personnel observed several herds of approximately 13 burros each near common segment 6 in the Crater Flat area. Field personnel noted evidence of burros consistently along common segment 6 south of Beatty Wash, with higher levels of use within the Bullfrog HMA.

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APPENDIX I

NOISE AND VIBRATION ASSESSMENT METHODOLOGY

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APPENDIX I

NOISE AND VIBRATION IMPACT ASSESSMENT METHODOLOGY

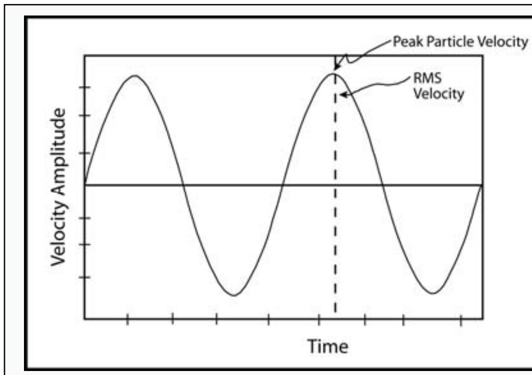
This appendix provides detailed information on the methodology DOE used to develop the assessment of potential impacts from noise and vibration described in Sections 4.2.8 and 4.3.8 of the Rail Alignment EIS (DOE/EIS-0639D).

Section **I.4** defines terms shown in ***bold italics***.

I.1 Noise and Vibration Terminology

Noise is considered a source of pollution because it can be a human health hazard. Potential health hazards range from hearing impairment at very high noise levels to annoyance at moderate to high noise levels. Noise is defined as sound waves that are unwanted and perceived as a nuisance by humans. Sound waves are characterized by frequency and measured in ***hertz***; sound pressure level is expressed as ***decibels*** (dB).

With the exception of prohibiting nuisance noise, neither the State of Nevada nor local governments have established numerical noise standards. Many federal agencies use ***day-night average noise levels*** (DNL) as guidelines for land-use compatibility and to assess the impact of noise on people. Noise levels for perceptible frequencies are weighted (***A-weighted decibels*** [dBA]) to simulate the frequency response of the human ear.



Peak Particle and Root-Mean-Square Vibration Velocity

Wayside noise refers collectively to train noise generated by steel wheels rolling on steel rail and diesel engine noise. Horn noise refers to the sound of locomotive warning horns, which are sounded at railroad crossings. Horn noise typically dominates over wayside noise at locations near grade crossings. There are three ground-vibration impacts of general concern: annoyance to humans, damage to buildings, and interference with vibration-sensitive activities. There are two measurements for evaluating ground vibration**:** ***peak particle velocity*** and ***root-mean-square velocity***. Peak particle velocity is the maximum instantaneous positive or negative peak of the vibration signal, measured as a distance per time (such as millimeters or inches per second). This measurement has been used historically to evaluate shock-wave type vibrations from actions like blasting, pile driving, and mining activities, and their relationship to building damage. The root-mean-square velocity is an average or smoothed vibration amplitude, commonly measured over 1-second intervals. It is expressed on a log scale in decibels (VdB) referenced to 0.000001 (10^{-6}) inch per second and is not to be confused with noise decibels (DIRS 155970-DOE 2002, p. 3-101). It is more suitable for addressing human annoyance and characterizing background vibration conditions because it better represents the response time of humans to ground vibration signals. A typical background level of ground vibration is

52 VdB, and the human threshold for the perception of ground vibration is 65 VdB (DIRS 148155-Hanson, Saurenman, and Towers 1998, p. 46.17).

Vibration criteria for structural damage in fragile or extremely fragile buildings have separate structural criteria based on peak particle velocity and an approximation of VdB that have been segregated into impulse and rail impacts. Table I-1 lists these criteria.

Table I-1. Benchmark ground-vibration criteria for buildings and human annoyance.[a]

Category	Frequent events (more than 70 per day) VdB[b]	Infrequent events (fewer than 70 per day)		Impact of concern
		Peak particle velocity (inches per second)[c]	VdB	
Annoyance or interference				
Highly sensitive building[d]	65	NA[e]	65	Sensitive equipment
Residential[f]	72	NA	80	Human disturbance
Institutional[g]	75	NA	83	Human disturbance
Structural damage				
Fragile buildings	NA	0.20	Approximately 100 (Impulse) 92 (Rail)	Structural damage
Extremely fragile buildings	NA	0.12	Approximately 95 (Impulse) 88 (Rail)	Structural damage

a. Source: DIRS 177297- Hanson, Towers, and Meister 2006, pp. 8-3 and 12-13.
b. Root-mean-square velocity expressed in decibels (VdB) referenced to 10^{-6} inch per second.
c. To convert to millimeters per second, multiply by 25.4.
d. Buildings with vibration-sensitive equipment (for example, at research institutions and medical facilities).
e. NA = not applicable.
f. Homes or buildings where people sleep.
g. Schools, churches, and office buildings.

I.2 Noise Analysis Methodology

DOE used the following methods to determine if constructing and operating the proposed rail line would result in an increase of the DNL of 3 dBA and if the DNL would equal or exceed 65 dBA:
Noise Models – DOE used a wayside noise model, based on past Surface Transportation Board (STB) noise studies including *Conrail Acquisition Environmental Impact Statement* (DIRS 174622-STB 1997, all) and *Draft Environmental Assessment for the Canadian National/Illinois Central Acquisition Environmental Assessment* (DIRS 174623-Kaiser 1998, all). Section I.2.1 lists the equations for this model. The horn noise model is based on data from *Draft Environmental Impact Statement, Proposed Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings* (DIRS 174551-DOT 1999, all; the 1999 Federal Railroad Administration DEIS). The overall noise model results are sensitive to horn noise, locomotive and rail car noise, train length, and train speed. DOE used wayside reference levels, the horn noise model, and equations shown in this appendix to generate noise contours. Finally, DOE used Cadna (DIRS 178129-DataKustik n.d., all), an environmental noise computer program, to calculate building shielding effects, where appropriate. DOE selected the individual components of the overall noise model because of the size of the noise measurement database, statistical reliability, and other factors.

Measure Ambient Noise – To establish a baseline for determining if there would be a 3 dBA or greater increase in noise, DOE measured ambient noise in the study area at seven representative locations – Caliente, Garden Valley, Goldfield, Silver Springs, Schurz, Mina, and Silver Peak. Substantial train activity already exists in Caliente; therefore, DOE used a combination of modeling and measurements to determine the difference between existing and future noise levels in that area. DOE measured ***ambient noise levels*** using Norsonics 118 octave band analyzers. For low ambient sound environments, DOE used special low-noise 1-inch diameter precision microphones. DOE measured vibration levels with a Rion SA-77 narrow band analyzer and high sensitivity seismic accelerometers.

Estimate or Measure Existing and Future Noise Exposure – DOE estimated noise exposure in terms of the DNL using information on distances and noise propagation paths to sensitive receptors and future operation plans.

Count Noise-Sensitive Receptors – DOE estimated the number of noise-sensitive receptors within the 65 DNL noise contours for the Proposed Action and Shared-Use Option, or where the DNL would increase by at least 3 dBA. DOE used digital aerial photographs and Geographic Information System software to estimate the number of receptors, including residences, schools, and places of worship, within the 65 DNL noise contour for future train volumes. The final result of this analysis was an estimate of the total number of receptors likely to be exposed to a DNL of 65 dBA or greater and the number of receptors where the DNL would increase by at least 3 dBA under the Proposed Action or the Shared-Use Option.

I.2.1 WAYSIDE NOISE MODEL METHODOLOGY

Wayside noise refers collectively to noise the railcars and locomotives would generate. DOE used noise measurements of past STB noise studies (including DIRS 174622-STB 1997, all; DIRS 174623-Kaiser 1998, all) to establish the basis for the wayside noise level projections. Noise from railcars is caused by the steel wheels rolling on the steel rails. This sound is referred to as wheel/rail noise. Wheel/rail noise varies as a function of speed and can increase by as much as 15 dBA if wheels or rails are in poor condition. One of the most common problems that creates additional noise from wheels is the formation of flat surfaces on wheels caused by wheels sliding during hard braking.

The main components of locomotive noise are the exhaust of the diesel engines, cooling fans, general engine noise, and the wheel/rail interaction. Noise associated with the engine exhaust and cooling fans usually dominates; the noise level depends on the throttle setting (most locomotives have eight throttle settings) and not on locomotive speed.

Tests have shown that locomotive noise levels change by about 2 dBA for each step change in throttle setting, meaning that noise levels increase by about 16 dBA as the locomotive throttle is moved from notch one to notch eight (DIRS 174623-Kaiser 1998, all). Because locomotive engineers constantly adjust throttle settings as necessary, only rough estimates of throttle settings are usually available for noise projections. Numerous field measurements of freight train operations indicate that locomotive noise can be projected with reasonable accuracy by assuming a base condition of throttle position six and adjusting noise levels when better information about typical throttle position is known.

Given the maximum train passby sound level of freight cars and a locomotive under a specific set of reference conditions, the noise models allow estimating the maximum train passby sound level, the sound exposure level, the DNL, and other noise metrics for varying distances from the track, varying train speeds, and varying schedules. The standard approach to projecting railcar noise is to model cars as moving, incoherent (in other words, random), dipole line sources, wherein the cars are sources of sound moving in a straight line, which is equal in both directions from the track center line. The basic equations used for the wayside noise model are:

$$SEL_{cars} = L_{eqref} + 10\log(T_{passby}) + 30\log(S/S_{ref})$$

For locomotives, which can be modeled as moving monopole point sources, the corresponding equation is:

$SEL_{locos} = SEL_{ref} + 10\log(N_{locos}) - 10\log(S/S_{ref})$

The total train sound exposure level is computed by logarithmically adding SEL_{locos} and SEL_{cars}:

$DNL_{100'} = SEL + 10\log(N_d + 10*N_n) - 49.4$

$DNL = DNL_{100'} + 15\log(100/D)$

The parameters that apply to the equations above are:

SEL_{cars} = Sound Exposure Level of rail cars

L_{eqref} = Reference Level Equivalent of rail car (passby L_{eq})

T_{passby} = Train passby time, in seconds

S = Train speed, in miles per hour

S_{ref} = Reference train speed

SEL_{locos} = Sound Exposure Level of locomotive

SEL_{ref} = Reference Sound Exposure Level of locomotive

N_{locos} = Number of locomotives

N_d = Number of trains during daytime

N_n = Number of trains during nighttime

D = Distance from tracks, in feet

Table I-2 shows the reference noise levels used in this study.

Table I-2. Reference noise levels.[a]

Description	Average level (dBA)
Horn SEL 1st 0.125 mile[b,c]	107
Horn SEL 2nd 0.125 mile[b,c]	110
Locomotive SEL (40 miles per hour at 100 feet)[d]	95
Rail car L_{eq} (40 miles per hour at 100 feet)[e]	82

a. dBA = A-weighted decibels; L_{eq} = equivalent sound level; SEL = sound exposure level.
b. To convert miles to kilometers, multiply by 1.6093.
c. Source: DIRS 174551-DOT 1999, all.
d. Source: DIRS 174622-STB 1997, all.
e. Source: DIRS 174623-Kaiser 1998, all.

I.2.2 HORN NOISE MODEL METHODOLOGY

The key components in projecting noise exposure from horn noise are the horn sound level, the duration of the horn noise, the distance of the receptor from the tracks, and the number of trains running during daytime and nighttime hours.

The Federal Railroad Administration requires train engineers to sound horns when approaching public grade crossings unless a Quiet Zone has been established. Horn sounding is generally not required at private crossings. Federal Railroad Administration regulations in 49 CFR 229.129 require all lead locomotives to have an audible warning device that produces a minimum sound level of 96 dBA at a distance of 30 meters (100 feet) in front of the locomotive.

Most freight train audible warning devices are air horns. The maximum sound level of the air horns can usually be adjusted to some degree by adjusting the air pressure. Maximum sound levels are typically 105 to 110 dBA at 30 meters (100 feet) in front of the trains, well above the 96 dBA required by the Federal Railroad Administration.

The Federal Railroad Administration finalized its rule on horn noise on April 27, 2005 (*Use of Locomotive Horns at Highway-Rail Grade Crossings; Final Rule (*70 *Federal Register* 21843). This rule essentially provides communities with means to establish quiet zones in which horns are not sounded if sufficient safety measures are installed at grade crossings. The rule will also likely have an effect on horn noise levels nationally because of a number of changes in how horns will be sounded. For example, the rule limits the maximum level to 110 dBA. Previously, there were no maximum horn noise level limits. Additionally, the noise measurement technique used to establish horn noise levels will change and limits on how long horns can be sounded will be implemented. All of these changes will likely result in somewhat lower horn noise levels nationally.

Because of the high noise levels created by train horns, noise exposure is dominated by horn noise near any grade crossing where sounding horns is required. Additional noise sources associated with grade crossings are the grade-crossing bells that start sounding just before the gates are lowered and idling traffic that must wait at the crossing. Such noises are usually insignificant compared to the horn noise. Freight train horn noise levels can vary for a variety of reasons, including the manner in which an engineer sounds the horn. Consequently, it is important to base horn noise reference levels on a large sample size. A substantial amount of horn noise data is available from the 1999 Federal Railroad Administration DEIS (DIRS 174551-DOT 1999, all).

The Federal Railroad Administration data indicate that horn noise levels increase from the point at which the horn is sounded 0.40 kilometer (0.25 mile) from the grade crossing to when it stops sounding at the grade crossing. In the first 0.2-kilometer (0.125-mile) segment, the energy average sound exposure level measured at a distance of 30 meters (100 feet) from the tracks was found to be 107 dBA, and in the second 0.2-kilometer segment, 110 dBA. The 1999 Federal Railroad Administration DEIS (DIRS 174551-DOT 1999, all) simplified the horn noise contour shape as a five-sided polygon, when it is actually a teardrop shape. *Final Environmental Impact Statement, Construction and Operation of a Rail Line from the Bayport Loop in Harris County, Texas* (DIRS 173225-STB 2003, all) discusses this subject in detail. DOE used the more accurate teardrop horn noise contour shape for this analysis. The attenuation or drop-off rate of horn noise is assumed to be 4.5 dBA per doubling of distance away from the tracks (DIRS 174551-DOT 1999, all).

To properly calculate building shielding effects, both wayside and horn noise were characterized by representative frequency spectra. Low-frequency sound can diffract or bend more easily than high-frequency sound over or around buildings or terrain; therefore, it is important to model horn and wayside noise separately according to frequency content. Figures I-1 and I-2 show these representative horn and wayside noise spectra. The relative spectrum shapes and absolute noise levels shown in Table I-2 were used in the modeling.

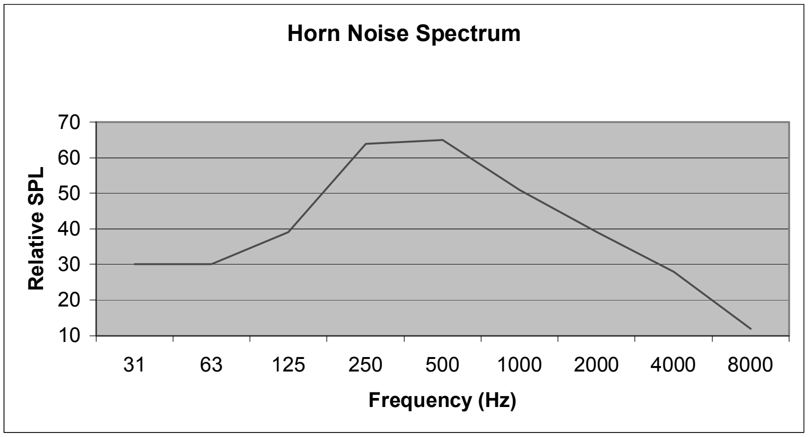


Figure I-1. Horn noise spectrum. (Source: DIRS 173225-STB 2003, p. 4-34. Hz = hertz; SPL = sound pressure level.)

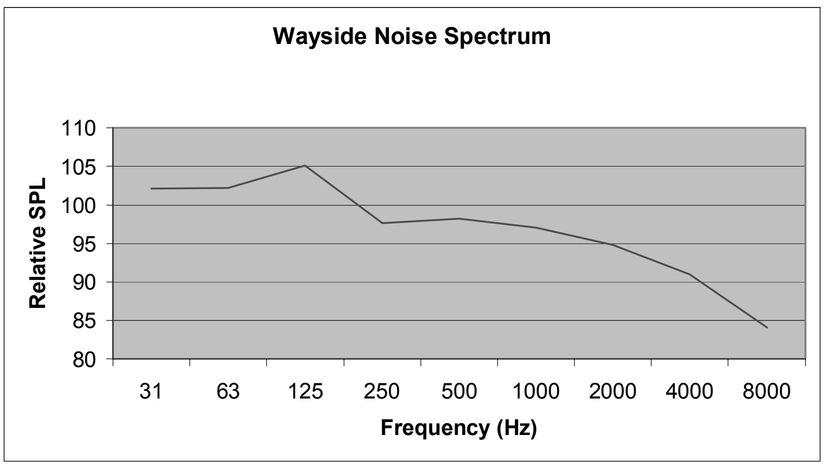


Figure I-2. Wayside noise spectrum. (Source: DIRS 173225-STB 2003, p. 4-34. Hz = hertz; SPL = sound pressure level.)

In general, the tear-drop shapes, shown in the figures in Section 4.2.8 and 4.3.8 of this EIS, are noise contours at grade crossings where horns might be sounded; noise contours shown in other areas are due to wayside noise. DOE used the noise contours in these figures, aerial photographs, and Geographic Information System software to identify and count any receptors that would be exposed to 65 DNL under the Proposed Action or the Shared-Use Option.

Counts of noise-sensitive receptors are approximate for several reasons, including changes in land use since the aerial photographs were taken (1994 to 2007), and difficulties in determining whether a structure is inhabited or uninhabited. In general, the approach was to count any structure within a noise contour as being inhabited. DOE also examined aerial photographs of portions of the proposed rail alignment not shown in these figures. However, these areas are generally uninhabited and no potential receptors were identified.

I.3 Vibration Analysis Methodology

The vibration analysis methodology is based on Federal Transit Administration Methods (DIRS 177297-Hanson, Towers, and Meister 2006, all).

I.3.1 CONSTRUCTION VIBRATION

Vibration due to construction activities, assuming point sources with normal propagation conditions, can be calculated on the basis of the following equation:

$$PPV_{equip} = PPV_{ref} \text{ x } (25/D)^{1.5}$$

Where: PPV_{equip} is the peak particle velocity in inches per second of the equipment adjusted for distance.

PPV_{ref} is the reference vibration level of equipment in inches per second at 25 feet.

D is the distance from the equipment to the receptor.

I.3.2 TRAIN VIBRATION

Vibration levels due to trains were estimated on the basis of generalized ground-surface vibration curves, as shown in Figure I-3.

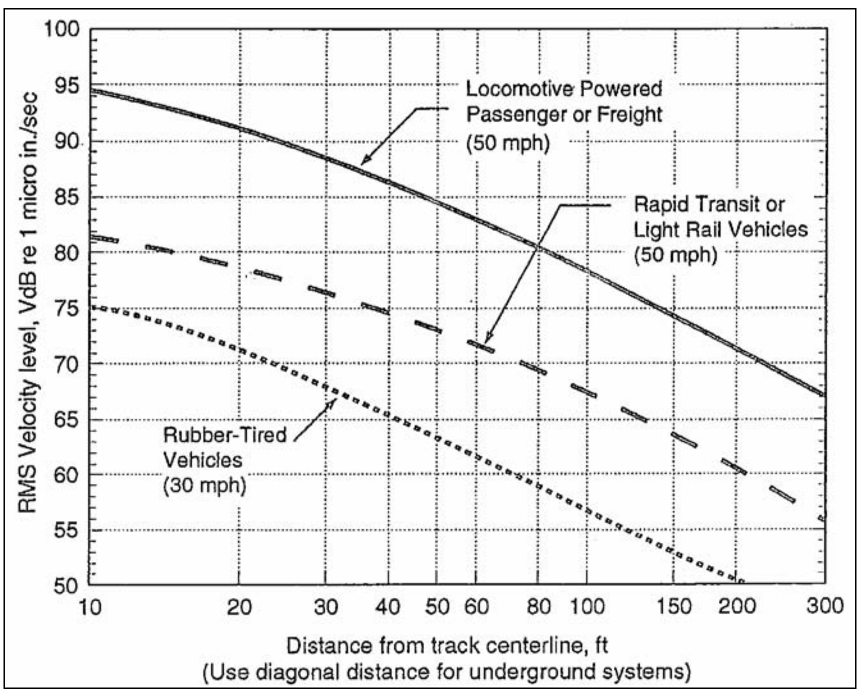


Figure I-3. Generalized ground surface vibration curves. (Source: DIRS 177297-Hanson, Towers, and Meister 2006.)

I.4 Glossary

ambient noise	The sum of all sounds (noise is unwanted sound) at a specific location over a specific time.
day-night average noise level	The energy average of ***A-weighted decibel*** sound levels over 24 hours, which includes an adjustment factor for noise between 10 p.m. and 7 a.m. to account for the greater sensitivity of most people to noise during the night. The effect of nighttime adjustment is that one nighttime event, such as a train passing by between 10 p.m. and 7 a.m., is equivalent to 10 similar events during the daytime.
decibel (dB)	A standard unit for measuring sound pressure levels based on a reference sound pressure of 0.0002 dyne per square centimeter. This is the smallest sound a human can hear.
decibel, A-weighted (dBA)	A frequency-weighted ***noise*** unit that corresponds approximately to the frequency response of the human ear and thus correlates well with loudness. It is widely used for traffic and industrial noise measurements.
hertz	A unit of frequency equal to one cycle per second.
peak particle velocity	The maximum instantaneous positive or negative peak of the vibration signal, measured as a distance per time (such as millimeters or inches per second). This measurement has been used historically to evaluate shock-wave type vibrations from actions like blasting, pile driving, and mining activities, and their relationship to building damage.
root mean-square velocity	An average or smoothed vibration amplitude, commonly measured over 1-second intervals. It is expressed on a log scale in ***decibels (VdB)*** referenced to 0.000001 (10^{-6}) inch per second and is not to be confused with noise ***decibels***.

I.5 References

178129	DataKustik [n.d.]	DataKustik [n.d.]. Cadna A, Software for Environmental Noise, Computer Aided Noise Abatement. Greifenberg, Germany: DataKustik. TIC: 258792.
155970	DOE 2002	DOE (U.S. Department of Energy) 2002. Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. DOE/EIS-0250. Washington, D.C.: U.S. Department of Energy, Office of Civilian Radioactive Waste Management. ACC: MOL.20020524.0314; MOL.20020524.0315; MOL.20020524.0316; MOL.20020524.0317; MOL.20020524.0318; MOL.20020524.0319; MOL.20020524.0320.
174551	DOT 1999	DOT (U.S. Department of Transportation) 1999. Proposed Rule for the Use of Locomotive Horns at Highway-Rail Grade Crossings. Washington, D.C.: U.S. Department of Transportation, Office of Railroad Development. ACC: MOL.20050824.0327.
148155	Hanson, Saurenman, and Towers 1998	Hanson, C.E.; Saurenman, H.J.; and Towers, D.A. 1998. "Rail Transportation Noise and Vibration." Chapter 46 of Handbook of Acoustical Measurements and Noise Control. Harris, C.M., ed. 3rd Edition. New York, New York: McGraw-Hill. TIC: 250744.

177297	Hanson, Towers, and Meister 2006	Hanson, C.E.; Towers, D.A.; and Meister, L.D. 2006. Transit Noise and Vibration Impact Assessment. FTA-VA-90-1003-06. Washington, D.C.: U.S. Department of Transportation, Federal Transit Administration. ACC: MOL.20060814.0190.
174623	Kaiser 1998	Kaiser, E.K. 1998. "Re: Railroad Control Application, Finance Docket No. 33556 — Canadian National — Control — Illinois Central: Release of Draft Environmental Assessment for Public Review and Comment." Letter from E.K. Kaiser (STB) to Interested Parties, November 9, 1998, with enclosure. ACC: MOL.20050824.0324.
174622	STB 1997	STB (Surface Transportation Board) 1997. Before the Surface Transportation Board, Finance Docket No. 33388, CSX Corporation and CSX Transportation, Inc., Norfolk Southern Corporation and Norfolk Southern Railway Company — Control and Operating Leases/Agreements — Conrail Inc. and Consolidated Rail Corporation. Railroad Control Application, Volume 6A of Environmental Report. CSX/NS-23. Washington, D.C.: Surface Transportation Board. ACC: MOL.20060404.0002.
173225	STB 2003	STB (Surface Transportation Board) 2003. Final Environmental Impact Statement, Construction and Operation of a Rail Line from the Bayport Loop in Harris County, Texas. Decision ID No. 33543. Finance Docket No. 34079. [Washington, D.C.]: Surface Transportation Board. ACC: MOL.20050418.0040.

APPENDIX J

SOCIOECONOMICS

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ACRONYMS AND ABBREVIATIONS

DIRS	Document Input Reference System
DOE	U.S. Department of Energy
EIS	environmental impact statement
FEIS	final environmental impact statement
LOS	level of service
REMI	Regional Economic Models, Inc.
SEIS	supplemental environmental impact statement

APPENDIX J

SOCIOECONOMICS

This appendix provides details to support the analysis results reported in Sections 4.2.9 and 4.3.9 of the Rail Alignment EIS.

Section J.2 defines terms shown in **bold italics**.

J.1 INTRODUCTION

The U.S. Department of Energy (DOE or the Department) used an economic-demographic forecasting model known as *Policy Insight*, developed by Regional Economic Models, Inc. (REMI®) (DIRS 178610-Bland 2007, all), to generate employment, ***real disposable income***, and ***gross regional product*** data for Lyon, Mineral, Clark, Lincoln, Nye, Esmeralda, and Washoe Counties, and Carson City. *Policy Insight* is an eight-region model, seven of the regions being Lyon, Mineral, Clark, Lincoln, Nye, and Esmeralda Counties, and Washoe County-Carson City. Because of the configuration of the DOE version of the model, Carson City and Washoe County are considered as a single economic entity.

The REMI® model has been in use since 1980 to generate year-by-year estimates of the total regional effects of any specific policy initiative. For this analysis DOE used *Policy Insight*, version 9.0 (DIRS 182251-REMI 2007, all). The model has the following features:

- It is calibrated to local conditions using a relatively large amount of local data.
- It combines several different kinds of analytical tools (including economic-base, input-output, and econometric models).
- It allows users to manipulate an unusually large number of input variables and gives forecasts for an unusually large number of output variables.
- It allows users to generate forecasts for any combination of future years, allowing users special flexibility in analyzing the timing of economic impacts.
- It accounts for business cycles.

The description of existing economic conditions in the Caliente and Mina rail alignments regions of influence and the forecast values of populations, gross regional product, and real disposable income draw on data from version 9.0 of *Policy Insight*. The description implicitly includes revenue from the DOE Payments Equal to Taxes program, described in detail in the *Final* (Yucca Mountain FEIS; DIRS 155970-DOE 2001, p. 3-90), and the *Supplemental Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain Nye County, Nevada* (Repository SEIS DOE/EIS-0250F-51). Revenue from this program is not described separately. Because the model is based on nationally collected data for which there is a lag between collection and issuance by the national agencies, and another lag before the data are incorporated into the *Policy Insight* model, there is always a gap of approximately 2 to 3 years between the current year and the last history year. The year 2004 is the last history year for the *Policy Insight* model (version 9.0) used in this baseline forecast.

To compensate for this time lag, the model's employment update feature is specifically designed to accommodate new historical data provided by users, which update the model's growth-rate assumptions. *Policy Insight* version 9.0 uses an employment update module that relies on data from the Nevada Department of Education, Training, and Rehabilitation for 2004 through 2006. This version also incorporates information from the latest Clark County population projections prepared by the University of Nevada, Las Vegas (DIRS 178806-CBER 2006, all) and the latest population projections developed by the Nevada State Demographer (DIRS 178807-Hardcastle 2006, all).

Impacts are stated in terms of the number of jobs, gross regional product, real disposable income, and state and local government spending. Direct economic effects are the changes in jobs, gross regional product, and income in sectors that would supply directly needed goods and services, such as heavy-duty equipment, during the proposed railroad construction and operations phase.

Items included as *Policy Insight* inputs include direct employment and costs, as follows:

- Employment in the following sectors:
  - Construction
  - Professional and Technical Services
  - Government Employees – Federal Civilian, State and Local
  - Administrative Support Services
  - Food services
  - Repair and Maintenance
  - Mining (surface mining for quarry sites)
  - Transportation
- For sectors for which wage data for the project are available, wage adjustments on the differential between project wages and model wages are made.
- Costs (increase in demand) for the following sectors are included:
  - Utilities
  - Wholesale Sales
  - Administrative Support Services
  - Construction
  - Mining (surface mining for quarry sites)
  - Accommodations
  - Food Services
  - Repair and Maintenance
  - Professional and Technical Services
  - Transportation

This appendix presents results from runs of *Policy Insight* version 9.0 (DIRS 182251-REMI 2007, all) made in March 2007 (DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all) for the Caliente rail alignment and in April 2007 (DIRS 180689-Bland 2007, all) for the Mina rail alignment. As described in Sections 4.2.9 and 4.3.9 of the Rail Alignment EIS, the *Policy Insight* model forecasts changes to baseline economic and demographic conditions that would be associated with the Proposed Action. For the Caliente rail alignment, DOE modeled two scenarios for this analysis, one with the Nevada Railroad

Control Center and National Transportation Operations Center in Lincoln County (Scenario 1) and one with these facilities in Nye County (Scenario 2). For the Mina rail alignment, DOE modeled two scenarios for this analysis, one with the Nevada Railroad Control Center and National Transportation Operations Center in Mineral County (Scenario 1) and one with these facilities in Nye County (Scenario 2). This appendix provides results for both rail alignments from each scenario for each Nevada county in the socioeconomics region of influence (for the Caliente rail alignment, Lincoln, Nye, Esmeralda, and Clark Counties; for the Mina rail alignment, Lyon, Mineral, Nye, Esmeralda, and Clark Counties, and Washoe County-Carson City).

This appendix also describes the methodology used to quantify impacts to public services, level of service on roadways, and traffic delays at rail-highway grade crossings.

J.1.1 RAILROAD CONSTRUCTION – CALIENTE RAIL ALIGNMENT

Table J-1 lists percent changes to the baseline that would be associated with the Caliente rail alignment construction phase. The table lists data by county, but does not break the data down by scenario for Esmeralda and Clark Counties because the percent changes would be the same under either scenario. Lincoln and Nye Counties would experience slightly different percent changes under the two scenarios. Rail Alignment EIS Section 3.2.9, Table 3-61, lists baseline numbers. Section 4.2.9, Table 4-101, lists absolute changes to the baseline.

Table J-1. Percent changes from baseline during the construction phase – Caliente rail alignment[a] (page 1 of 2).

	Variable				
Year	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
			Lincoln County		
Scenario 1					
2010	0.89	4.56	1.28	4.11	28.36
2011	1.20	4.67	1.62	2.57	17.29
2012	1.42	5.55	1.87	3.01	19.99
2013	1.50	3.36	1.84	2.31	8.64
2014	1.65	2.86	1.91	2.95	3.83
Scenario 2					
2010	0.87	4.42	1.26	4.06	26.18
2011	1.16	4.67	1.61	2.56	17.29
2012	1.41	5.54	1.86	3.00	19.99
2013	1.49	3.35	1.83	2.31	8.64
2014	1.56	2.41	1.80	2.32	3.35
			Nye County		
Scenario 1					
2010	0.12	1.24	0.33	0.89	3.06
2011	0.13	1.08	0.34	0.56	2.44
2012	0.19	1.36	0.40	0.83	3.50
2013	0.23	0.87	0.36	0.62	2.00
2014	0.23	0.40	0.32	0.32	0.67

Table J-1. Percent changes from baseline during the construction phase – Caliente rail alignment[a] (page 2 of 2).

Year	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
	Variable				
Nye County *(continued)*					
Scenario 2					
2010	0.12	1.24	0.33	0.89	3.06
2011	0.13	1.08	0.34	0.56	2.44
2012	0.19	1.38	0.40	0.85	3.57
2013	0.24	0.90	0.37	0.64	2.11
2014	0.24	0.42	0.33	0.33	0.71
Esmeralda County					
2010	0.41	2.73	1.35	7.32	9.47
2011	0.69	2.73	1.79	7.35	1.15
2012	0.91	2.67	2.15	7.57	1.13
2013	0.99	1.92	2.01	4.10	4.47
2014	1.12	1.78	1.95	3.44	1.68
Clark County					
2010	0.02	0.14	0.02	0.17	0.15
2011	0.03	0.14	0.04	0.17	0.15
2012	0.04	0.14	0.05	0.17	0.15
2013	0.05	0.08	0.05	0.10	0.09
2014	0.04	0.04	0.05	0.06	0.05

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.

J.1.2 RAILROAD OPERATIONS – CALIENTE RAIL ALIGNMENT

Tables J-2 through J-5 list impacts associated with the railroad operation**s** phase for the Caliente rail alignment.

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 1of 4).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
	Variable				
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	102	88	1,001,520	4,148,820	4,414,644
2016	114	89	1,138,761	4,311,450	4,595,292
2017	127	93	1,268,163	4,486,950	6,164,730
2018	136	93	1,375,569	4,609,800	6,415,110
2019	145	94	1,476,657	4,722,120	6,585,930

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 2 of 4).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2020	153	95	1,560,078	4,819,230	6,781,320
2021	160	95	1,640,340	4,915,170	6,950,970
2022	164	96	1,694,979	4,988,880	7,077,330
2023	167	96	1,734,291	5,048,550	7,176,780
2024	171	96	1,787,643	5,123,430	7,304,310
2025	174	96	1,828,242	5,191,290	7,427,160
2026	177	97	1,865,214	5,260,320	7,557,030
2027	178	97	1,894,113	5,322,330	7,651,800
2028	180	97	1,918,215	5,384,340	7,793,370
2029	181	98	1,947,699	5,451,030	7,933,770
2030	183	98	1,972,620	5,517,720	8,058,960
2031	184	98	1,994,265	5,585,580	8,186,490
2032	185	98	2,014,389	5,655,780	8,288,280
2033	186	99	2,033,109	5,729,490	8,434,530
2034	187	99	2,052,999	5,806,710	8,501,220
2035	187	99	2,068,677	5,882,760	8,542,170
2036	188	99	2,080,026	5,956,470	8,661,510
2037	188	100	2,088,918	6,029,010	8,773,830
2038	187	100	2,093,364	6,102,720	8,877,960
2039	187	100	2,098,863	6,182,280	8,994,960
2040	186	100	2,104,947	6,265,350	9,058,140
2041	185	100	2,101,788	6,342,570	9,009,000
2042	185	100	2,108,808	6,437,340	9,116,640
2043	186	100	2,119,338	6,540,300	9,257,040
2044	185	101	2,122,029	6,638,580	9,390,420
2045	185	101	2,124,252	6,740,370	9,337,770
2046	185	101	2,129,985	6,850,350	9,481,680
2047	186	101	2,140,281	6,973,200	9,637,290
2048	187	101	2,154,906	7,108,920	9,796,410
2049	188	102	2,169,882	7,251,660	9,961,380
2050	189	102	2,187,549	7,400,250	10,129,860
2051	190	102	2,196,324	7,429,933	10,170,492
2052	191	103	2,205,133	7,459,736	10,211,287
2053	191	103	2,213,978	7,489,658	10,252,246
2054	192	104	2,222,859	7,519,700	10,293,369

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 3 of 4).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2055	193	104	2,231,775	7,549,862	10,334,657
2056	194	105	2,240,727	7,580,146	10,376,111
2057	195	105	2,249,715	7,610,551	10,417,731
2058	195	105	2,258,739	7,641,078	10,459,518
2059	196	106	2,267,799	7,671,727	10,501,472
2060	197	106	2,276,895	7,702,499	10,543,595
2061	198	107	2,286,028	7,733,395	10,585,887
2062	198	107	2,295,198	7,764,415	10,628,348
2063	199	108	2,304,404	7,795,559	10,670,980
2064	200	108	2,313,647	7,826,828	10,713,782
2065	201	108	2,322,928	7,858,222	10,756,757
2066	202	109	2,332,245	7,889,742	10,799,904
2067	202	109	2,341,600	7,921,389	10,843,223
Scenario 2: Assuming Transportation Operations Center and Railroad Control Center in Nye County					
2015	88	66	865,952	2,890,066	3,394,153
2016	93	67	928,200	2,956,782	3,490,084
2017	99	70	990,336	3,055,036	4,990,050
2018	103	70	1,039,719	3,115,884	5,181,956
2019	107	71	1,088,399	3,175,589	5,298,965
2020	110	71	1,127,135	3,229,418	5,447,529
2021	114	71	1,166,568	3,286,739	5,571,557
2022	115	71	1,189,968	3,330,055	5,659,334
2023	116	72	1,205,187	3,366,325	5,724,845
2024	118	72	1,230,927	3,413,134	5,811,434
2025	119	72	1,249,652	3,456,441	5,898,005
2026	120	72	1,267,210	3,502,063	5,991,631
2027	121	72	1,280,072	3,543,030	6,051,292
2028	121	72	1,290,606	3,583,989	6,160,128
2029	122	73	1,305,812	3,629,619	6,265,411
2030	122	73	1,318,695	3,675,240	6,355,484
2031	123	73	1,330,399	3,723,193	6,449,127
2032	123	73	1,342,103	3,773,529	6,518,131
2033	124	73	1,353,799	3,826,170	6,631,586
2034	124	73	1,366,669	3,882,391	6,665,560
2035	125	74	1,377,208	3,937,390	6,674,937
2036	125	74	1,386,568	3,992,380	6,764,992

Table J-2. Changes from baseline for railroad operations[a] – Caliente rail alignment – Lincoln County (page 4 of 4).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2037	125	74	1,394,753	4,047,353	6,849,215
2038	125	74	1,399,438	4,101,190	6,925,300
2039	125	74	1,405,288	4,159,707	7,015,407
2040	125	74	1,412,308	4,221,709	7,049,355
2041	125	74	1,414,648	4,281,414	6,975,610
2042	125	74	1,421,672	4,351,648	7,051,695
2043	125	74	1,432,198	4,428,921	7,159,335
2044	126	75	1,439,222	4,504,979	7,264,635
2045	126	75	1,445,068	4,583,378	7,182,700
2046	126	75	1,453,271	4,667,618	7,295,020
2047	127	75	1,463,796	4,760,031	7,414,429
2048	128	75	1,476,662	4,861,786	7,536,075
2049	129	76	1,489,541	4,967,095	7,662,452
2050	130	76	1,503,585	5,075,913	7,790,034
2051	131	76	1,509,616	5,096,273	7,821,281
2052	131	77	1,515,671	5,116,715	7,852,653
2053	132	77	1,521,751	5,137,239	7,884,151
2054	132	77	1,527,855	5,157,845	7,915,776
2055	133	77	1,533,983	5,178,534	7,947,527
2056	133	78	1,540,136	5,199,306	7,979,405
2057	134	78	1,546,314	5,220,161	8,011,412
2058	134	78	1,552,517	5,241,100	8,043,547
2059	135	79	1,558,744	5,262,122	8,075,810
2060	135	79	1,564,996	5,283,229	8,108,204
2061	136	79	1,571,274	5,304,421	8,140,727
2062	136	80	1,577,576	5,325,698	8,173,380
2063	137	80	1,583,904	5,347,060	8,206,165
2064	138	80	1,590,257	5,368,508	8,239,081
2065	138	81	1,596,636	5,390,041	8,272,129
2066	139	81	1,603,040	5,411,661	8,305,309
2067	139	81	1,609,470	5,433,368	8,338,623

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

Table J-3. Changes from baseline for railroad operations[a] – Caliente rail alignment – Nye County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	143	56	617,270	3,587,624	7,035,854
2016	149	53	647,337	3,463,212	7,037,582
2017	154	54	675,180	3,446,165	7,775,518
2018	159	54	700,701	3,451,968	8,083,646
2019	163	55	724,280	3,483,277	8,349,515
2020	167	56	746,807	3,537,518	8,674,915
2021	171	58	768,362	3,607,239	8,974,574
2022	174	59	788,982	3,682,680	9,252,561
2023	178	61	809,415	3,761,070	9,509,683
2024	181	62	828,678	3,846,761	9,768,114
2025	184	63	846,988	3,930,861	10,025,514
2026	187	64	864,980	4,017,722	10,282,161
2027	190	65	881,781	4,105,752	10,501,982
2028	192	66	898,066	4,198,264	10,771,362
2029	195	67	914,468	4,289,665	11,029,737
2030	197	67	929,901	4,383,487	11,265,186
2031	199	68	944,747	4,482,375	11,504,339
2032	201	69	958,939	4,584,306	11,717,697
2033	203	70	972,732	4,692,086	11,963,537
2034	205	70	987,076	4,797,725	12,139,316
2035	207	71	1,001,103	4,901,715	12,279,437
2036	209	71	1,015,143	5,013,146	12,502,016
2037	211	72	1,030,038	5,130,696	12,736,016
2038	213	73	1,044,967	5,251,487	12,958,873
2039	215	73	1,060,563	5,377,659	13,204,573
2040	218	74	1,076,042	5,503,259	13,380,353
2041	220	74	1,091,321	5,634,252	13,451,389
2042	222	75	1,106,449	5,769,130	13,673,411
2043	224	75	1,121,846	5,913,320	13,930,531
2044	227	76	1,137,359	6,061,852	14,189,047
2045	229	77	1,152,569	6,211,565	14,247,826
2046	232	77	1,168,504	6,370,627	14,505,506
2047	235	78	1,184,451	6,539,107	14,787,421
2048	238	78	1,199,766	6,718,339	15,068,221
2049	240	79	1,216,215	6,904,041	15,349,300
2050	243	80	1,231,530	7,094,751	15,643,473
2051	247	81	1,248,771	7,194,076	15,862,478

Table J-3. Changes from baseline for railroad operations[a] – Caliente rail alignment – Nye County (page 2 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
	Variable				
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2052	250	82	1,266,254	7,294,792	16,084,549
2053	254	83	1,283,981	7,396,917	16,309,729
2054	257	84	1,301,957	7,500,472	16,538,062
2055	261	86	1,320,184	7,605,477	16,769,591
2056	265	87	1,338,666	7,711,952	17,004,361
2057	268	88	1,357,407	7,819,917	17,242,418
2058	272	89	1,376,410	7,929,394	17,483,808
2059	276	90	1,395,680	8,040,404	17,728,577
2060	280	92	1,415,219	8,152,968	17,967,773
2061	284	93	1,435,032	8,267,108	18,228,444
2062	288	94	1,455,122	8,382,845	18,483,638
2063	292	96	1,475,493	8,500,203	18,742,405
2064	296	97	1,496,150	8,619,204	19,004,794
2065	300	98	1,517,096	8,739,871	19,270,857
2066	304	100	1,538,335	8,862,227	19,540,644
2067	308	101	1,559,871	8,986,296	19,814,209
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	148	59	638,317	3,761,433	7,505,082
2016	154	56	671,990	3,640,104	7,517,835
2017	160	57	703,041	3,625,830	8,266,986
2018	166	58	731,507	3,635,892	8,588,151
2019	170	59	757,786	3,671,694	8,866,845
2020	175	60	782,777	3,731,130	9,205,911
2021	179	62	806,610	3,805,191	9,519,237
2022	183	63	829,378	3,885,921	9,811,269
2023	187	65	851,830	3,969,576	10,083,060
2024	191	66	872,925	4,061,421	10,356,138
2025	194	67	892,979	4,150,809	10,627,461
2026	197	68	912,542	4,243,239	10,897,848
2027	200	69	930,946	4,336,956	11,131,848
2028	203	70	948,659	4,435,119	11,415,456
2029	206	71	966,420	4,532,346	11,687,481
2030	208	72	983,151	4,630,626	11,936,808
2031	210	73	999,110	4,735,107	12,190,230
2032	213	73	1,014,449	4,842,747	12,417,327
2033	215	74	1,029,261	4,955,652	12,677,535
2034	217	75	1,044,611	5,067,855	12,867,075

Table J-3. Changes from baseline for railroad operations[a] – Caliente rail alignment – Nye County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2035	219	75	1,059,611	5,178,303	13,021,749
2036	221	76	1,074,598	5,296,005	13,258,791
2037	224	77	1,090,463	5,420,142	13,507,533
2038	226	77	1,106,340	5,548,140	13,745,745
2039	228	78	1,122,908	5,680,584	14,006,304
2040	230	79	1,139,288	5,812,560	14,197,716
2041	233	79	1,155,515	5,951,673	14,283,477
2042	235	80	1,171,509	6,095,817	14,521,689
2043	238	80	1,187,784	6,247,215	14,794,767
2044	240	81	1,204,129	6,403,527	15,067,962
2045	243	81	1,220,252	6,561,126	15,143,778
2046	246	82	1,236,983	6,728,553	15,417,675
2047	249	83	1,253,807	6,905,925	15,716,844
2048	251	83	1,270,023	7,093,242	16,014,141
2049	255	84	1,287,351	7,288,398	16,312,491
2050	258	85	1,303,462	7,490,574	16,623,126
2051	261	86	1,321,710	7,595,440	16,855,846
2052	265	87	1,340,214	7,701,775	17,091,824
2053	269	88	1,358,976	7,809,598	17,331,105
2054	272	90	1,378,002	7,918,930	17,573,737
2055	276	91	1,397,293	8,029,794	17,819,765
2056	280	92	1,416,855	8,142,209	18,069,238
2057	284	94	1,436,691	8,256,198	18,322,203
2058	288	95	1,456,804	8,371,783	18,578,709
2059	292	96	1,477,199	8,488,986	18,838,807
2060	296	98	1,497,880	8,607,830	19,102,546
2061	300	99	1,518,850	8,728,337	19,369,977
2062	304	100	1,540,113	8,850,532	19,641,152
2063	309	102	1,561,674	8,974,437	19,916,124
2064	313	103	1,583,537	9,100,077	20,194,945
2065	317	105	1,605,707	9,227,476	20,477,670
2066	322	106	1,628,186	9,356,659	20,764,352
2067	326	108	1,650,980	9,487,650	21,055,049

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

Table J-4. Changes from baseline for railroad operations[a] – Caliente rail alignment – Esmeralda County (page 1 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	14	11	124,992	895,739	701,737
2016	15	11	136,313	893,335	728,820
2017	16	11	144,510	894,511	755,607
2018	16	11	152,480	897,486	784,038
2019	17	12	159,981	902,288	813,518
2020	18	12	164,562	908,345	842,297
2021	18	12	170,427	916,626	872,824
2022	18	12	174,891	924,740	903,235
2023	19	12	179,358	933,682	934,366
2024	19	12	183,473	943,101	965,962
2025	19	12	187,003	952,491	997,910
2026	20	12	190,297	962,240	1,030,325
2027	20	13	193,123	972,228	1,063,083
2028	20	13	195,949	984,080	1,096,320
2029	20	13	198,655	995,349	1,130,029
2030	20	13	201,129	1,006,523	1,164,310
2031	20	13	203,601	1,018,011	1,199,533
2032	21	13	205,837	1,029,759	1,235,819
2033	21	13	207,838	1,041,843	1,272,097
2034	21	13	209,722	1,053,825	1,309,553
2035	21	13	211,253	1,065,446	1,346,993
2036	21	13	212,784	1,077,306	1,386,779
2037	21	13	214,314	1,089,716	1,426,590
2038	21	13	215,608	1,102,758	1,466,372
2039	21	13	217,253	1,116,247	1,508,500
2040	21	13	218,662	1,130,344	1,551,804
2041	21	13	219,956	1,144,791	1,595,102
2042	21	13	221,014	1,159,815	1,639,567
2043	21	13	221,836	1,169,539	1,685,205
2044	21	13	222,425	1,178,575	1,730,835
2045	21	13	222,778	1,189,156	1,777,661
2046	21	13	223,013	1,195,033	1,825,631
2047	21	13	223,129	1,212,666	1,874,780
2048	21	13	223,131	1,231,468	1,925,099
2049	21	14	223,013	1,251,441	1,976,596
2050	21	14	222,660	1,258,527	2,028,081
2051	21	14	223,088	1,260,945	2,031,977

Table J-4. Changes from baseline for railroad operations[a] – Caliente rail alignment – Esmeralda County (page 2 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2052	21	14	223,517	1,263,367	2,035,881
2053	21	14	223,946	1,265,795	2,039,793
2054	21	14	224,376	1,268,227	2,043,711
2055	21	14	224,808	1,270,663	2,047,638
2056	21	14	225,239	1,273,104	2,051,572
2057	21	14	225,672	1,275,550	2,055,514
2058	21	14	226,106	1,278,001	2,059,463
2059	21	14	226,540	1,280,456	2,063,419
2060	21	14	226,975	1,282,916	2,067,384
2061	21	14	227,411	1,285,381	2,071,356
2062	21	14	227,848	1,287,851	2,075,535
2063	22	14	228,286	1,290,325	2,079,323
2064	22	14	228,725	1,292,804	2,083,317
2065	22	14	229,164	1,295,288	2,087,320
2066	22	14	229,604	1,297,776	2,091,330
2067	22	14	230,046	1,300,270	2,095,348
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	14	11	125,053	895,279	701,735
2016	15	11	136,330	892,489	728,784
2017	16	11	144,525	893,387	755,563
2018	16	11	152,488	896,190	783,994
2019	17	12	159,981	900,867	813,476
2020	18	12	164,550	906,842	842,263
2021	18	12	170,403	915,050	872,789
2022	18	12	174,852	923,148	903,204
2023	19	12	179,305	932,078	934,331
2024	19	12	183,406	941,478	965,938
2025	19	12	186,921	950,866	997,877
2026	20	12	190,202	960,607	1,030,297
2027	20	13	193,015	970,600	1,063,048
2028	20	13	195,829	982,443	1,096,281
2029	20	13	198,525	993,717	1,129,985
2030	20	13	200,987	1,004,888	1,164,273
2031	20	13	203,450	1,016,392	1,199,496
2032	21	13	205,679	1,028,145	1,235,768
2033	21	13	207,672	1,040,224	1,272,045
2034	21	13	209,549	1,052,208	1,309,498

Table J-4. Changes from baseline for railroad operations[a] – Caliente rail alignment – Esmeralda County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2035	21	13	211,074	1,063,834	1,346,936
2036	21	13	212,600	1,075,697	1,386,716
2037	21	13	214,125	1,088,147	1,426,524
2038	21	13	215,416	1,101,202	1,466,302
2039	21	13	217,058	1,114,713	1,508,413
2040	21	13	218,467	1,128,814	1,551,725
2041	21	13	219,759	1,143,266	1,595,204
2042	21	13	220,816	1,158,289	1,639,493
2043	21	13	221,639	1,168,040	1,685,123
2044	21	13	222,228	1,177,088	1,730,761
2045	21	13	222,582	1,187,680	1,777,574
2046	21	13	222,820	1,193,556	1,825,544
2047	21	13	222,938	1,211,162	1,874,689
2048	21	13	222,942	1,229,957	1,924,994
2049	21	14	222,827	1,249,907	1,976,496
2050	21	14	222,477	1,256,975	2,027,980
2051	21	14	222,905	1,259,390	2,031,877
2052	21	14	223,333	1,261,810	2,035,780
2053	21	14	223,762	1,264,234	2,039,692
2054	21	14	224,192	1,266,663	2,043,610
2055	21	14	224,623	1,269,097	2,047,537
2056	21	14	225,054	1,271,535	2,051,471
2057	21	14	225,487	1,273,978	2,055,412
2058	21	14	225,920	1,276,426	2,059,361
2059	21	14	226,354	1,278,878	2,063,317
2060	21	14	226,789	1,281,335	2,067,282
2061	21	14	227,225	1,283,797	2,071,253
2062	21	14	227,661	1,286,263	2,075,223
2063	22	14	228,099	1,288,734	2,079,220
2064	22	14	228,537	1,291,210	2,083,214
2065	22	14	228,976	1,293,691	2,087,217
2066	22	14	229,416	1,296,177	2,091,227
2067	22	14	229,857	1,298,667	2,095,245

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

Table J-5. Changes from baseline for railroad operations[a] – Caliente rail alignment – Clark County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County					
2015	1008	74	4,087,278	13,340,457	10,872,342
2016	900	23	3,678,726	10,452,897	5,507,307
2017	798	1	3,288,905	8,488,935	2,705,040
2018	709	-3	2,937,741	7,346,898	1,704,924
2019	631	3	2,632,044	6,730,425	1,740,375
2020	563	13	2,364,008	6,533,748	2,320,344
2021	505	24	2,135,695	6,462,261	3,311,451
2022	457	36	1,941,311	6,703,281	4,195,854
2023	416	47	1,778,576	6,998,355	5,338,476
2024	382	57	1,641,522	7,311,096	6,301,620
2025	352	64	1,518,672	7,605,819	7,122,726
2026	326	71	1,416,718	7,909,083	7,801,326
2027	304	76	1,323,059	8,096,283	8,480,511
2028	283	79	1,241,113	8,363,745	8,890,245
2029	264	83	1,167,169	8,613,657	9,390,771
2030	249	85	1,102,362	8,801,676	9,712,170
2031	234	88	1,043,277	8,944,065	10,122,606
2032	222	89	994,196	9,221,355	10,586,511
2033	212	90	953,948	9,408,204	10,818,405
2034	204	91	921,656	9,702,576	11,229,777
2035	199	92	903,825	9,908,145	11,336,130
2036	195	93	885,912	10,140,741	11,640,096
2037	192	94	883,701	10,372,050	11,818,755
2038	192	94	884,871	10,631,439	12,228,957
2039	193	94	893,751	10,783,188	12,335,895
2040	197	94	912,717	11,050,533	12,694,968
2041	200	94	933,941	11,283,363	12,798,981
2042	206	95	958,511	11,568,141	13,173,966
2043	210	96	990,873	11,862,747	13,407,966
2044	218	96	1,023,165	12,256,569	13,830,453
2045	225	98	1,063,413	12,789,270	14,269,437
2046	234	99	1,104,656	13,339,755	14,725,737
2047	242	101	1,150,356	13,960,440	15,287,337
2048	251	105	1,191,715	14,516,424	15,991,209
2049	259	107	1,234,022	15,101,424	16,675,308
2050	267	110	1,267,473	15,927,210	17,496,180
2051	269	111	1,281,157	16,099,174	17,685,084

Table J-5. Changes from baseline for railroad operations[a] – Caliente rail alignment – Clark County (page 2 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Lincoln County (continued)					
2052	272	112	1,294,990	16,272,994	17,876,027
2053	275	113	1,308,972	16,448,691	18,069,032
2054	278	115	1,323,104	16,626,285	18,264,120
2055	281	116	1,337,390	16,805,797	18,461,315
2056	284	117	1,351,829	16,987,247	18,660,640
2057	287	118	1,366,425	17,170,655	18,862,116
2058	290	120	1,381,178	17,356,044	19,065,767
2059	294	121	1,396,090	17,543,435	19,271,617
2060	297	122	1,411,164	17,732,849	19,479,690
2061	300	124	1,426,400	17,924,308	19,690,010
2062	303	125	1,441,801	18,117,834	19,902,600
2063	307	126	1,457,367	18,313,450	20,117,485
2064	310	128	1,473,102	18,511,177	20,334,691
2065	313	129	1,489,007	18,711,040	20,554,241
2066	317	130	1,505,084	18,913,060	20,776,162
2067	320	132	1,521,334	19,117,262	21,000,480
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	1014	81	4,108,478	13,956,345	11,675,781
2016	907	30	3,707,742	11,113,479	6,248,151
2017	807	8	3,324,602	9,194,094	3,427,983
2018	719	3	2,980,142	8,034,273	2,356,614
2019	641	8	2,677,791	7,471,386	2,365,272
2020	575	18	2,415,336	7,230,015	2,972,034
2021	519	29	2,190,369	7,158,411	3,918,330
2022	471	41	2,001,566	7,426,224	4,891,770
2023	431	52	1,841,054	7,703,514	6,017,310
2024	397	62	1,708,469	8,034,156	6,997,770
2025	368	70	1,587,807	8,337,771	7,854,210
2026	343	77	1,487,070	8,650,044	8,586,630
2027	320	81	1,395,576	8,801,442	9,230,130
2028	300	85	1,316,952	9,095,814	9,711,000
2029	282	89	1,244,178	9,327,708	10,211,760
2030	266	91	1,179,360	9,524,736	10,551,060
2031	252	94	1,122,498	9,711,819	10,996,830
2032	240	95	1,073,475	10,015,902	11,497,590
2033	231	97	1,037,673	10,184,733	11,764,350
2034	223	98	1,006,434	10,470,213	12,230,010

Table J-5. Changes from baseline for railroad operations[a] – Caliente rail alignment – Clark County (page 3 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2035	219	99	991,926	10,738,260	12,407,850
2036	215	100	975,195	10,970,856	12,675,780
2037	212	100	972,972	11,237,850	12,889,890
2038	212	101	976,365	11,505,780	13,424,580
2039	213	101	988,650	11,649,105	13,549,770
2040	217	102	1,007,604	11,916,450	13,855,140
2041	221	102	1,031,004	12,193,740	14,066,910
2042	226	103	1,056,744	12,487,410	14,495,130
2043	232	103	1,091,259	12,737,790	14,746,680
2044	239	104	1,123,551	13,130,910	15,205,320
2045	247	105	1,166,022	13,691,340	15,608,970
2046	256	107	1,207,323	14,214,330	16,225,560
2047	264	109	1,250,730	14,835,600	16,787,160
2048	273	113	1,296,594	15,445,170	17,490,330
2049	281	115	1,336,725	16,030,170	18,174,780
2050	289	118	1,374,633	16,837,470	19,138,860
2051	292	120	1,389,475	17,019,262	19,345,499
2052	295	121	1,404,477	17,203,016	19,554,370
2053	298	122	1,419,641	17,388,755	19,765,496
2054	302	123	1,434,968	17,576,498	19,978,901
2055	305	125	1,450,461	17,766,269	20,194,610
2056	308	126	1,466,122	17,958,089	20,412,648
2057	312	128	1,481,951	18,151,980	20,633,041
2058	315	129	1,497,952	18,347,964	20,855,812
2059	318	130	1,514,125	18,546,064	21,080,990
2060	322	132	1,530,473	18,746,304	21,308,598
2061	325	133	1,546,997	18,948,705	21,538,664
2062	329	135	1,563,700	19,153,291	21,771,213
2063	332	136	1,580,583	19,360,086	22,006,274
2064	336	137	1,597,648	19,569,114	22,243,873
2065	340	139	1,614,898	19,780,399	22,484,036
2066	343	140	1,632,333	19,993,965	22,726,793
2067	347	142	1,649,957	20,209,837	22,972,171

a. Sources: DIRS 179558-Bland 2007, all; DIRS 180485-Bland 2007, all.
b. Data expressed in dollars.

J.1.3 RAILROAD CONSTRUCTION – MINA RAIL ALIGNMENT

Table J-6 lists percent changes to the baseline that would be associated with the Mina rail alignment construction phase. The table lists data by county, but does not break the data down by scenario for Lyon, Esmeralda, and Clark Counties because the percent changes would be the same for under either scenario. Mineral and Nye Counties would experience slightly different percent changes under the two scenarios. Section 3.3.9, Table 3-61, lists baseline numbers. Rail Alignment EIS Section 4.3.9, Table 4-245, lists absolute changes to the baseline. As a sensitivity analysis, the socioeconomic analysis for the Mina rail alignment assesses the impacts of the project's construction phase on the combined area of Washoe County-Carson City. This alternative analysis assumes that 50 percent of the construction workers come from the Washoe County-Carson City area. Table J-7 includes percent changes to the baseline for this combined area.

Table J-6. Percent changes from baseline for railroad construction – Mina rail alignment[a] (page 1 of 2).

	Variable				
Year	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
Lyon County					
2010	0.00	0.02	0.00	0.02	0.04
2011	0.01	0.02	0.01	0.03	0.02
2012	0.01	0.02	0.01	0.03	0.02
2013	0.01	0.01	0.01	0.02	0.01
2014	0.01	0.01	0.01	0.01	0.01
Mineral County					
Scenario 1					
2010	0.75	4.87	1.19	3.72	1.63
2011	1.08	5.36	1.53	4.19	13.97
2012	1.36	6.09	1.76	4.47	14.13
2013	1.36	3.47	1.45	2.62	7.21
2014	1.33	2.25	1.32	1.83	1.72
Scenario 2					
2010	0.74	4.78	1.18	3.70	1.52
2011	1.08	5.36	1.52	4.18	13.97
2012	1.35	6.09	1.75	4.47	14.13
2013	1.35	3.47	1.45	2.62	7.21
2014	1.27	1.87	1.27	1.42	1.52
Nye County					
Scenario 1					
2010	0.04	0.42	0.12	0.29	0.58
2011	0.05	0.34	0.12	0.14	0.36
2012	0.09	0.54	0.16	0.32	0.80
2013	0.14	0.54	0.17	0.38	0.93
2014	0.15	0.19	0.16	0.17	0.27

Table J-6. Percent changes from baseline for railroad construction – Mina rail alignment[a] (page 2 of 2).

Year	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
			Nye County *(continued)*		
Scenario 2					
2010	0.04	0.34	0.13	0.15	0.37
2011	0.10	0.55	0.17	0.33	0.83
2012	0.15	0.56	0.18	0.40	1.02
2013	0.16	0.22	0.17	0.19	0.38
2014	0.15	0.09	0.16	0.12	0.15
			Esmeralda County		
2010	0.45	5.655	2.70	17.63	27.52
2011	0.68	6.136	3.04	17.90	10.03
2012	1.62	13.85	4.36	27.15	56.67
2013	2.46	11.07	4.10	18.78	53.00
2014	3.08	10.70	4.61	15.22	41.35
			Clark County		
2010	0.02	0.14	0.02	0.14	0.13
2011	0.03	0.14	0.03	0.14	0.13
2012	0.04	0.14	0.04	0.14	0.13
2013	0.04	0.06	0.04	0.06	0.06
2014	0.04	0.03	0.04	0.04	0.03

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007 all.

Table J-7. Percent changes from baseline on Washoe County-Carson City for railroad construction – Mina rail alignment[a].

Year	Population	Total Employment	State and local government spending	Real disposable personal income	Total gross regional product
			Washoe County-Carson City		
2010	0.03	0.24	0.03	0.24	0.20
2011	0.06	0.24	0.06	0.24	0.21
2012	0.07	0.23	0.08	0.24	0.20
2013	0.07	0.08	0.07	0.09	0.07
2014	0.06	0.05	0.07	0.06	0.04

a. Source: DIRS 181590-Bland 2007, all.

J.1.4 RAILROAD OPERATIONS – MINA RAIL ALIGNMENT

Tables J-8 through J-12 list impacts associated with the railroad operations phase for the Mina rail alignment, and Table J-13 lists the results of the alternative analysis for the combined area of Washoe County-Carson City.

Table J-8. Changes from baseline for railroad operations[a] – Mina rail alignment – Lyon County (page 1 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
	Variable				
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	8	1	34,972	123,575	54,815
2016	8	1	35,669	121,762	51,188
2017	8	1	36,330	125,120	52,018
2018	8	1	36,956	126,079	52,861
2019	8	1	37,454	127,331	54,534
2020	8	1	37,799	129,425	56,066
2021	8	1	38,251	130,829	58,851
2022	8	1	38,423	132,643	60,945
2023	8	1	38,770	135,568	62,618
2024	8	1	39,187	137,101	64,724
2025	8	1	39,407	140,306	66,807
2026	8	1	39,789	143,372	69,603
2027	8	1	40,068	146,028	71,136
2028	9	1	40,241	148,262	72,809
2029	9	1	40,484	151,609	74,623
2030	9	1	40,693	155,926	76,296
2031	9	1	41,042	158,582	80,344
2032	9	1	41,286	162,630	81,175
2033	9	1	41,460	165,695	81,877
2034	9	1	41,705	169,287	86,054
2035	9	1	42,015	172,493	88,569
2036	9	1	42,260	174,342	89,681
2037	9	1	42,541	177,723	91,213
2038	9	1	43,033	183,866	94,010
2039	9	1	43,477	186,908	95,402
2040	9	1	43,934	190,219	99,017
2041	9	1	44,249	193,916	101,825
2042	9	1	44,706	198,374	103,206
2043	9	1	45,057	200,012	105,721
2044	9	1	45,607	207,558	109,348
2045	9	1	46,238	211,396	113,818
2046	9	1	46,800	218,685	116,602
2047	9	1	47,455	227,390	122,171
2048	9	1	48,075	234,070	123,856
2049	10	1	48,777	243,278	128,876
2050	10	1	49,339	249,959	134,164

Table J-8. Changes from baseline for railroad operations[a] – Mina rail alignment – Lyon County (page 2 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	10	1	50,128	253,958	136,311
2052	10	1	50,930	258,021	138,491
2053	10	1	51,745	262,150	140,707
2054	10	1	52,573	266,344	142,959
2055	10	1	53,414	270,606	145,246
2056	11	1	54,269	274,935	147,570
2057	11	2	55,137	279,334	149,931
2058	11	2	56,019	283,804	152,330
2059	11	2	56,916	288,344	154,767
2060	11	2	57,826	292,958	157,243
2061	11	2	58,752	297,645	159,759
2062	12	2	59,692	302,407	162,315
2063	12	2	60,647	307,246	164,912
2064	12	2	61,617	312,162	167,551
2065	12	2	62,603	317,156	170,232
2066	12	2	63,605	322,231	172,955
2067	13	2	64,622	327,386	175,723
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	8	1	33,543	104,187	43,101
2016	8	1	33,333	99,168	37,241
2017	7	1	33,122	100,148	36,679
2018	7	1	32,876	99,305	36,398
2019	7	1	32,572	99,023	37,798
2020	7	1	32,186	99,303	38,631
2021	7	1	31,975	99,445	40,582
2022	7	1	31,589	100,565	42,257
2023	7	1	31,378	102,517	43,510
2024	7	1	31,272	103,069	45,614
2025	7	1	31,108	104,881	47,007
2026	7	1	30,968	106,553	49,098
2027	7	1	30,897	108,926	49,791
2028	7	1	30,722	110,327	51,193
2029	6	1	30,721	112,978	52,863
2030	6	1	30,581	116,039	54,116
2031	6	1	30,825	118,274	56,770
2032	6	1	30,790	120,509	58,018

Table J-8. Changes from baseline for railroad operations[a] – Mina rail alignment – Lyon County (page 3 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
	Variable				
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	6	1	30,825	123,011	57,743
2034	6	1	30,895	125,914	61,505
2035	6	1	31,000	128,276	62,210
2036	6	1	31,140	130,126	63,041
2037	6	1	31,351	132,677	64,153
2038	6	1	31,631	136,723	66,388
2039	6	1	31,936	139,760	67,508
2040	6	1	32,251	142,524	70,012
2041	6	1	32,497	144,818	71,416
2042	7	1	32,813	148,445	71,690
2043	7	1	33,059	150,641	74,483
2044	7	1	33,469	155,952	76,437
2045	7	1	34,065	159,785	80,339
2046	7	1	34,521	165,680	82,293
2047	7	1	34,978	171,602	87,028
2048	7	1	35,492	176,885	87,037
2049	7	1	35,984	183,581	91,770
2050	7	1	36,475	189,152	94,837
2051	7	1	36,208	186,510	94,087
2052	7	1	36,788	189,494	95,593
2053	7	1	37,376	192,526	97,122
2054	7	1	37,974	195,607	98,676
2055	8	1	38,582	198,736	100,255
2056	8	1	39,199	201,916	101,859
2057	8	1	39,826	205,147	103,489
2058	8	1	40,464	208,429	105,144
2059	8	1	41,111	211,764	106,827
2060	8	1	41,769	215,152	108,536
2061	8	1	42,437	218,594	110,272
2062	8	1	43,116	222,092	112,037
2063	9	1	43,806	225,645	113,829
2064	9	1	44,507	229,256	115,651
2065	9	1	45,219	232,924	117,501
2066	9	1	45,942	236,651	119,381
2067	9	1	46,678	240,437	121,291

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-9. Changes from baseline for railroad operations[a] – Mina rail alignment – Mineral County (page 1 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	66	63	534,362	3,033,927	2,168,478
2016	68	62	552,813	3,081,312	2,170,584
2017	70	65	575,172	3,185,442	3,698,253
2018	71	64	593,307	3,222,063	3,809,754
2019	73	63	608,283	3,250,260	3,842,514
2020	74	63	618,930	3,274,830	3,915,288
2021	74	62	628,290	3,297,060	3,961,035
2022	75	62	634,257	3,315,780	3,986,424
2023	75	61	638,469	3,333,330	3,997,188
2024	75	61	641,511	3,349,710	4,019,652
2025	74	61	642,330	3,364,920	4,047,498
2026	74	60	641,979	3,380,130	4,081,194
2027	73	60	640,107	3,394,170	4,087,746
2028	73	60	637,767	3,409,380	4,146,246
2029	72	60	634,257	3,423,420	4,194,567
2030	71	59	630,279	3,438,630	4,229,082
2031	70	59	625,716	3,456,180	4,268,043
2032	69	59	621,387	3,474,900	4,280,445
2033	69	59	617,058	3,494,790	4,337,424
2034	68	59	613,548	3,517,020	4,316,013
2035	67	58	610,272	3,539,250	4,266,171
2036	67	58	607,464	3,561,480	4,303,494
2037	66	58	605,826	3,584,880	4,333,563
2038	66	58	604,422	3,609,450	4,360,239
2039	65	58	603,486	3,635,190	4,399,785
2040	65	58	603,018	3,663,270	4,378,842
2041	64	57	602,316	3,690,180	4,252,950
2042	64	57	601,848	3,720,600	4,273,074
2043	64	57	601,497	3,752,190	4,318,353
2044	64	57	601,380	3,786,120	4,367,376
2045	64	57	600,678	3,820,050	4,225,104
2046	63	57	600,093	3,857,490	4,275,531
2047	63	57	599,508	3,897,270	4,327,362
2048	63	57	598,923	3,940,560	4,382,820
2049	63	57	597,987	3,983,850	4,438,863
2050	63	57	596,466	4,027,140	4,496,544

Table J-9. Changes from baseline for railroad operations[a] – Mina rail alignment – Mineral County (page 2 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
	Variable				
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	62	57	594,075	4,010,998	4,478,521
2052	62	56	591,694	3,994,922	4,460,570
2053	62	56	589,322	3,978,909	4,442,691
2054	62	56	586,960	3,962,961	4,424,884
2055	61	56	584,608	3,947,077	4,407,148
2056	61	55	582,264	3,931,256	4,389,484
2057	61	55	579,931	3,915,499	4,371,890
2058	61	55	577,606	3,899,804	4,354,366
2059	60	55	575,291	3,884,173	4,336,913
2060	60	55	572,985	3,868,605	4,319,530
2061	60	54	570,688	3,853,099	4,302,216
2062	60	54	568,401	3,837,655	4,284,972
2063	59	54	566,123	3,822,273	4,267,797
2064	59	54	563,854	3,806,952	4,250,691
2065	59	53	561,594	3,791,693	4,233,653
2066	59	53	559,343	3,776,495	4,216,684
2067	59	53	557,101	3,761,358	4,199,783
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	58	44	469,946	2,012,871	1,530,465
2016	55	44	453,939	1,997,687	1,519,952
2017	54	46	446,230	2,055,043	3,042,087
2018	53	45	438,170	2,056,248	3,150,949
2019	51	45	430,344	2,057,461	3,182,539
2020	50	45	421,704	2,060,980	3,253,892
2021	49	45	414,341	2,065,651	3,297,165
2022	48	44	406,520	2,071,501	3,319,429
2023	47	44	399,157	2,077,369	3,325,349
2024	46	44	392,385	2,084,424	3,341,677
2025	45	43	385,248	2,091,418	3,362,737
2026	43	43	378,236	2,098,464	3,388,494
2027	42	43	371,099	2,105,501	3,386,154
2028	41	43	364,318	2,113,674	3,435,347
2029	40	43	357,298	2,120,711	3,473,887
2030	39	42	350,759	2,128,919	3,498,544
2031	39	42	344,441	2,139,449	3,527,794
2032	38	42	338,955	2,151,140	3,530,099

Table J-9. Changes from baseline for railroad operations[a] – Mina rail alignment – Mineral County (page 3 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	37	42	334,158	2,164,036	3,576,951
2034	36	42	330,301	2,178,102	3,545,379
2035	36	41	327,029	2,193,347	3,485,691
2036	36	41	324,451	2,207,335	3,512,619
2037	35	41	322,813	2,222,527	3,532,561
2038	35	41	321,652	2,237,737	3,548,837
2039	35	41	321,179	2,254,135	3,578,156
2040	34	41	320,950	2,271,755	3,546,584
2041	34	41	320,720	2,289,287	3,409,764
2042	34	41	320,841	2,309,195	3,419,019
2043	34	40	321,084	2,330,324	3,452,984
2044	34	40	321,669	2,353,742	3,490,459
2045	34	40	321,899	2,377,177	3,337,154
2046	34	40	322,029	2,402,951	3,375,834
2047	34	40	322,033	2,431,031	3,415,544
2048	34	40	321,929	2,461,521	3,458,938
2049	34	40	321,353	2,490,789	3,502,194
2050	34	40	320,304	2,519,986	3,546,654
2051	33	40	318,712	2,508,913	3,532,056
2052	33	40	317,435	2,498,857	3,517,899
2053	33	40	316,163	2,488,841	3,503,798
2054	33	39	314,895	2,478,865	3,489,754
2055	33	39	313,633	2,468,930	3,475,767
2056	33	39	312,376	2,459,034	3,461,835
2057	33	39	311,124	2,449,177	3,447,959
2058	33	39	309,877	2,439,361	3,434,139
2059	32	39	308,635	2,429,583	3,420,375
2060	32	39	307,398	2,419,845	3,406,665
2061	32	38	306,166	2,410,146	3,393,010
2062	32	38	304,939	2,400,485	3,379,411
2063	32	38	303,716	2,390,864	3,365,865
2064	32	38	302,499	2,381,281	3,352,374
2065	32	38	301,286	2,371,736	3,338,937
2066	32	38	300,079	2,362,230	3,325,554
2067	31	37	298,876	2,352,761	3,312,225

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-10. Changes from baseline for railroad operations[a] – Mina rail alignment – Nye County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	84	16	362,670	1,558,161	1,743,161
2016	82	13	357,388	1,439,852	1,663,601
2017	81	15	353,392	1,400,823	2,268,491
2018	79	15	349,783	1,371,434	2,413,571
2019	78	15	346,723	1,363,383	2,501,460
2020	77	16	344,483	1,369,094	2,640,551
2021	76	16	343,231	1,385,055	2,752,731
2022	76	17	342,529	1,407,564	2,844,549
2023	75	17	342,880	1,433,916	2,913,439
2024	75	18	343,582	1,464,755	2,988,932
2025	75	18	344,518	1,495,175	3,067,879
2026	75	19	346,004	1,526,904	3,147,300
2027	75	19	347,677	1,558,355	3,191,342
2028	75	19	349,549	1,593,122	3,286,948
2029	75	20	351,737	1,627,191	3,369,739
2030	75	20	354,077	1,660,369	3,432,780
2031	75	20	356,417	1,696,221	3,500,640
2032	75	20	359,108	1,733,661	3,537,189
2033	76	21	361,799	1,774,611	3,620,259
2034	76	21	365,227	1,813,415	3,616,749
2035	76	21	368,655	1,851,327	3,584,601
2036	77	21	372,446	1,895,175	3,643,101
2037	77	21	376,810	1,939,635	3,694,302
2038	78	21	381,559	1,986,575	3,741,381
2039	78	21	386,556	2,031,786	3,801,051
2040	79	22	391,669	2,078,726	3,797,541
2041	80	22	396,817	2,124,635	3,679,650
2042	81	22	402,199	2,173,969	3,717,369
2043	81	22	407,616	2,228,959	3,779,712
2044	82	22	413,279	2,287,125	3,846,681
2045	83	22	418,895	2,342,115	3,712,689
2046	84	23	424,932	2,406,132	3,783,222
2047	85	23	430,829	2,471,985	3,856,599
2048	87	23	437,217	2,546,478	3,930,921
2049	88	23	443,418	2,621,691	4,009,032
2050	89	23	449,268	2,698,074	4,089,708

Table J-10. Changes from baseline for railroad operations[a] – Mina rail alignment – Nye County (page 2 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	90	24	455,557	2,735,847	4,146,963
2052	91	24	461,935	2,774,148	4,205,019
2053	93	24	468,402	2,812,985	4,263,889
2054	94	25	474,959	2,852,366	4,323,582
2055	95	25	481,609	2,892,299	4,384,111
2056	97	26	488,351	2,932,790	4,445,488
2057	98	26	495,188	2,973,849	4,507,724
2058	99	26	502,121	3,015,482	4,570,831
2059	101	27	509,150	3,057,698	4,634,821
2060	102	27	516,278	3,100,505	4,699,708
2061	103	27	523,506	3,143,911	4,765,502
2062	105	28	530,835	3,187,925	4,832,218
2063	106	28	538,266	3,232,556	4,899,868
2064	108	29	545,802	3,277,811	4,968,465
2065	109	29	553,443	3,323,699	5,038,023
2066	111	29	561,191	3,370,230	5,108,554
2067	112	30	569,048	3,417,413	5,180,072
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	87	17	379,045	1,623,843	2,134,782
2016	86	19	379,022	1,590,264	2,751,255
2017	86	19	378,951	1,565,460	2,908,386
2018	85	19	379,220	1,562,652	3,009,591
2019	85	20	379,993	1,572,714	3,161,925
2020	85	20	381,467	1,594,710	3,288,051
2021	85	21	383,304	1,621,971	3,393,117
2022	85	21	386,065	1,654,731	3,476,889
2023	85	22	388,978	1,690,416	3,567,330
2024	85	22	391,938	1,727,271	3,660,228
2025	86	23	395,378	1,764,009	3,753,711
2026	86	23	398,795	1,801,449	3,812,328
2027	86	24	402,340	1,841,346	3,921,138
2028	86	24	406,130	1,882,179	4,018,716
2029	87	24	409,968	1,920,906	4,096,521
2030	87	25	413,712	1,963,026	4,178,538
2031	88	25	417,620	2,005,497	4,228,380
2032	88	25	421,493	2,052,297	4,325,607

Table J-10. Changes from baseline for railroad operations[a] – Mina rail alignment – Nye County (page 3 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	89	25	426,009	2,097,342	4,336,605
2034	89	25	430,478	2,141,685	4,319,055
2035	90	26	435,416	2,191,293	4,391,829
2036	90	26	440,692	2,242,305	4,458,051
2037	91	26	446,378	2,296,242	4,519,593
2038	92	26	452,427	2,349,360	4,595,175
2039	93	26	458,582	2,403,414	4,606,524
2040	94	27	464,666	2,455,830	4,504,266
2041	95	27	471,065	2,515,383	4,557,267
2042	96	27	477,348	2,578,797	4,636,359
2043	97	27	484,029	2,643,615	4,718,727
2044	98	27	490,546	2,707,497	4,599,972
2045	99	28	497,426	2,779,686	4,688,658
2046	100	28	504,329	2,855,853	4,777,695
2047	101	28	511,559	2,937,285	4,870,944
2048	103	28	518,766	3,022,812	4,965,831
2049	104	29	525,564	3,110,328	5,062,941
2050	105	29	532,753	3,159,582	5,138,323
2051	107	29	540,211	3,203,815	5,210,258
2052	108	30	547,774	3,248,668	5,283,201
2053	110	30	555,443	3,294,149	5,357,164
2054	111	31	563,219	3,340,266	5,432,164
2055	113	31	571,104	3,387,029	5,508,213
2056	114	32	579,099	3,434,447	5,585,326
2057	116	32	587,207	3,482,528	5,663,520
2058	118	32	595,427	3,531,283	5,742,808
2059	119	33	603,763	3,580,720	5,823,206
2060	121	33	612,216	3,630,849	5,904,729
2061	123	34	620,787	3,681,680	5,987,394
2062	124	34	629,478	3,733,223	6,071,216
2063	126	35	638,290	3,785,487	6,156,212
2064	128	35	647,226	3,838,483	6,242,397
2065	130	36	656,287	3,892,221	6,329,789
2066	131	36	665,475	3,946,711	6,418,405
2067	19	7	97,912	535,275	1,256,385

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-11. Changes from baseline for railroad operations[a] – Mina rail alignment – Esmeralda County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	37	46	333,646	3,537,174	6,485,641
2016	40	47	368,625	3,515,455	6,661,215
2017	44	47	403,848	3,518,072	6,841,384
2018	48	48	440,953	3,536,957	7,029,744
2019	51	50	477,822	3,567,475	7,222,791
2020	54	51	508,146	3,603,793	7,412,327
2021	58	52	544,785	3,649,456	7,610,042
2022	62	53	588,445	3,703,296	7,814,787
2023	66	54	633,748	3,761,814	8,020,707
2024	71	55	676,009	3,820,317	8,228,970
2025	74	56	710,077	3,876,457	8,432,552
2026	77	57	742,037	3,933,781	8,632,637
2027	79	58	772,007	3,991,131	8,836,219
2028	82	59	800,807	4,047,289	9,038,629
2029	84	59	828,436	4,101,124	9,241,057
2030	86	60	851,500	4,154,972	9,443,469
2031	88	61	873,043	4,209,969	9,651,746
2032	89	61	891,191	4,267,340	9,857,664
2033	90	62	907,464	4,324,667	10,062,427
2034	91	63	920,695	4,382,023	10,267,197
2035	92	63	930,298	4,437,045	10,470,785
2036	92	64	937,091	4,493,235	10,674,383
2037	92	64	942,596	4,550,589	10,879,159
2038	92	65	946,230	4,609,159	11,087,421
2039	92	65	950,563	4,668,872	11,294,520
2040	91	65	948,228	4,727,451	11,492,272
2041	90	66	941,446	4,786,011	11,698,200
2042	89	66	929,984	4,843,402	11,899,458
2043	87	66	914,191	4,893,709	12,098,358
2044	85	66	894,069	4,935,859	12,285,571
2045	83	66	874,061	4,983,868	12,484,484
2046	81	66	854,989	5,021,325	12,671,684
2047	79	66	837,320	5,086,893	12,870,597
2048	77	66	819,535	5,153,649	13,057,797
2049	76	66	801,631	5,222,744	13,268,410
2050	74	66	783,259	5,268,395	13,467,319

Table J-11. Changes from baseline for railroad operations[a] – Mina rail alignment – Esmeralda County (page 2 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	74	66	784,764	5,278,517	13,493,193
2052	74	66	786,272	5,288,659	13,519,117
2053	74	66	787,782	5,298,819	13,545,090
2054	74	66	789,296	5,309,000	13,571,114
2055	75	66	790,812	5,319,200	13,597,187
2056	75	66	792,332	5,329,419	13,623,311
2057	75	67	793,854	5,339,658	13,649,485
2058	75	67	795,379	5,349,917	13,675,709
2059	75	67	796,907	5,360,196	13,701,983
2060	75	67	798,438	5,370,494	13,728,308
2061	75	67	799,972	5,380,812	13,754,684
2062	76	67	801,509	5,391,150	13,781,110
2063	76	67	803,049	5,401,508	13,807,587
2064	76	67	804,592	5,411,885	13,834,115
2065	76	68	806,138	5,422,283	13,860,694
2066	76	68	807,687	5,432,700	13,887,323
2067	76	68	809,238	5,443,138	13,914,004
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	37	46	333,664	3,535,969	6,485,513
2016	40	47	368,575	3,513,757	6,661,035
2017	44	47	403,797	3,516,059	6,841,201
2018	48	48	440,893	3,534,774	7,029,571
2019	51	50	477,753	3,565,191	7,222,619
2020	54	51	508,062	3,601,469	7,412,164
2021	58	52	544,686	3,647,117	7,609,883
2022	62	53	588,330	3,700,962	7,814,628
2023	66	54	633,616	3,759,500	8,020,553
2024	71	55	675,859	3,818,040	8,228,830
2025	74	56	709,911	3,874,228	8,432,408
2026	77	57	741,857	3,931,588	8,632,489
2027	79	58	771,814	3,988,966	8,836,060
2028	82	59	800,602	4,045,152	9,038,475
2029	84	59	828,219	4,099,014	9,240,893
2030	86	60	851,273	4,152,890	9,443,310
2031	88	61	872,807	4,207,918	9,651,576
2032	89	61	890,948	4,265,301	9,857,498

Table J-11. Changes from baseline for railroad operations[a] – Mina rail alignment – Esmeralda County (page 3 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	90	62	907,215	4,322,659	10,062,255
2034	91	63	920,441	4,380,039	10,267,018
2035	92	63	930,039	4,435,072	10,470,596
2036	92	64	936,830	4,491,278	10,674,176
2037	92	64	942,333	4,548,656	10,878,954
2038	92	65	945,964	4,607,224	11,087,212
2039	92	65	950,297	4,666,950	11,294,293
2040	91	65	947,962	4,725,511	11,492,045
2041	90	66	941,181	4,784,072	11,697,974
2042	89	66	929,719	4,841,449	11,899,223
2043	87	66	913,928	4,891,799	12,098,123
2044	85	66	893,808	4,933,958	12,285,331
2045	83	66	873,804	4,981,990	12,484,244
2046	81	66	854,737	5,019,456	12,671,444
2047	79	66	837,071	5,085,032	12,870,349
2048	77	66	819,291	5,151,797	13,057,544
2049	76	66	801,392	5,220,887	13,268,166
2050	74	66	783,024	5,266,565	13,467,070
2051	74	66	784,529	5,276,684	13,492,944
2052	74	66	786,036	5,286,822	13,518,867
2053	74	66	787,546	5,296,979	13,544,840
2054	74	66	789,059	5,307,156	13,570,864
2055	75	66	790,575	5,317,352	13,596,937
2056	75	66	792,094	5,327,568	13,623,060
2057	75	67	793,616	5,337,804	13,649,233
2058	75	67	795,141	5,348,059	13,675,457
2059	75	67	796,668	5,358,334	13,701,731
2060	75	67	798,199	5,368,629	13,728,055
2061	75	67	799,733	5,378,943	13,754,430
2062	76	67	801,269	5,389,277	13,780,856
2063	76	67	802,808	5,399,632	13,807,332
2064	76	67	804,351	5,410,006	13,833,860
2065	76	68	805,896	5,420,400	13,860,438
2066	76	68	807,445	5,430,814	13,887,067
2067	76	68	808,996	5,441,247	13,913,748

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-12. Changes from baseline for railroad operations[a] – Mina rail alignment – Clark County (page 1 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	904	63	3,662,945	11,734,492	9,631,874
2016	803	21	3,286,151	9,158,889	5,096,391
2017	710	4	2,925,899	7,489,604	2,839,156
2018	627	2	2,601,864	6,524,786	2,062,276
2019	556	8	2,321,009	6,087,944	2,258,708
2020	494	17	2,075,309	5,908,934	2,811,814
2021	442	28	1,864,709	5,829,197	3,767,271
2022	397	39	1,686,761	6,034,685	4,677,098
2023	359	49	1,535,831	6,364,496	5,712,548
2024	328	58	1,408,192	6,649,976	6,569,597
2025	301	65	1,297,042	6,926,834	7,373,387
2026	277	71	1,203,333	7,185,404	7,998,167
2027	256	75	1,113,532	7,364,716	8,640,789
2028	237	78	1,041,066	7,632,214	9,033,617
2029	220	82	970,737	7,863,874	9,497,229
2030	206	83	910,541	7,997,686	9,818,687
2031	192	85	858,008	8,212,101	10,175,829
2032	181	86	814,554	8,462,481	10,550,534
2033	173	88	778,869	8,649,248	10,872,284
2034	166	88	747,618	8,908,684	11,211,279
2035	161	89	733,122	9,131,721	11,461,964
2036	159	90	719,714	9,381,236	11,764,994
2037	157	91	719,726	9,649,329	11,853,317
2038	156	91	718,544	9,864,013	12,193,214
2039	158	91	730,899	9,988,594	12,456,756
2040	161	91	746,460	10,211,631	12,673,557
2041	164	91	768,807	10,435,534	12,801,017
2042	170	91	791,154	10,622,864	13,152,614
2043	174	92	821,282	10,889,752	13,438,959
2044	181	92	847,946	11,273,512	13,795,517
2045	188	93	883,748	11,764,654	14,222,859
2046	195	95	921,609	12,279,454	14,714,856
2047	202	97	956,284	12,817,654	15,152,717
2048	209	99	990,853	13,350,308	15,784,517
2049	216	101	1,026,484	13,911,300	16,357,208
2050	222	103	1,057,831	14,567,108	17,142,314

Table J-12. Changes from baseline for railroad operations[a] – Mina rail alignment – Clark County (page 2 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	224	105	1,069,252	14,724,387	17,327,397
2052	226	106	1,080,797	14,883,364	17,514,478
2053	229	107	1,092,466	15,044,058	17,703,579
2054	231	108	1,104,261	15,206,486	17,894,722
2055	234	109	1,116,184	15,370,669	18,087,929
2056	236	110	1,128,235	15,536,623	18,283,221
2057	239	111	1,140,416	15,704,370	18,480,623
2058	242	113	1,152,729	15,873,928	18,680,155
2059	244	114	1,165,175	16,045,316	18,881,842
2060	247	115	1,177,755	16,218,555	19,085,707
2061	249	116	1,190,471	16,393,664	19,291,772
2062	252	118	1,203,325	16,570,664	19,500,063
2063	255	119	1,216,317	16,749,575	19,710,602
2064	258	120	1,229,449	16,930,418	19,923,414
2065	260	121	1,242,723	17,113,213	20,138,524
2066	263	123	1,256,141	17,297,982	20,355,957
2067	266	124	1,269,703	17,484,746	20,575,737
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	911	74	3,691,958	12,528,945	10,694,151
2016	813	32	3,326,322	10,060,479	6,194,331
2017	722	15	2,979,452	8,480,394	3,963,843
2018	642	13	2,666,582	7,533,513	3,204,864
2019	573	19	2,394,651	7,114,536	3,365,622
2020	514	28	2,156,766	6,917,625	3,945,474
2021	462	38	1,952,859	6,837,831	4,918,680
2022	419	49	1,781,606	7,061,184	5,837,130
2023	383	59	1,635,134	7,364,214	6,891,300
2024	352	68	1,513,079	7,685,496	7,747,740
2025	325	75	1,404,117	7,989,111	8,569,080
2026	303	81	1,312,740	8,274,474	9,247,680
2027	282	85	1,227,330	8,400,132	9,872,460
2028	264	88	1,155,960	8,694,504	10,300,680
2029	247	91	1,091,259	8,943,948	10,800,270
2030	233	93	1,032,174	9,077,796	11,139,570
2031	220	95	981,864	9,301,149	11,567,790
2032	210	97	938,457	9,578,322	11,997,180

Table J-12. Changes from baseline for railroad operations[a] – Mina rail alignment – Clark County (page 3 of 3).

	Variable				
Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	202	98	907,218	9,747,153	12,300,210
2034	195	99	879,255	10,024,443	12,747,150
2035	191	100	866,970	10,283,130	12,979,980
2036	188	101	853,632	10,497,006	13,300,560
2037	186	102	853,632	10,738,260	13,442,130
2038	186	102	856,908	11,006,190	13,906,620
2039	188	102	869,310	11,140,155	14,134,770
2040	191	102	887,094	11,389,950	14,405,040
2041	195	103	910,494	11,667,240	14,640,210
2042	200	103	934,011	11,881,350	15,045,030
2043	205	104	966,303	12,184,380	15,366,780
2044	212	104	995,202	12,576,330	15,848,820
2045	219	105	1,033,227	13,059,540	16,240,770
2046	228	107	1,071,135	13,582,530	16,857,360
2047	234	109	1,110,213	14,157,000	17,348,760
2048	242	112	1,149,291	14,743,170	18,087,030
2049	250	114	1,184,976	15,339,870	18,677,880
2050	256	117	1,220,778	15,995,070	19,641,960
2051	259	118	1,233,959	16,167,766	19,854,031
2052	262	119	1,247,281	16,342,327	20,068,392
2053	265	121	1,260,748	16,518,773	20,285,068
2054	268	122	1,274,360	16,697,124	20,504,083
2055	270	123	1,288,119	16,877,400	20,725,462
2056	273	124	1,302,027	17,059,623	20,949,232
2057	276	126	1,316,085	17,243,813	21,175,418
2058	279	127	1,330,294	17,429,992	21,404,046
2059	282	129	1,344,657	17,618,181	21,635,142
2060	285	130	1,359,175	17,808,402	21,868,733
2061	288	131	1,373,850	18,000,677	22,104,847
2062	292	133	1,388,683	18,195,027	22,343,510
2063	295	134	1,403,677	18,391,477	22,584,749
2064	298	136	1,418,832	18,590,047	22,828,594
2065	301	137	1,434,151	18,790,761	23,075,070
2066	304	139	1,449,635	18,993,642	23,324,209
2067	308	140	1,465,287	19,198,713	23,576,037

a. Sources: DIRS 182251-REMI 2007, all; DIRS 179558-Bland 2007, all; DIRS 180690-Bland 2007, all; DIRS 180689-Bland 2007, all.
b. Data expressed in dollars.

Table J-13. Changes from baseline for railroad operations[a] – Mina rail alignment – Washoe County-Carson City (page 1 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County					
2015	313	24	1,434,226	4,404,941	3,276,281
2016	273	9	1,262,376	3,446,060	1,774,516
2017	238	2	1,108,539	2,767,354	1,055,586
2018	208	2	974,079	2,374,445	848,039
2019	182	4	859,158	2,153,210	877,009
2020	160	7	760,382	2,051,420	1,102,386
2021	142	11	677,024	2,037,052	1,383,197
2022	126	15	604,484	2,044,294	1,677,605
2023	113	18	544,175	2,089,078	1,954,672
2024	101	20	490,400	2,122,684	2,178,587
2025	91	23	443,528	2,182,027	2,392,252
2026	82	24	401,453	2,200,115	2,579,979
2027	73	25	362,068	2,213,424	2,695,809
2028	66	26	325,798	2,226,619	2,771,555
2029	59	27	293,506	2,246,725	2,861,212
2030	53	27	264,977	2,275,759	2,937,262
2031	47	28	239,588	2,323,620	3,003,729
2032	43	28	217,592	2,390,310	3,074,666
2033	40	28	201,068	2,447,749	3,138,069
2034	37	29	187,730	2,526,139	3,226,989
2035	35	29	179,909	2,588,695	3,307,064
2036	34	29	174,013	2,662,405	3,342,386
2037	34	29	172,979	2,740,682	3,400,886
2038	34	29	175,687	2,823,210	3,445,124
2039	34	29	179,944	2,858,635	3,490,321
2040	36	29	187,680	2,936,916	3,565,692
2041	38	29	197,789	3,039,444	3,583,476
2042	40	29	208,880	3,144,418	3,672,981
2043	42	29	220,884	3,264,928	3,739,788
2044	44	29	235,135	3,407,450	3,838,887
2045	47	30	250,544	3,569,974	3,949,803
2046	50	31	265,567	3,768,980	4,105,881
2047	52	31	280,940	3,978,515	4,288,986
2048	55	32	296,291	4,239,729	4,499,118
2049	58	33	309,898	4,517,218	4,704,336
2050	60	34	323,610	4,762,590	4,976,010

Table J-13. Changes from baseline for railroad operations[a] – Mina rail alignment – Washoe County-Carson City (page 2 of 3).

Year	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 1: Assuming Railroad Control Center and National Transportation Operations Center in Mineral County (continued)					
2051	61	35	327,610	4,821,460	5,037,518
2052	62	35	331,660	4,881,057	5,099,785
2053	62	35	335,760	4,941,391	5,162,823
2054	63	36	339,910	5,002,470	5,226,640
2055	64	36	344,111	5,064,305	5,291,245
2056	65	37	348,365	5,126,904	5,356,649
2057	66	37	352,671	5,190,277	5,422,862
2058	66	38	357,030	5,254,433	5,489,893
2059	67	38	361,433	5,319,382	5,557,752
2060	68	39	365,911	5,385,134	5,626,451
2061	69	39	370,434	5,451,698	5,695,998
2062	70	40	375,013	5,519,086	5,766,405
2063	71	40	379,648	5,587,306	5,837,683
2064	71	41	384,341	5,656,370	5,909,841
2065	72	41	389,092	5,726,287	5,982,892
2066	73	42	393,901	5,797,069	6,056,845
2067	74	42	398,770	5,868,725	6,131,713
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County					
2015	313	24	1,433,250	4,398,246	3,231,649
2016	273	8	1,261,260	3,432,671	1,720,961
2017	238	2	1,106,586	2,753,964	995,327
2018	207	1	971,568	2,367,755	783,323
2019	182	3	856,368	2,146,516	821,223
2020	160	7	756,756	2,040,264	1,039,904
2021	141	10	672,840	2,010,276	1,311,786
2022	125	14	599,742	2,024,209	1,597,266
2023	112	17	538,875	2,077,920	1,878,804
2024	100	20	484,542	2,102,599	2,102,706
2025	90	22	437,391	2,157,480	2,307,456
2026	80	24	394,758	2,182,266	2,486,250
2027	72	25	354,816	2,213,424	2,606,544
2028	64	25	318,546	2,222,155	2,695,680
2029	58	26	286,254	2,240,035	2,771,946
2030	51	26	256,887	2,269,064	2,847,996
2031	46	27	231,498	2,319,156	2,910,006
2032	41	27	208,944	2,385,846	2,967,554

Table J-13. Changes from baseline for railroad operations[a] – Mina rail alignment – Washoe County-Carson City (page 3 of 3).

Year	Variable				
	Population	Total Employment	State and local government spending[b]	Real disposable personal income[b]	Total gross regional product[b]
Scenario 2: Assuming Railroad Control Center and National Transportation Operations Center in Nye County (continued)					
2033	38	27	192,699	2,452,211	3,035,414
2034	35	28	179,361	2,530,601	3,128,796
2035	33	28	170,703	2,604,311	3,199,950
2036	32	28	164,529	2,678,021	3,244,194
2037	32	28	162,936	2,754,071	3,302,694
2038	32	28	165,087	2,841,064	3,342,474
2039	32	28	169,065	2,869,794	3,374,280
2040	34	28	176,247	2,943,611	3,436,290
2041	35	28	185,796	3,028,285	3,454,056
2042	37	28	196,326	3,131,029	3,525,644
2043	39	28	208,611	3,251,539	3,597,014
2044	42	28	222,021	3,391,830	3,687,104
2045	44	29	236,880	3,552,120	3,798,036
2046	47	29	251,064	3,751,129	3,936,314
2047	50	30	266,157	3,951,745	4,114,890
2048	52	31	280,944	4,201,795	4,302,745
2049	55	32	294,003	4,481,510	4,499,084
2050	57	33	306,873	4,717,955	4,739,454
2051	58	33	310,666	4,776,273	4,798,037
2052	58	34	314,506	4,835,311	4,857,345
2053	59	34	318,394	4,895,080	4,917,385
2054	60	34	322,330	4,955,587	4,978,168
2055	61	35	326,314	5,016,842	5,039,703
2056	61	35	330,347	5,078,854	5,101,997
2057	62	36	334,431	5,141,633	5,165,062
2058	63	36	338,565	5,205,188	5,228,907
2059	64	37	342,749	5,269,528	5,293,540
2060	65	37	346,986	5,334,664	5,358,973
2061	65	38	351,275	5,400,604	5,425,214
2062	66	38	355,617	5,467,360	5,492,274
2063	67	38	360,013	5,534,941	5,560,163
2064	68	39	364,463	5,603,358	5,628,891
2065	69	39	368,968	5,672,620	5,698,469
2066	69	40	373,529	5,742,738	5,768,907
2067	70	40	378,146	5,813,723	5,840,215

a. Source: DIRS 181590-Bland 2007, all.
b. Data expressed in dollars.

J.1.5 PUBLIC SERVICES IMPACT ANALYSIS

To estimate potential impacts to public services, DOE assessed the changes to the county or community baseline capacity (assuming no railroad). This assessment, as described in detail in Sections 4.2.9 and 4.3.9 of the Rail Alignment EIS, is a qualitative analysis. To perform the analysis, DOE identified the relevant changes that would affect public services (population changes) and characterized the magnitude of the changes as either a positive or negative impact on public services. The analysis then qualitatively described whether the burden or benefit associated with the change would degrade or supplement the delivery of public services to the county or community. Using this methodology, DOE concluded whether impacts to the various public services in counties and communities would be small, moderate, or large.

J.1.6 TRAFFIC DELAY AT RAIL-HIGHWAY GRADE CROSSINGS

DOE estimated the delay road vehicles would experience at rail-highway grade crossings. For each grade crossing analyzed, DOE calculated the time that a given crossing would be closed for each train event and estimated the average delay per vehicle on that crossing in a 24-hour period. DOE used the following steps in the delay calculation:

Step 1: Calculation of blocked crossing time (T)

$$T = 0.5 + \frac{L}{V \times 88}$$

T = Blocked crossing time per train event, in minutes.
0.5 = Time necessary for any warning devices (such as gates) to engage and disengage, in minutes. Not all crossings have gates, so blocked crossing times could be overestimated for such cases.
L = Train length, in feet.
V = Train speed, in miles per hour.
88 = Conversion factor from miles per hour to feet per minute.

Step 2: Calculation of average crossing delay per vehicle (D)

$$D = \frac{T \times \left[\frac{R_D}{(R_D - R_A)}\right]}{2}$$

D = Average crossing delay per vehicle, in minutes.
R_D = Vehicle departure rate[a], in vehicles per hour per lane.
R_A = Vehicle arrival rate (average daily traffic divided by the number of lanes), in vehicles per hour per lane.
2 = Factor to account for the fact that vehicles do not experience delay for the entire time that crossing is blocked. Vehicles arrive, on average, at the midpoint of the train blocked crossing time.

a. Vehicle departure rate is a measure of the rate at which vehicles can return to free-flow speed from a state where vehicles are stopped. Vehicle departure rates depend on a number of factors such as the presence of warning signals, numbers and types of lanes, width of lanes, road grade, sight distance, curve radius, and traffic type. Because there were not enough data available to characterize each grade crossing, DOE used default values. This analysis assumes 1,800 vehicles per hour , 1,400 vehicles per hour for arterials, 900 vehicles per hour for collectors, and 700 vehicles per hour for local roads (DIRS 176524-TRB 2001, all).

Step 3: Calculation of the number of delayed vehicles per day (N_V)

$$N_V = \frac{T}{1{,}440} \times N_T \times ADT$$

N_V	= Number of delayed vehicles per day.
N_T	= Number of daily trains.[a]
ADT	= Average daily traffic, in number of vehicles per day in both directions of traffic.

a. If different estimates for average train daily traffic were available, the highest estimate was considered.

Step 4: Calculation of average vehicle delay in a 24-hour period (D_{24}) in minutes

$$D_{24} = \frac{N_V}{ADT} \times D$$

J.1.7 LEVEL OF SERVICE ANALYSIS

The calculation of level of service (LOS) for baseline and adjusted scenarios is based on the methodology included in the Highway Capacity Manual for Class I two-lane highways (DIRS 176524-TRB 2001, Chapter 20). Two-lane highways can be divided in two types: Class I, on which users expect to drive at relatively high speeds; and Class II, on which users do not expect to travel at high speeds (that is, scenic/recreational routes). This section summarizes the complete methodology.

As described in Sections 3.2.9 and 3.3.9 of the Rail Alignment EIS, roadway performance can be characterized in terms of level of service, which is a qualitative ranking of traffic conditions experienced by roadway users. There are six levels of service that can characterize the performance of roadways, with level A representing the best operating conditions (free flow), and level F the worst.

The determination of the level of service of a given roadway is based on factors that affect how users perceive the quality of service they are receiving, such as speed, travel time, freedom to maneuver, traffic interruptions, and comfort. For Class I two-lane highways, level of service is determined in relation to percent of time-spent-following (PTSF) and average travel speed. PTSF is the average percent of travel time vehicles must travel behind slower vehicles due to the inability to pass on a two-lane highway. Table J-14 lists the criteria to determine level of service. If the passenger-car equivalent flow rate is higher than the highway capacity, the facility is oversaturated and the level is F.

Table J-14. Criteria to calculate LOS in Class I two-lane highways.[a]

Level of Service	Percent time-spent-following	Average travel speed (miles per hour)
A	Less than or equal to 35 percent	Greater than 55
B	Between 35 percent and 50 percent	Between 50 and 55
C	Between 50 percent and 65 percent	Between 45 and 50
D	Between 65 percent and 80 percent	Between 40 and 45
E	Greater than 80 percent	Less than or equal to 40

a. Source: DIRS 176524-TRB 2001, Chapter 20.

Calculation of PTSF

The PTSF is estimated based on the demand flow rate (V_p), the directional distribution of traffic, and the percentage of no-passing zones.

$$PTSF = 100 \times (1 - e^{-0.000879Vp}) + f_{d/np} \qquad \text{where}$$

PTSF = percent time-spent-following

V_p = demand flow rate

$f_{d/np}$ = adjustment for the combined effect of the directional distribution of traffic and of the percentage of no-passing zones on percent time-spent-following

The flow rate V_p is an adjusted measure of traffic volume (in vehicles per hour), taking into account the percentage of daily traffic that occurs during the peak 15-minute period (peak-hour factor), a grade adjustment factor, and a heavy-vehicle adjustment factor that accounts for the percentage of trucks and recreational vehicles (RVs) on the road.

$$V_p = V / (PHF \times F_G \times F_{HV}) \qquad \text{where}$$

V_p = passenger-car equivalent flow rate for peak 15-minute period (veh/h)

V = demand volume for the peak hour (veh/h)

PHF = peak-hour factor

F_G = grade adjustment factor

F_{HV} = heavy-vehicle adjustment factor

In all level of service calculations included in this analysis, the distribution of traffic within the peak hour is assumed to be uniform. Therefore, the peak-hour factor is assumed to be 1. All roadways are also assumed to be flat, so the grade adjustment factor is also 1. The heavy-vehicle adjustment factor varied by roadway segment.

Calculation of average travel speed

The average travel speed (ATS) is estimated from the free flow speed (FFS), the demand flow rate (V_p), and an adjustment factor for the percentage of no-passing zones.

$$ATS = FFS - 0.00776V_p - f_{np} \qquad \text{where}$$

ATS = average travel speed (miles per hour)

FFS = Free flow speed (miles per hour)

V_p = demand flow rate (vehicles per hour)

f_{np} = adjustment for percentage of no passing zones

J.2 Glossary

gross regional product	The dollar value of all final goods and services produced in a given year in a specific region (such as the ***region of influence***).
real disposable income	The value of total income received after taxes; it is the income available for spending or saving; also referred to as ***real disposable personal income***.
real disposable personal income	See ***real disposable income***.
region of influence	The physical area that bounds the environmental, sociologic, economic, or cultural features of interest for the purpose of analysis.

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APPENDIX K

RADIOLOGICAL HEALTH AND SAFETY

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APPENDIX K

RADIOLOGICAL HEALTH AND SAFETY

K.1 Radiation and Human Health

K.1.1 RADIATION

Radiation is the emission and propagation of energy through space or through a material in the form of waves or bundles of energy called ***photons***, or in the form of high-energy ***subatomic particles***. Radiation generally results from atomic or subatomic processes that occur naturally. The most common kind of radiation is electromagnetic radiation, which is transmitted as photons. Electromagnetic radiation is emitted over a range of wavelengths and energies. Humans are most commonly aware of visible light, which is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation, which heats material when the material and the radiation interact, and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (which are more penetrating) includes ultraviolet radiation, which causes sunburn, and X-rays and ***gamma radiation***.

Ionizing radiation is radiation that has sufficient energy to displace ***electrons*** from atoms or molecules to create ***ions***. It can be electromagnetic (for example, X-rays or gamma radiation) or subatomic particles (for example, ***alpha***, ***beta***, or ***neutron radiation***). The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in the tissue or organism.

K.1.2 RADIOACTIVITY

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation. Usually the emitted radiation is ionizing radiation. The result of the process, called ***radioactive decay***, is the transformation of an unstable atom (a ***radionuclide***) into a different atom, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radioactive decay produces three main types of ionizing radiation—alpha particles, beta particles, and gamma or X-rays. Neutrons emitted during nuclear fission are another type of ionizing radiation. These types of ionizing radiation can have different characteristics and levels of energy and, thus, varying abilities to penetrate and interact with atoms in the human body. Because each type has different characteristics, each requires different amounts of material to stop (shield) the radiation. Alpha particles are the least penetrating and can be stopped by a thin layer of material such as a single sheet of paper. However, if radioactive atoms (called radionuclides) emit alpha particles in the body when they decay, there is a concentrated deposition of energy near the point where the radioactive decay occurs. Shielding beta particles requires thicker layers of material such as several reams of paper or several inches of wood or water. Shielding from gamma rays, which are highly penetrating, requires very thick material such as several inches to several feet of heavy material (for example, concrete or lead). Deposition of the energy by gamma rays is dispersed across the body in contrast to the local energy deposition by an alpha particle. Some gamma radiation will pass through the body without interacting with it. Shielding from neutrons, which are also highly penetrating, requires materials that contain light elements such as hydrogen.

In a nuclear reactor, heavy atoms such as uranium and plutonium can undergo another process, called ***fission***, after the absorption of a subatomic particle (usually a neutron). In fission, a heavy atom splits into two lighter atoms and releases energy in the form of radiation and the kinetic energy of the two new lighter atoms. The new lighter atoms are called ***fission products***. The fission products are usually unstable and undergo ***radioactive decay*** to reach a more stable state.

Some of the heavy atoms might not fission after absorbing a subatomic particle. Rather, a new nucleus is formed that tends to be unstable (like fission products) and undergo radioactive decay.

The radioactive decay of fission products and unstable heavy atoms is the source of the radiation from ***spent nuclear fuel*** and ***high-level radioactive waste*** that makes these materials hazardous in terms of potential human health impacts.

K.1.3 EXPOSURE TO RADIATION AND RADIATION DOSE

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an X-ray machine or from radioactive materials that directly emit radiation, such as radioactive waste or radionuclides in soil. Exposure to direct radiation can be mitigated by placing shielding, such as lead, between the source of the radiation and the exposed individual. Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once in the body, the ***fate*** of a radioactive material is determined by its chemical behavior and how it is metabolized. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move rapidly through the gastrointestinal tract or be deposited in the lungs.

Exposure to ionizing radiation is expressed in terms of ***absorbed dose***, which is the amount of energy imparted to matter per unit mass. Often simply called ***dose***, it is a fundamental concept in measuring and quantifying the effects of exposure to radiation. The unit of absorbed dose is the ***rad***. The different types of radiation mentioned above have different effects in damaging the cells of biological systems. ***Dose equivalent*** is a concept that considers the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems, using a radiation-specific quality factor. The unit of dose equivalent is the ***rem***. In quantifying the effects of radiation on humans, other types of concepts are also used. The concept of ***effective dose equivalent*** is used to quantify effects of radionuclides in the body. It involves estimating the susceptibility of the different tissue in the body to radiation to produce a tissue-specific weighting factor. The weighting factor is based on the susceptibility of that tissue to cancer. The sum of the products of each affected tissue's estimated dose equivalent multiplied by its specific weighting factor is the effective dose equivalent. The potential effects from a one-time ingestion or inhalation of radioactive material are calculated over a period of 50 years to account for radionuclides that have long ***half-lives*** and long residence time in the body. The result is called the ***committed effective dose equivalent***. The unit of effective dose equivalent is the rem. Total effective dose equivalent is the sum of the committed effective dose equivalent from radionuclides in the body plus the dose equivalent from radiation sources external to the body (also in rem). All estimates of radiation dose in the Rail Alignment EIS, unless specifically noted otherwise, are total effective dose equivalents, which are quantified in terms of rem or ***millirem*** (mrem).

More detailed information on the concepts of radiation dose and dose equivalent are in publications of the National Council on Radiation Protection and Measurements (DIRS 101857-NCRP 1993, all) and the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) or external exposure to radionuclides (by ***groundshine*** or ***cloudshine*** [immersion]) to radiation dose are called ***dose conversion factors*** or ***dose coefficients***. The International Commission on Radiological Protection and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors (DIRS

172935-ICRP 2001, all; DIRS 175544-EPA 2002, all). They are based on original recommendations of the International Commission on Radiological Protection (DIRS 101836-ICRP 1991, all).

The radiation dose to an individual or to a group of people can be expressed as the ***total dose*** received or as a ***dose rate***, which is dose per unit time (usually an hour or a year). ***Collective dose*** is the total dose to an exposed population. ***Person-rem*** is the unit of collective dose. Collective dose is calculated by summing the individual dose to each member of a population. For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 persons × 0.1 rem).

K.1.4 BACKGROUND RADIATION

Nationwide, on average, members of the public are exposed to approximately 360 millirem per year from natural and manmade sources (DIRS 101855-NCRP 1987, p. 53). About 60 millirem per year is from medical radiation and consumer products. About 300 millirem per year is from natural sources (DIRS 100472-NCRP 1987, p. 149). The largest natural sources are radon-222 and its radioactive decay products in homes and buildings, which contribute about 200 millirem per year. Additional natural sources include radioactive material in the earth (primarily the uranium and thorium decay series, and potassium-40) and cosmic rays from space filtered through the atmosphere. With respect to exposures resulting from human activities, the combined doses from weapons testing fallout, consumer and industrial products, and air travel (***cosmic radiation***) account for the remaining approximately 3 percent of the total annual dose. Nuclear fuel cycle facilities contribute less than 0.1 percent (0.05 millirem per year) of the total dose.

K.1.5 IMPACTS TO HUMAN HEALTH FROM EXPOSURE TO RADIATION

Exposures to radiation or radionuclides are often characterized as being acute or chronic. Acute exposures occur over a short period, typically 24 hours or less. Chronic exposures occur over longer periods (months to years); they are usually assumed to be continuous over a period, even though the dose rate might vary. For a given dose of radiation, chronic radiation exposure is usually less harmful than acute exposure because the dose rate (dose per unit time, such as rem per hour) is lower, providing more opportunity for the body to repair damaged cells.

K.1.5.1 Acute Exposures at High Dose Rates

Exposures to high levels of radiation at high dose rates over a short period (less than 24 hours) can result in acute radiation effects. Minor changes in blood characteristics might be noted at doses in the range of 25 to 50 rad. The external symptoms of radiation sickness begin to appear following acute exposures to levels of radiation of about 50 to 100 rad and can include anorexia, nausea, and vomiting. More severe symptoms occur at higher doses and can include death at doses higher than 200 to 300 rad of total body irradiation, depending on the level of medical treatment received. Information on the effects of acute exposures on humans was obtained from studies of the survivors of the Hiroshima and Nagasaki bombings and from studies following a multitude of acute accidental exposures.

Acute exposures have occurred following detonations of nuclear weapons, both in wartime and during weapons testing, and in other events involving testing of nuclear materials. In addition, there is a potential for acute exposures in the event of an accident at an operating nuclear electric generating station, although Nuclear Regulatory Commission regulations require that the electric utilities design their stations such that these events are extremely unlikely. Such exposures could occur only if there were a highly unlikely failure of the containment vessel surrounding the nuclear reactor and a large release of fission products from the generating station following an accident.

In contrast, accidents during the shipment of spent nuclear fuel or high-level radioactive waste do not have the potential to release sufficient fission products to lead to acute exposures that might immediately threaten the life of the surrounding public. This is because the fission product ***source term*** in the spent nuclear fuel would have decayed by a factor of 10,000 or more by the time DOE would ship the material to the proposed repository. Thus, there would not be sufficient energy generated by the fission products in the spent nuclear fuel being shipped to melt the fuel elements and vaporize fission products, as postulated for an accident at an operating nuclear electric generating station.

K.1.5.2 Chronic Exposures at Low Dose Rates

The radiation dose estimates discussed in the Rail Alignment EIS are associated with exposure to radiation at low dose rates. Such exposures can be chronic (continuous or nearly continuous), such as those to workers who are escorts. In some instances, exposures to low levels of radiation would be intermittent (for example, infrequent exposures to an individual from radiation emitted from shipping casks as they are transported). ***Cancer*** induction is the principal potential risk to human health from exposure to low levels of radiation. However, this cancer induction is a statistical process because exposure to radiation conveys only a chance of developing cancer, not a certainty. Furthermore, other causes, such as exposure to chemical agents, can induce cancer in individuals.

K.1.6 DOSE-TO-HEALTH EFFECT CONVERSION FACTORS

Cancer is the principal potential risk to human health from exposure to low or chronic levels of radiation. Radiological health impacts are expressed as the incremental changes in the number of expected fatal cancers (referred to as ***latent cancer fatalities***) for populations and as the incremental increases in lifetime probabilities of contracting a fatal cancer for an individual. The estimates are based on the dose received and on dose-to-health-effect conversion factors recommended by the Interagency Steering Committee on Radiation Standards (DIRS 174559-Lawrence 2002, all). The Interagency Steering Committee on Radiation Standards is comprised of eight federal agencies (the Environmental Protection Agency, the Nuclear Regulatory Commission, DOE, the Department of Defense, the Department of Homeland Security, the Department of Transportation, the Occupational Safety and Health Administration, and the Department of Health and Human Services), three federal observer agencies (the Office of Science and Technology Policy, the Office of Management and Budget, and the Defense Nuclear Facilities Safety Board), and two state observer agencies (Illinois and Pennsylvania). The Committee estimated that, for the general population and workers, a collective dose of 1 person-rem would yield 6×10^{-4} excess latent cancer fatalities.

Sometimes, calculations of the number of latent cancer fatalities associated with radiation dose do not yield whole numbers, and, especially in environmental applications, can yield numbers less than 1.0. For example, if each individual in a population of 100,000 received a total radiation dose of 0.001 rem, the collective radiation dose would be 100 person-rem and the corresponding estimated number of latent cancer fatalities would be 0.06 (100,000 persons × 0.001 rem × 0.0006 latent cancer fatalities per person-rem). How should one interpret a nonintegral number of latent cancer fatalities, such as 0.06? The answer is to interpret the result as a statistical estimate. That is, 0.06 is the average number of latent cancer fatalities that would result if the same exposure situation were applied to many different groups of 100,000 people. For most groups, no one would incur a latent cancer fatality from the 0.001 rem radiation dose each member would have received. In a small fraction of the groups (about 6 percent), one latent cancer fatality would result; in exceptionally few groups, two or more latent cancer fatalities would occur. The average number of latent cancer fatalities over all of the groups would be 0.06. The most likely outcome for any single group is zero latent cancer fatalities.

K.1.7 COMPARISON TO OTHER DOSE-TO-HEALTH EFFECT CONVERSION FACTORS

The dose-to-health effect conversion factor recommended by the Interagency Steering Committee on Radiation Standards is higher than the dose-to-health effect conversion factors used in the Yucca Mountain FEIS, 0.0004 latent cancer fatality per person-rem for workers and 0.0005 latent cancer fatality per person-rem for individuals among the general population (DIRS 155970-DOE 2002, p. 3-97). The dose-to-health effect conversion factors are similar to the lethality adjusted cancer risk coefficients published in 2007 by the International Commission on Radiological Protection in ICRP 103: *Recommendations of the ICRP*, 0.00041 per person-rem for workers and 0.00055 per person-rem for individuals among the general population. The dose-to-health effect conversion factor recommended by the Interagency Steering Committee on Radiation Standards is also similar to the dose-to-health effect conversion factors published by the National Research Council in the *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, p. 15), which ranged from 0.00041 to 0.00061 latent cancer fatality per person-rem for solid cancers and 0.000050 to 0.000070 latent cancer fatality per person-rem for leukemia, and the age-specific dose-to-health effect conversion factor published by the Environmental Protection Agency, 0.000575 latent cancer fatality per person-rem (DIRS 153733-EPA 2000, Table 7.3, p. 179).

K.1.8 LINEAR NO-THRESHOLD MODEL

The premise of the Linear No-Threshold Model, as used in radiation health effects research, is that there will be some risk, even at low radiation doses. The use of the Linear No-Threshold Model was reviewed in *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, all). The BEIR VII committee examined materials that included arguments that low doses of radiation are more harmful than the Linear No-Threshold Model would suggest. The BEIR VII committee concluded that radiation health effects research, taken as a whole, does not support this view.

K.1.9 RADIATION HORMESIS

The premise of radiation ***hormesis*** is that a threshold or decrease in effect exists at low radiation doses, and that use of the Linear No-Threshold Model exaggerates the health effects of low levels of ionizing radiation. The issue of radiation hormesis was also reviewed in *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, all). The BEIR VII committee did not accept the hypothesis that the risks are lower than predicted by the Linear No-Threshold Model, that they are nonexistent, or that low doses of radiation might even be beneficial. The BEIR VII committee concluded that there will be some risk, even at low radiation doses.

K.1.10 OTHER RADIATION HEALTH EFFECTS

Other health effects such as nonfatal cancers and genetic effects can occur as a result of chronic exposure to radiation. These other health effects were evaluated by the International Commission on Radiological Protection and are listed in Table K-1.

The dose-to-health effect conversion factors for cancer listed in Table K-1, 0.00041 per person-rem for workers and 0.00055 per person-rem for individuals among the general population, are based on cancer incidence data but include consideration of cancer lethality and life impairment. Table K-1 also lists dose-to-health effect conversion factors for heritable effects, 0.00001 per person-rem for workers and 0.00002 per person-rem for individuals among the general population. The total detriment, 0.00040 per person-rem for workers and 0.00060 per person-rem for individuals among the general population, is consistent with the dose-to-health effect conversion factor recommended by the Interagency Steering Committee on Radiation Standards. While DOE recognizes the existence of health effects other than fatal cancers, the Department has chosen to quantify the impacts in the Rail Alignment EIS in terms of latent cancer fatalities, in part because these other health effects are a small portion of the total detriment from exposure to radiation.

Radiation exposure has also been demonstrated to increase the risk of other diseases, particularly cardiovascular disease, in persons exposed to high therapeutic doses and also atomic bomb survivors exposed to more modest doses.

The issue of health effects other than cancer was reviewed in *Health Risks from Exposure to Low Levels of Ionizing Radiation, BEIR VII Phase 2* (DIRS 181250-National Research Council 2006, all). The BEIR VII committee concluded that there was no direct evidence of increased risk of noncancer diseases at low doses, and data were inadequate to quantify this risk if it exists. Radiation exposure has also been shown to increase risks of some benign tumors, but the BEIR VII committee also concluded that data were inadequate to quantify this risk.

Table K-1. Detriment-adjusted nominal risk coefficients for cancer and genetic effects from exposure to radiation.

Population	Cancer (per rem)	Heritable effects (per rem)	Total (per rem)
Whole population	5.5×10^{-4}	2×10^{-5}	6.0×10^{-4}
Adults	4.1×10^{-4}	1×10^{-5}	4.0×10^{-4}

a. Source: ICRP Publication 103: *Recommendations of the ICRP*.

K.1.11 EXPOSURE IN UTERO

Studies of prenatal exposure or exposure in early life to diagnostic X-rays have shown that there is a significantly increased risk of leukemia and childhood cancer following a diagnostic dose of 1 to 2 rem to the embryo or fetus *in utero*. In recognition of this, exposure of declared pregnant workers is specifically addressed in DOE and Nuclear Regulatory Commission radiation protection regulations (10 Code of Federal Regulations [CFR] 835.206 and 10 CFR 20.1208), which limit the exposure of the embryo/fetus to 0.5 rem from the period of conception to birth.

K.2 Transportation Methods and Data

K.2.1 TRANSPORTATION ROUTES

K.2.1.1 Distances and Population Densities

There are many possible segments that could make up the rail alignment from its junction with the Union Pacific Railroad Mainline near Caliente, Nevada, to the repository, or its junction with the Union Pacific Railroad Mainline near Hazen, Nevada, to the repository. For the radiological transportation analyses, DOE composed four specific rail alignments from the possible segments, for both the Caliente and Mina rail corridors: (1) the rail alignment with the highest exposed population, (2) the longest distance rail alignment, (3) the rail alignment with the lowest exposed population, and (4) the shortest distance rail alignment. In addition, DOE evaluated potential radiological impacts to workers and the public at the possible locations of the Staging Yard (Caliente-Indian Cove, Caliente-Upland, Eccles-North, and Hawthorne).

The distances were determined using geographic information system data that described the rail alignment segments. The method used to estimate the population densities within 800 meters (0.5 mile) of the rail segments is described by Johnson and Michelhaugh (DIRS 181276-Johnson and Michelhaugh 2003, Section 2.5). The population densities were determined using 2000 census data for an 800-meter (0.5-mile) band on either side of the rail alignment for urban, rural, and suburban population density zones. Urban areas were defined as areas with a population density greater than 3,326 people per square kilometer. Rural areas were defined as areas with a population density of less than 139 people per square kilometer. Suburban areas were areas with a population density between 139 and 3,326 people per square kilometer. Table K-2 lists the distance and population densities for the rail alignments. There are no urban areas along the rail alignments.

For the four potential Staging Yard locations, the population densities were determined for an 800-meter (0.5-mile) area around the Staging Yard footprint. Three of the potential Staging Yard locations (Eccles-North, Caliente-Upland, and Caliente-Indian Cove) are in Lincoln County. The Staging Yard at Hawthorne would be in Mineral County. Based on 2000 census data, there would be no residents within 800 meters of the Staging Yard at Hawthorne. Table K-3 lists the population densities for the Staging Yard locations.

K.2.1.2 Population Escalation Factors

The population densities presented in Tables K-2 and K-3 are based on 2000 census data. In the radiological transportation analyses, the estimated population impacts were escalated to the year 2067 to account for potential population growth along the rail alignments and near the Staging Yard locations during operation of the proposed railroad. The population escalation factors are based on U.S. Census Bureau 2000 data and population forecasts developed using the Regional Economics Model, Inc., REMI *Policy Insight* model (DIRS 174681-REMI 2004, all), which is updated with population projections to 2024 from the Nevada State Demographer (DIRS 174313-Nevada State Demographer [n.d.], all). Table K-4 lists the escalation factors.

K.2.2 SHIPMENTS

Estimates of shipments of spent nuclear fuel and high-level radioactive waste to the repository have been developed incorporating the use of transport, aging, and disposal canisters and updated cask-handling assumptions at each reactor site. Table K-5 summarizes the number of rail casks that would be shipped to the repository under the Proposed Action. Using these estimates, there would be 9,495 rail casks shipped under the Proposed Action (DIRS 181377-BSC 2007, Section 7). The 9,495 rail casks would be shipped using 2,833 trains.

K.2.3 INCIDENT-FREE TRANSPORTATION

Radiation doses during normal, incident-free transportation of radioactive materials results from exposure of workers and the public to the external radiation field that surrounds the shipping containers. The radiation dose is a function of the number of people exposed, their proximity to the containers, their length of time of exposure, and the intensity of the radiation field surrounding the containers. The intensity of the radiation field around the spent nuclear fuel or high-level radioactive waste shipping container was assumed to be at its regulatory maximum, 10 millirem per hour at 2 meters (80 inches) from the railcar that holds the shipping container [10 CFR 71.47(b)(3)]. In addition, because most spent nuclear fuel and high-level radioactive waste would be placed in canisters before being shipped, the intensity of the radiation field around an empty shipping container was assumed not to contribute to the radiation dose for workers or members of the public.

Table K-2. Distances and population densities for the Caliente and Mina rail alignments (page 1 of 2).

Rail alignment	Segment	Total exposed population	Total distance (km)[b]	County	Urban distance (km)[b]	Suburban distance (km)[b]	Rural distance (km)[a]	Urban density (people/km^2)[c]	Suburban density (people/km^2)[c]	Rural density (people/km^2)[b]
Caliente rail alignment[a]										
Highest population	Caliente	279	538.9	Lincoln	0	0.35	148.75	0	133.65	0.64
				Nye	0	0	358.64	0	0	0.10
				Esmeralda	0	0.12	31.08	0	221.43	0.24
Shortest distance	Caliente	213	527.4	Lincoln	0	0.35	138.81	0	133.65	0.55
				Nye	0	0	384.75	0	0	0.10
				Esmeralda	0	0	3.44	0	0	0
Longest distance	Eccles	112	541.1	Lincoln	0	0	134.88	0	0	0.16
				Nye	0	0	375.02	0	0	0.10
				Esmeralda	0	0.12	31.08	0	221.43	0.24
Lowest population	Eccles	78	530.2	Lincoln	0	0	134.88	0	0	0.16
				Nye	0	0	391.87	0	0	0.10
				Esmeralda	0	0	3.44	0	0	0
Mina rail alignment										
Highest population	Hazen	941	545.8	Churchill	0	0	18.61	0	0	5.76
				Lyon	0	0.88	89.09	0	121.98	4.33
				Mineral	0	0	0154.81	0	0	0.38
				Esmeralda	0	0.11	132.76	0	221.43	0.058
				Nye	0	0	149.55	0	0	0.22
Shortest distance	Hazen	904	520.5	Churchill	0	0	17.70	0	0	6.06
				Lyon	0	0.88	76.01	0	121.98	4.86
				Mineral	0	0	149.23	0	0	0.49
				Esmeralda	0	0	151.06	0	0	0.029
				Nye	0	0	125.67	0	0	0.26

Table K-2. Distances and population densities along the Caliente and Mina rail alignments (page 2 of 2).

Rail alignment	Segment	Total exposed population	Total distance (km)[b]	County	Urban distance (km)[b]	Suburban distance (km)[b]	Rural distance (km)[b]	Urban density (people/km^2)[c]	Suburban density (people/km^2)[c]	Rural density (people/km^2)[c]
Mina rail alignment (*continued*)										
Longest distance	Hazen	901	569.8	Churchill	0	0	32.05	0	0	3.34
				Lyon	0	0.88	85.69	0	121.98	4.49
				Mineral	0	0	145.77	0	0	0.39
				Esmeralda	0	0	175.17	0	0	0.0035
				Nye	0	0	130.24	0	0	0.25
Lowest population	Hazen	878	558.3	Churchill	0	0	17.70	0	0	6.06
				Lyon	0	0.88	75.83	0	121.98	4.87
				Mineral	0	0	163.07	0	0	0.36
				Esmeralda	0	0	175.17	0	0	0.0035
				Nye	0	0	125.67	0	0	0.26

a. There are no urban areas along the Caliente rail alignment.
b. km = kilometers; to convert kilometers to miles, multiply by 0.621371.
c. km^2 = square kilometers; to convert people per square kilometer to people per square mile, multiply by 2.589988.

Table K-3. Population densities near possible locations for the Staging Yard.

Location[a]	Exposed population	Population density (people per square kilometer)[b]
Caliente-Indian Cove	8	1.56
Caliente-Upland	2	0.384
Eccles-North	2	0.234
Hawthorne	0	0

a. The Caliente and Eccles Staging Yard locations would be in Lincoln County, Nevada; the Hawthorne Staging Yard location would be in Mineral County, Nevada.
b. To convert people per square kilometer to people per square mile, multiply by 2.589988.

Table K-4. Population escalation factors.

County	2000 population	Estimated 2067 population	Escalation factor
Churchill	24,157	53,524	2.2157
Esmeralda	1,061	1,084	1.0219
Lincoln	4,165	6,944	1.6673
Lyon	35,685	172,377	4.8305
Mineral	5,071	3,715	0.7327
Nye	32,978	131,075	3.9746

Table K-5. Rail casks that would be shipped to the repository.[a]

Type	Trains	Rail casks
Pressurized-water reactor spent nuclear fuel	1,363	4,047
Boiling-water reactor spent nuclear fuel	929	2,759
Naval spent nuclear fuel	80	400
DOE spent nuclear fuel	74	365
High-level radioactive waste	387	1,924
Totals	2,833	9,495

a. Source: DIRS 181377-BSC 2007, Section 7.

The rail alignment would consist of a single set of tracks with multiple sidings. Rail casks would be shipped to the repository using dedicated trains. For shipments of commercial spent nuclear fuel, there would be three casks containing spent nuclear fuel per train. For shipments of DOE spent nuclear fuel and high-level radioactive waste, there would be five casks per train. In both cases, two buffer railcars, two locomotives, and one escort railcar would be present in the dedicated train. Escorts would also be present in all areas for all rail shipments.

Radiological impacts were determined for members of the public during normal, incident-free transportation of the casks. For members of the public, radiation doses were estimated for people located within 800 meters (0.5 mile) of the rail alignment. These exposures are referred to as off-link radiation doses. Once the train left the Union Pacific Mainline, there would be normally no additional stops en route to the repository, except at the Staging Yard, and the rail alignment will be constructed with the goal of transporting shipments of spent nuclear fuel and high-level radioactive waste from the Staging Yard to the repository without a stop for a crew change (DIRS 180923-Nevada Rail Partners 2007, Section 5.1). Therefore, under normal circumstances, there would be no off-link exposures of members of the public at any en route stops. Members of the public could, however, be exposed while the train was stopped at the Staging Yard.

Exposures of individuals using the rail line are referred to as on-link radiation doses. Two trains would not be able to share the single track simultaneously, and consequently, there would be no on-link radiation doses for any members of the public because no members of the public would be sharing the track with the cask trains.

Two groups of workers would be present on the train en route to the repository, engineers and conductors, referred to as rail workers, and escorts. Engineers and conductors would be located in the train locomotives at least 150 feet from the closest rail cask and would be shielded from radiation exposure by the locomotives; therefore there would be no radiation doses for these workers en route to the repository. Escorts would be situated closer to the casks and would not be shielded by the locomotives, therefore radiation doses have been estimated for these workers en route to the repository.

The train would not stop en route to the repository, therefore there would be no radiation doses from any en route stops for workers. Radiation doses have been estimated for workers located at sidings who could be exposed when a train with casks containing spent nuclear fuel or high-level radioactive waste passed a train carrying empty casks or other materials stopped at a siding. Radiation doses have also been estimated for workers present at the Maintenance-of-Way Trackside Facility who could be exposed when a train with casks containing spent nuclear fuel or high-level radioactive waste passed by the workers en route to the repository. Workers at the Staging Yard would also be exposed to radiation during railcar handling operations. Radiation doses were estimated for two groups of workers at the Staging Yard, workers directly involved in railcar handling operations (involved workers) and workers not directly involved in railcar handling operations (noninvolved workers).

K.2.3.1 Collective Dose Estimation Methodology

Collective radiation doses were estimated based on unit risk factors. Unit risk factors provide an estimate of the radiation doses from transporting one shipment or container of radioactive material over a unit distance of travel in a given population density zone.

Unit risk factors may also provide an estimate of the radiation dose from one container or shipment being stopped at a location such as the Staging Yard, the radiation dose from one container or shipment passing a location such as the Maintenance-of-Way Facility, or the radiation dose from one container or shipment passing a train stopped at a siding. There were five types of unit risk factors used to estimate collective incident-free radiation doses:

- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks, the population density in each population zone, and the distance in each population zone.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks and the distance in each population zone.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks and the population density around locations such as the Staging Yard.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of trains (shipments) and the distance in each population zone.
- Unit risk factors that were used to estimate incident-free radiation doses that depended on the number of casks.

The unit risk factors were combined with the cask, shipment, population density, and distance data using the following equations:

$$\text{Incident-Free Dose} = \sum_{m} \sum_{k} \sum_{j} \sum_{i} C_k \times PD_{j,m} \times D_{j,m} \times EF_m \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_{m} \sum_{k} \sum_{j} \sum_{i} C_k \times D_{j,m} \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_{m} \sum_{k} \sum_{j} \sum_{i} C_k \times PD_m \times EF_m \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_{m} \sum_{k} \sum_{j} \sum_{i} T_k \times D_{j,m} \times URF_{i,j}$$

$$\text{Incident-Free Dose} = \sum_{k} \sum_{j} \sum_{i} C_k \times URF_{i,j}$$

Where:

C_k = Number of casks for fuel type k

T_k = Number of trains (shipments) for fuel type k

$PD_{j,m}$ = Population density in population zone j in county m (persons per square kilometer)

PD_m = Population density at Staging Yard in county m (persons per square kilometers)

$D_{j,m}$ = Distance in population zone j in county m (kilometers)

EF_m = Population escalation factor for county m

$URF_{i,j}$ = Unit risk factor for receptor i in population zone j (person-rem per kilometer per persons per square kilometers, person-rem per kilometer, person-rem per person per square kilometers, or person-rem)

The unit risk factors used to estimate radiation doses were estimated using the RADTRAN 5 computer code (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all; DIRS 155970, DOE 2002, p. J-40) and the RISKIND computer code (DIRS 101483-Yuan et al. 1995, all). Both RADTRAN and RISKIND have been verified and validated for estimating incident-free radiation doses during transportation of radioactive material (DIRS 101845-Maheras and Pippen 1995, all; DIRS 177031-Osborn et al. 2005, all; DIRS 102060-Biwer et al. 1997, all).

The incident-free unit risk factors used in the analysis in the Rail Alignment EIS are based on *Transportation Health and Safety Calculation/Analysis Documentation in Support of the Final EIS for Yucca Mountain Repository* (DIRS 157144-Jason Technologies 2001, Tables 4-20 and 4-21) and the following additional assumptions:

- There would be no on-link radiation doses for members of the public, as no members of the public would share the single track with the cask trains.
- There would be no radiation doses at stops for members of the public, workers, or escorts.

- There would be no radiation doses for rail workers (engineers or conductors) en route to the repository. There would, however, be radiation doses for escorts en route to the repository.
- Escorts would be present on the trains in all areas en route to the repository and would also be present at the Staging Yard.
- A train containing commercial spent nuclear fuel would contain 3 casks. A train containing DOE spent nuclear fuel and high-level radioactive waste would contain 5 casks.
- Unit risk factors were estimated for workers located at the Maintenance-of-Way Trackside Facility, workers located at sidings, and noninvolved workers at the Staging Yard.

At the Staging Yard, there would be three groups of involved workers: inspectors, escorts, and rail workers. For the purposes of this analysis, inspectors would be present for 1 hour at a distance of 1 meter from the railcar containing the rail cask (DIRS 157144-Jason Technologies 2001, p. 88). Escorts would be present at a distance of 30 meters (100 feet) from the rail cask for a period of 2 hours. Radiation doses to rail workers were estimated using the time- and distance-weighted "b" factors contained in RADTRAN5 Technical Manual (DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, Appendix B). For noninvolved workers at the Caliente Staging Yard, 65 workers would be present 100 meters (330 feet) from the rail casks for 2 hours. At the Mina Staging Yard, 55 workers would be present 100 meters (330 feet) from the rail casks for 2 hours.

At the Maintenance-of-Way Trackside Facility, 40 workers would be present at the facility 60 meters (200 feet) from the railroad tracks. At sidings, up to 10 workers (an engineer, a conductor, and escorts) would be present 7.62 meters (25 feet) from the railroad tracks. Workers would not be continuously present at sidings. Under the Proposed Action, a loaded cask train could pass an empty cask train or a train containing other materials at a siding up to 53 times for the Caliente rail alignment or 29 times for the Mina rail alignment. Under the Shared-Use Option, a loaded cask train could pass an empty cask train or a train containing other materials at a siding up to 114 times for the Caliente rail alignment or 62 times for the Mina rail alignment. For the Maintenance-of-Way Trackside Facilities and passes at sidings, the train containing loaded spent nuclear fuel or high-level radioactive waste would pass the facility or siding at about 50 kilometers (30 miles) per hour.

Table K-6 contains the unit risk factors for workers and members of the public used in this analysis. Because multiple casks would be shipped in the same train, some unit risk factors depend on the number of casks, while other unit risk factors depend on the number of trains. This is noted in Table K-6.

K.2.3.2 Maximally Exposed Individual Scenarios

Maximally exposed individuals are hypothetical workers and members of the public who would receive the highest radiation doses. Radiation doses for these hypothetical individuals were estimated for cask shipments en route to the repository and for railcar handling activities at the Staging Yards.

The scenarios used to estimate the radiation doses are based on the scenarios analyzed in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Section J.1.3.2.2) and the following additional assumptions. For workers, radiation doses were estimated for inspectors, escorts, and Staging Yard workers, including involved workers and noninvolved workers, under several operating scenarios. In the first scenario, a worker located at the Maintenance-of-Way Trackside Facility is exposed to a loaded cask train as it passed the facility en route to the repository. In the second scenario, a worker located at a siding is exposed to a loaded cask as it passed the siding en route to the repository. The assumptions used to evaluate these scenarios are listed in the previous section.

Table K-6. Incident-free unit risk factors.

Receptor	Type of zone or person	Unit risk factor[a]	Unit risk factor[b]
Public			
Off-link (public along rail alignment)	Rural	5.01×10^{-8}	5.08×10^{-8}
(person-rem/km per persons per square kilometer)[c]	Suburban	6.24×10^{-8}	6.33×10^{-8}
(based on number of casks)	Urban	1.04×10^{-7}	1.05×10^{-7}
On-link (public sharing rail alignment)	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
Residents near stops en route to the repository	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
Residents located near Staging Yard (person-rem per persons per square kilometer)[c] (based on number of casks)	Site-specific	1.06×10^{-6}	1.08×10^{-6}
Workers			
En route rail workers (engineers and conductors)	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of trains)	Urban	0	0
En route rail workers at stops	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
En route escorts	Rural	2.08×10^{-4}	2.08×10^{-4}
(person-rem per kilometer)[d]	Suburban	2.59×10^{-4}	2.59×10^{-4}
(based on number of trains)	Urban	4.32×10^{-4}	4.32×10^{-4}
En route escorts at stops	Rural	0	0
(person-rem per kilometer)[d]	Suburban	0	0
(based on number of casks)	Urban	0	0
Workers at Maintenance-of-Way Trackside Facility (person-rem per pass) (based on number of casks)	Rural	3.72×10^{-6}	3.88×10^{-6}
Workers at Siding (person-rem per pass) (based on number of casks)	Rural	4.50×10^{-5}	4.50×10^{-5}
Workers at Staging Yard (involved)	Escorts	2.08×10^{-2}	2.08×10^{-2}
(person-rem/train or cask)	Inspector	1.70×10^{-2}	1.70×10^{-2}
(escort based on number of trains, inspector and railyard workers based on number of casks)	Railyard workers	1.60×10^{-3}	1.68×10^{-3}
Workers at Staging Yard (noninvolved)	Caliente	1.30×10^{-3}	1.37×10^{-3}
(person-rem/cask) (based on number of casks)	Mina	1.10×10^{-3}	1.16×10^{-3}

a. Unit risk factors for shipments of commercial and DOE spent nuclear fuel and high-level radioactive waste.
b. Unit risk factors for shipments of Naval spent nuclear fuel.
c. To convert person-rem per kilometer per persons per square kilometer to person-rem per mile per persons per square mile, multiply by 0.623171.
d. To convert person-rem per kilometer to person-rem per mile, multiply by 1.609344.

For members of the public, two scenarios were evaluated. In the first scenario, a resident living 18 meters (60 feet) from the rail line is exposed to all loaded casks as they passed by en route to the repository. The passing train is traveling at a speed of 24.2 kilometers (15 miles) per hour. In the second scenario, a resident living near the Staging Yard is exposed to all loaded casks at the Staging Yard for a duration of 2 hours per cask. The distances from the Staging Yard for these residents are listed in Table K-7 and were based on site-specific data around each Staging Yard.

Table K-7. Distance to members of the public around staging yards.

Staging Yard location	Distance (meters)[a]	Type of location
Caliente-Indian Cove	1,600	Residence
Caliente-Upland	400	Residence
Eccles	1,500	Residence
Hawthorne	660	Business

a. To convert meters to feet, multiply by 3.280840.

K.2.4 TRANSPORTATION ACCIDENT RISKS

The radiological dose risks from transporting spent nuclear fuel and high-level radioactive waste could result from: 1) accidents in which there is no breach of the containment provided by the transportation cask, but there is loss of shielding because of lead shield displacement, and 2) accidents that release and disperse radioactive material from the transportation cask. In the Rail Alignment EIS, the risk to the general public from the radiological consequences of transportation accidents is called dose risk. Dose risk is the sum of the products of the probabilities (dimensionless) and the consequences (in person-rem) of all potential transportation accidents. The probability of a single accident is usually determined by historical information on accidents of a similar type and severity. The consequences are estimated by analysis of the quantity of radionuclides likely to be released, potential exposure pathways, potentially affected population, likely weather conditions, and other information.

As an example, the dose risk from a single accident that had a probability of 0.001 (1 chance in 1,000), and would cause a population dose of 20,000 person-rem in a population if it did occur, would be 20 person-rem. If that population was subject to 1,000 similar accident scenarios, the total dose risk would be 20,000 person-rem. Using the conversion factor of 0.0006 latent cancer fatality per person-rem, an analysis would estimate a health and safety risk of 12 latent cancer fatalities from this population dose risk.

Potential accidents ranged from accidents with high probabilities and low consequences to accidents with low probabilities and high consequences. The analyses used the following information to determine the risks of accidents:

- The number of shipments
- The distances and population densities along the rail alignments in rural, suburban, and urban areas
- The kind and amount of radioactive material that would be transported
- Track-class-specific accident rates
- ***Conditional probabilities*** of release and the fraction of cask contents that could be released in accidents

Conditional probability is the probability of an accident of a given severity category, given that an accident occurs.

- Conditional probabilities of amounts of lead shielding displacement that could occur during accidents, and the resulting radiation dose rates
- Exposure scenarios including inhalation, ingestion, groundshine, resuspension, and immersion pathways, Nevada-specific agricultural factors, and neutral atmospheric dispersion factors

As in the incident-free transportation analysis, the RADTRAN 5 computer code (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all; DIRS 155970-DOE 2002, Section J.1.4.2) was used to estimate unit risk factors for each radionuclide of concern in spent nuclear fuel and high-level radioactive waste. RADTRAN has been verified and validated for estimating the accident risks from transporting radioactive material (DIRS 101845-Maheras and Pippen 1995, all; DIRS 177031-Osborn et al. 2005, all). The unit risk factors were combined with radionuclide inventories, number of shipments, accident rates, conditional probabilities of release, ***release fractions***, distance, and population densities to determine the dose risk for populations within 80 kilometers (50 miles) of the rail alignment. For accidents involving loss of shielding, the unit risk factors were also estimated using RADTRAN 5. The methods and data used to estimate the dose risks are based on the following:

Release fraction is the fraction of material released during an accident.

- The distances and population densities reflect specific rail alignments. This is discussed in Section K.2.1.1.
- The number of rail casks to be shipped has been estimated to be 9,495. This is discussed in Section K.2.3.
- Track Class-specific rail accident rates were used in the analysis. This is discussed in Section K.2.4.1.
- The radionuclide inventories are as discussed in Section K.2.4.2.
- Radiation dosimetry has been used to estimate unit risk factors and radiation doses. This is discussed in Section K.2.4.7.
- Health risk conversion factors have been used to estimate the number of latent cancer fatalities. This is discussed in Section K.1.6

Transportation accidents are organized into categories based on the severity of the accident. These categories are known as severity categories.

For the inhalation, immersion, resuspension, and groundshine pathways, the dose risk is given by:

$$\text{Dose Risk} = AR \times \sum_{p} \sum_{n} \sum_{m} \sum_{j} \sum_{i} \sum_{k} PD_{m,p} \times D_{m,p} \times I_{i,n} \times CP_{j,n} \times RF_{i,j,n} \times EF_{p} \times URF_{i,k}$$

Where:

AR	=	Accident rate (accidents/km)
$PD_{m,p}$	=	Population density in population zone m in county p (people/km^2)
$D_{m,p}$	=	Distance in population zone m in county p (km)
$I_{i,n}$	=	Total inventory of radionuclide i for fuel type n (Ci)
$CP_{j,n}$	=	Conditional probability for severity category j and fuel type n
$RF_{i,j,n}$	=	Release fraction for radionuclide i and severity category j for fuel type n

EF_p = Population escalation factor for county p

$URF_{i,k}$ = Unit risk factor for radionuclide i and pathway k (person-rem/Ci per person/km^2)

For the ingestion pathway, the dose risk is given by:

$$\text{Dose Risk} = AR \times \sum_p \sum_n \sum_j \sum_i D_{rural,p} \times I_{i,n} \times CP_{j,n} \times RF_{i,j,n} \times FTF_i \times URF_i$$

Where:

AR = Accident rate (accidents/km)

$D_{rural,p}$ = Distance in rural population zone in county p (km)

$I_{i,n}$ = Total inventory of radionuclide i for fuel type n (Ci)

$CP_{j,n}$ = Conditional probability for severity category j and fuel type n

$RF_{i,j,n}$ = Release fraction for radionuclide i and severity category j and fuel type n

FTF_i = Food transfer factor for radionuclide i (Ci/Ci deposited) (state-specific)

URF_i = Ingestion unit risk factor for radionuclide i (person-rem/Ci × Ci deposited)

For loss of shielding accidents, the dose risk is given by:

$$\text{Dose Risk} = AR \times \sum_p \sum_n \sum_m \sum_j C_n \times PD_{m,p} \times D_{m,p} \times CP_{j,n} \times EF_p \times URF_{j,n}$$

Where:

AR = Accident rate (accidents/km)

C_n = Number of casks for fuel type n

$PD_{m,p}$ = Population density in population zone m in county p (people/km^2)

$D_{m,p}$ = Distance in population zone m in county p (km)

$CP_{j,n}$ = Conditional probability for severity category j and fuel type n

EF_p = Population escalation factor for county p

$URF_{j,n}$ = Loss of shielding unit risk factor for severity category j and fuel type n (person-rem/km per person/km^2)

K.2.4.1 Transportation Accident Rates

In this analysis, the Department used a combination of rail accident rates based on both train-kilometers and railcar-kilometers to estimate accident dose risks (see Table K-8). These rates were for Track Class 3 and include derailments and collisions (DIRS 180220-Bendixen and Facanha 2007, all).

Enrichment is the fraction of atoms of a specified isotope in a mixture of isotopes of the same element when this fraction exceeds that in the naturally occurring mixture. By convention, uranium enrichment is given on a weight basis.

Decay time is the time since the spent nuclear fuel has been discharged from the reactor.

Burnup is the total energy released per initial unit mass of nuclear fuel as a result of irradiation. The commonly used units of burnup are megawatt-days per metric ton of heavy metal (MWd/MTHM).

Table K-8. Track Class 3 rail accident rates.[a]

Train-based accident rate (accidents per train-kilometer) [b]	Railcar-based accident rate (accidents per railcar-kilometer) [c]
7.5×10^{-7}	1.7×10^{-8}

a. Source: DIRS 180220-Bendixen and Facanha 2007, p. 2.
b. To convert accidents per train-kilometer to accidents per train-mile, multiply by 1.609344.
c. To convert accidents per railcar-kilometer to accidents per railcar-mile, multiply by 1.609344.

K.2.4.2 Radionuclide Inventory

The primary sources of the radionuclide inventory information for the Rail Alignment EIS are:

- *PWR Source Term Generation and Evaluation* (DIRS 169061-BSC 2004, all)
- *BWR Source Term Generation and Evaluation* (DIRS 164364-BSC 2003, all)
- *Source Term Estimates for DOE Spent Nuclear Fuels* (DIRS 169354-DOE 2004, all)
- *Recommended Values for HLW Glass for Consistent Usage on the Yucca Mountain Project* (DIRS 180471-BSC 2007, all)

The radionuclide inventory used in the Rail Alignment EIS represents the radioactivity contained in about 65,600 metric tons of heavy metal (MTHM) of spent nuclear fuel and high-level radioactive waste which would be shipped to the repository by rail. The remaining 4,400 MTHM would be shipped to the repository using trucks and is not evaluated in the Rail Alignment EIS. The updated radionuclide inventories are listed in Tables K-9 through K-14.

DOE spent nuclear fuel was organized into 34 groups based on the fuel compound, fuel ***enrichment***, fuel cladding material, and fuel cladding condition (DIRS 171271-DOE 2004, all). The characteristics of the spent nuclear fuel, including percent enrichment, ***decay time***, and ***burnup***, affect the radionuclide inventory and thereby the radiation dose. The descriptions below are for a typical spent nuclear fuel for each group.

- Group 1: Uranium Metal, Zirconium Alloy Clad, Low-Enriched Uranium—This group contains uranium metal fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.5 to 1.7 percent. The cladding is in fair to poor condition. This group of fuel comprises approximately 2,103 MTHM.
- Group 2: Uranium Metal, Non-Zirconium Alloy Clad, Low-Enriched Uranium—This group contains uranium metal fuel compounds with no known zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.2 to 3.4 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 8 MTHM.

- Group 3: Uranium-Zirconium—This group contains uranium-zirconium alloy fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.5 to 92.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.66 MTHM.
- Group 4: Uranium-Molybdenum—This group contains uranium-molybdenum alloy fuel compounds with various types of cladding. The end-of-life effective enrichment ranges from 2.4 to 25.8 percent. If present, the cladding is in good to poor condition. This group of fuel comprises approximately 3.9 MTHM.
- Group 5: Uranium Oxide, Intact Zirconium Alloy Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with intact zirconium alloy cladding. The end-of-life effective enrichment ranges from 23.1 to 92.5 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 1 MTHM.
- Group 6: Uranium Oxide, Intact Zirconium Alloy Clad, Medium-Enriched Uranium—This group contains uranium oxide fuel compounds with intact zirconium alloy cladding. The end-of-life effective enrichment ranges from 5 to 6.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 1.9 MTHM.
- Group 7: Uranium Oxide, Intact Zirconium Alloy Clad, Low-Enriched Uranium—This group contains uranium oxide fuel compounds with intact zirconium alloy cladding. The end-of-life effective enrichment ranges from 0.6 to 4.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 89.6 MTHM.
- Group 8: Uranium Oxide, Intact Stainless Steel/Hastelloy Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with intact stainless steel or hastelloy cladding. The end-of-life effective enrichment ranges from 91 to 93.2 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.19 MTHM.
- Group 9: Uranium Oxide, Intact Stainless Steel Clad, Medium-Enriched Uranium—This group contains uranium oxide fuel compounds with intact stainless steel cladding. The end-of-life effective enrichment ranges from 5.5 to 20 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.69 MTHM.
- Group 10: Uranium Oxide, Intact Stainless Steel Clad, Low-Enriched Uranium—This group contains uranium oxide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 0.2 to 1.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.9 MTHM.
- Group 11: Uranium Oxide, Non-Intact or Declad Non-Aluminum Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with no known aluminum cladding. The end-of-life effective enrichment ranges from 21 to 93.3 percent. If present, the cladding is in poor condition. This group of fuel comprises approximately 0.82 MTHM.
- Group 12: Uranium Oxide, Non-Intact or Declad Non-Aluminum Clad, Medium-Enriched Uranium—This group contains uranium oxide fuel compounds with no known aluminum cladding. The end-of-life effective enrichment ranges from 5.2 to 18.6 percent. If present, the cladding is in poor condition. This group of fuel comprises approximately 0.47 MTHM.
- Group 13: Uranium Oxide, Non-Intact or Declad Non-Aluminum Clad, Low-Enriched Uranium—This group contains uranium oxide fuel compounds with no known aluminum cladding. The end-of-life effective enrichment ranges from 1.1 to 3.2 percent. If present, the cladding is in poor condition. This group of fuel comprises approximately 82.5 MTHM.
- Group 14: Uranium Oxide, Aluminum Clad, Highly Enriched Uranium—This group contains uranium oxide fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges

from 58.1 to 89.9 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 4.6 MTHM.

- Group 15: Uranium Oxide, Aluminum Clad, Medium-Enriched Uranium and Low-Enriched Uranium—This group contains uranium oxide fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 8.9 to 20 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.29 MTHM.
- Group 16: Uranium-Aluminum, Highly Enriched Uranium—This group contains uranium-aluminum alloy fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 21.9 to 93.3 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 7.5 MTHM.
- Group 17: Uranium-Aluminum, Medium-Enriched Uranium—This group contains uranium-aluminum alloy fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 9 to 20 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 2.6 MTHM.
- Group 18: Uranium-Silicide—This group contains uranium-silicide fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 5.2 to 22 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 7.2 MTHM.
- Group 19: Thorium/Uranium Carbide, TRISO- or BISO-Coated Particles in Graphite—This group contains thorium/uranium carbide fuel compounds with TRISO- or BISO-coated particles. TRISO-coated particles consist of an isotropic pyrocarbon outer layer, a silicon carbide layer, an isotropic carbon layer, and a porous carbon buffer inner layer. BISO-coated particles consist of an isotropic pyrocarbon outer layer and a low density porous carbon buffer inner layer. The end-of-life effective enrichment ranges from 71.4 to 84.4 percent. The coating is in good condition. This group of fuel comprises approximately 24.7 MTHM.
- Group 20: Thorium/Uranium Carbide, Mono-Pyrolytic Carbon-Coated Particles in Graphite—This group contains thorium/uranium carbide fuel compounds with mono-pyrolytic carbon-coated particles. The end-of-life effective enrichment ranges from 80.6 to 93.2 percent. The coating is in poor condition. This group of fuel comprises approximately 1.6 MTHM.
- Group 21: Plutonium/Uranium Carbide, Nongraphite Clad, Not Sodium Bonded—This group contains plutonium/uranium carbide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 1 to 67.3 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 0.08 MTHM.
- Group 22: Mixed Oxide, Zirconium Alloy Clad—This group contains plutonium/uranium oxide fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 1.3 to 21.3 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 1.6 MTHM.
- Group 23: Mixed Oxide, Stainless Steel Clad—This group contains plutonium/uranium and plutonium oxide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 2.1 to 87.4 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 10.7 MTHM.
- Group 24: Mixed Oxide, Non-Stainless Steel/Non-Zirconium Alloy Clad—This group contains plutonium/uranium oxide fuel compounds with no known stainless steel or zirconium alloy cladding. The end-of-life effective enrichment ranges from 5 to 54.3 percent. The cladding is in poor to nonintact condition. This group of fuel comprises approximately 0.11 MTHM.

- Group 25: Thorium/Uranium Oxide, Zirconium Alloy Clad—This group contains thorium/uranium oxide fuel compounds with zirconium alloy cladding. The end-of-life effective enrichment ranges from 10.1 to 98.4 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 42.6 MTHM.
- Group 26: Thorium/Uranium Oxide, Stainless Steel Clad—This group contains thorium/uranium oxide fuel compounds with stainless steel cladding. The end-of-life effective enrichment ranges from 7.6 to 97.8 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 7.6 MTHM.
- Group 27: Uranium-Zirconium Hydride, Stainless Steel/Incoloy Clad, Highly Enriched Uranium—This group contains uranium-zirconium hydride fuel compounds with stainless steel or incoloy cladding. The end-of-life effective enrichment ranges from 42.5 to 93.2 percent. The cladding is in good to fair condition. This group of fuel comprises approximately 0.16 MTHM.
- Group 28: Uranium-Zirconium Hydride, Stainless Steel/Incoloy Clad, Medium-Enriched Uranium—This group contains uranium-zirconium hydride fuel compounds with stainless steel or incoloy cladding. The end-of-life effective enrichment ranges from 11.9 to 20 percent. The cladding is in good to poor condition. This group of fuel comprises approximately 1.4 MTHM.
- Group 29: Uranium-Zirconium Hydride, Aluminum Clad, Medium-Enriched Uranium—This group contains uranium-zirconium hydride fuel compounds with aluminum cladding. The end-of-life effective enrichment ranges from 16.8 to 20 percent. The cladding is in good condition. This group of fuel comprises approximately 0.35 MTHM.
- Group 30: Uranium-Zirconium Hydride, Declad—This group contains uranium-zirconium hydride fuel compounds that have been declad. The end-of-life effective enrichment is about 89.7 percent. This group of fuel comprises approximately 0.03 MTHM.
- Group 31: Metallic Sodium Bonded—This group contains a wide variety of spent nuclear fuel that has the common attribute of containing metallic sodium bonding between the fuel matrix and the cladding. The end-of-life effective enrichment ranges from 0.1 to 93.2 percent. If present, the cladding is in good to poor condition. This group of fuel comprises approximately 59.9 MTHM. This spent nuclear fuel will be treated and will be disposed of as high-level radioactive waste.
- Group 32: Naval Fuel—Naval nuclear fuel is highly robust and designed to operate in a high-temperature, high-pressure environment for many years. This fuel is highly enriched (93 to 97 percent) in uranium-235. In addition, to ensure that the design will be capable of withstanding battle shock loads, the naval fuel material is surrounded by large amounts of zirconium alloy. This group of fuel comprises approximately 65 MTHM.
- Group 33: Canyon Stabilization—This spent nuclear fuel is being treated and will be disposed of as high-level radioactive waste.
- Group 34: Miscellaneous—This group contains spent nuclear fuel that does not fit into other groups. The spent nuclear fuel in this group was generated from numerous reactors of different types. The end-of-life effective enrichment ranges from 14.6 to 90 percent. If present, the cladding is in good to poor condition. This group of fuel comprises approximately 0.44 MTHM.

The DOE spent nuclear fuel radionuclide inventories are in the year 2010 for the amount of spent nuclear fuel that would be shipped in rail casks. These radionuclide inventories were compiled from data contained in *Source Term Estimates for DOE Spent Nuclear Fuels* (DIRS 169354-DOE 2004, Volume II, Appendix C). For naval spent nuclear fuel, the radionuclide inventory is for 400 casks. The single-cask naval spent fuel inventory was compiled from information provided by the Department of the Navy (DIRS

155857-McKenzie 2001, Table 3). Tables K-9 through K-12 list the radionuclide inventories for DOE spent nuclear fuel.

For commercial spent nuclear fuel, the radionuclide inventories are for the amount of spent nuclear fuel that would be shipped in rail casks. For pressurized water reactor spent nuclear fuel, 85,914 spent nuclear fuel assemblies are estimated to be shipped in rail casks (DIRS 181377-BSC 2007, Section 7). For boiling water reactor spent nuclear fuel, 121,932 spent nuclear fuel assemblies are estimated to be shipped in rail casks (DIRS 181377-BSC 2007, Section 7). For the purposes of analysis, all shipping casks were assumed to be full and all trains were assumed to have a full complement of casks. This increases the number of spent nuclear fuel assemblies to 87,057 for pressurized water reactor spent nuclear fuel and 123,537 for boiling water reactor spent nuclear fuel. The representative pressurized water reactor assembly would have a burnup of 60,000 megawatt-days per metric ton of heavy metal (MWd/MTHM), an enrichment of 4 percent, and a decay time of 10 years (DIRS 169061-BSC 2004, all). The representative boiling water reactor assembly would have a burnup of 50,000 MWd/MTHM, an enrichment of 4 percent, and a decay time of 10 years (DIRS 164364-BSC 2003, all). Table K-13 contains the radionuclide inventory for commercial spent nuclear fuel.

The high-level radioactive waste radionuclide inventory is based on 5,316 canisters for Hanford Site high-level radioactive waste, 528 canisters for Idaho National Laboratory high-level radioactive waste, 3,490 canisters of Savannah River Site high-level radioactive waste, and 277 canisters of high-level radioactive waste from West Valley (DIRS 181377-BSC 2007, Section 7). For the purposes of analysis, all shipping casks containing high-level radioactive waste were assumed to be full and all trains were assumed to have a full complement of casks. This increases the amount of high-level radioactive waste to 5,325 canisters for Hanford Site high-level radioactive waste, 550 canisters for Idaho National Laboratory high-level radioactive waste, 3,500 canisters of Savannah River Site high-level radioactive waste, and 300 canisters of high-level radioactive waste from West Valley. Table K-14 lists the radionuclide inventory for high-level radioactive waste.

K.2.4.3 Conditional Probabilities and Release Fractions

In this appendix, DOE spent nuclear fuel is organized into 34 groups based on the fuel compound, fuel matrix, fuel enrichment, fuel cladding material, and fuel cladding condition. Table K-15 lists these spent nuclear fuel groups. Commercial spent nuclear fuel is organized into two groups, pressurized-water-reactor spent nuclear fuel and boiling-water-reactor spent nuclear fuel. High-level radioactive waste is organized into four groups, Idaho high-level waste, Hanford high-level waste, Savannah River high-level radioactive waste, and West Valley high-level radioactive waste. These groups were assigned to a set of 10 conditional probabilities and release fractions known as release fraction groups based on the characteristics and behaviors of the spent nuclear fuel or high-level radioactive waste (see Tables K-16 through K-26). Release fractions were specified for inert gases, volatile constituents such as cesium and ruthenium, particulates, and activation products such as Co-60 that were deposited on the exterior surfaces of the spent nuclear fuel (also known as crud).

For loss of shielding accidents, the Rail Alignment EIS uses unit risk factors for six severity categories of accidents (DIRS 155970-DOE 2002, p. J-54, Table J-19). These unit risk factors are listed in Tables K-27 and K-28.

Tables K-16 through K-26 also list "one-group" release fractions. One-group release fractions are defined as the sum of the products of the conditional probability and release fraction for all six accident severity categories:

$$\text{One Group Release Fraction} = \sum_{\text{Severity Category, i=1}}^{6} \text{Conditional Probability}_i \times \text{Release Fraction}_i$$

Similarly, the one-group unit risk factors listed in Tables K-27 and K-28 are defined as the sum of the products of the conditional probability and unit risk factor for all six accident severity categories:

$$\text{One Group Unit Risk Factor} = \sum_{\text{Severity Category, i=1}}^{6} \text{Conditional Probability}_i \times \text{Unit Risk Factor}_i$$

The conditional probabilities and release fractions listed in Tables K-16 through K-28 would be mostly a direct consequence of error on the part of transport vehicle operators, operators of other vehicles, or persons who maintain vehicles and rights-of-way. The number and severity of the accidents would be minimized through the use of trained and qualified personnel.

Others have argued that other kinds of human error could also contribute to accident consequences: (1) undetected error in the design and certification of transportation packaging (cask) used to ship radioactive material, (2) hidden or undetected defects in the manufacture of these packages, and (3) error in preparing the packages for shipment. DOE has concluded that U.S. Nuclear Regulatory Commission and U.S. Department of Transportation regulations and regulatory practices address the design, manufacture, and use of transportation packaging and are effective in preventing these kinds of human error by requiring:

- Independent Nuclear Regulatory Commission review of designs to ensure compliance with requirements (10 CFR Part 71)
- Nuclear Regulatory Commission-approved and audited quality assurance programs for design, manufacturing, and use of transportation packages

In addition, federal provisions (10 CFR Part 21) provide additional assurance of timely and effective actions to identify and initiate corrective actions for undetected design or manufacturing defects. Furthermore, conservatism in the approach to safety incorporated in the regulatory requirements and practices provides confidence that design or manufacturing defects that might remain undetected or operational deficiencies would not lead to a meaningful reduction in the performance of a package under normal or accident conditions of transportation.

K.2.4.4 Atmospheric Conditions

Because it is not possible to forecast the atmospheric conditions that might exist during an accident, DOE selected neutral weather conditions (Pasquill Stability Class D) for the transportation risk assessments for the Rail Alignment EIS. The accident calculation methodology includes a probabilistic component that includes the atmospheric stability; therefore, DOE assumed neutral conditions. Atmospheric conditions affect the dispersion of radionuclides that could be released during an accident. Neutral weather conditions are typified by moderate wind speeds, vertical mixing within the atmosphere, and good dispersion of atmospheric contaminants. On the basis of observations from National Weather Service surface meteorological stations at 177 locations in the United States, on an annual average, neutral conditions (Pasquill Class C and D) occur 11 percent and 47 percent of the time, respectively. Stable conditions (Pasquill Class E and F) occur 12 percent and 21 percent of the time, respectively. Unstable conditions (Pasquill Class A and B) occur 1 percent and 7 percent of the time, respectively (DIRS 104800-CRWMS M&O 1999, p. 40).

Table K-9. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 1 through 8 (page 1 of 2).[a,b]

	Uranium metal				Uranium oxide			
					Zirconium clad (intact)			Stainless steel/hastelloy clad (intact)
Radionuclide	Zirconium clad LEU Group 1 (Ci)	Non-zirconium clad LEU Group 2 (Ci)	Uranium-zirconium Group 3 (Ci)	Uranium-molybdenum Group 4 (Ci)	HEU Group 5 (Ci)	MEU Group 6 (Ci)	LEU Group 7 (Ci)	HEU Group 8 (Ci)
Ac-227	5.0E-3	5.8E-4	3.0E-3	8.4E-3	5.4E-3	2.9E-5	4.2E-3	1.0E-4
Am-241	7.1E+5	2.1E+4	1.4E+4	1.8E+2	4.6E+2	4.8E+3	3.7E+5	4.6E-1
Am-242m	4.4E+2	3.4E+1	2.2E+0	2.8E-2	8.6E-1	9.7E+0	7.8E+2	3.5E-5
Am-243	3.7E+2	6.4E+0	1.3E+0	1.6E-2	1.8E+0	2.1E+1	1.7E+3	4.1E-6
C-14	1.1E+3	2.0E+3	7.0E+2	1.1E+1	5.3E+1	1.6E+0	6.6E+2	9.5E-1
Cl-36	5.2E-2	3.7E+1	1.2E-3	4.8E-3	2.8E-1	2.7E-2	2.1E+0	5.1E-3
Cm-243	1.7E+1	6.6E+0	3.1E-1	4.0E-3	7.5E-1	8.7E+0	7.6E+2	9.8E-7
Cm-244	6.5E+3	8.9E+1	6.5E+0	8.3E-2	1.5E+2	1.7E+3	1.6E+5	8.9E-6
Co-60	2.7E+4	4.6E+5	4.0E+4	6.8E+2	1.6E+4	1.2E+2	4.7E+4	2.5E+2
Cs-134	1.1E+2	1.5E+2	5.0E+0	1.2E-1	1.8E+0	1.9E+1	2.6E+3	1.0E-2
Cs-135	7.6E+1	1.9E+0	5.0E+0	4.0E+0	7.0E+0	4.9E-1	4.2E+1	1.3E-1
Cs-137	9.3E+6	2.2E+5	9.0E+5	1.3E+5	3.4E+5	4.8E+4	4.9E+6	5.7E+3
Eu-154	5.2E+4	1.2E+3	4.2E+3	6.9E+1	2.3E+2	7.8E+2	9.1E+4	2.4E+0
Eu-155	2.5E+3	7.7E+2	3.9E+2	1.3E+2	1.7E+2	8.5E+1	1.2E+4	2.5E+0
Fe-55	4.7E+1	6.2E+3	3.7E+1	1.7E+0	2.8E+2	6.8E+0	1.1E+3	4.2E+0
H-3	2.6E+4	4.2E+3	1.5E+4	4.9E+2	6.5E+2	7.6E+2	8.7E+4	9.4E+0
I-129	6.5E+0	1.3E-1	4.7E-1	1.1E-1	1.7E-1	3.3E-2	2.9E+0	3.0E-3
Kr-85	2.1E+5	7.5E+3	2.4E+4	3.7E+3	9.6E+3	1.0E+3	1.3E+5	1.5E+2
Np-237	6.4E+1	1.9E+0	3.5E+0	3.3E-1	3.0E-1	3.8E-1	3.1E+1	4.8E-3
Pa-231	1.2E-2	1.1E-3	5.0E-3	1.7E-2	1.0E-2	4.3E-5	6.9E-3	2.0E-4
Pb-210	2.0E-3	3.6E-4	2.7E-3	3.5E-5	3.7E-7	2.7E-6	2.2E-3	3.1E-9
Pm-147	4.7E+3	1.6E+4	6.2E+2	1.1E+2	2.8E+2	5.6E+1	8.9E+3	4.0E+0
Pu-238	1.5E+5	3.6E+3	4.0E+3	6.5E+1	2.9E+2	2.5E+3	2.1E+5	1.2E+0
Pu-239	2.2E+5	7.1E+3	1.2E+4	1.8E+3	2.0E+2	3.9E+2	4.0E+4	2.8E+0

Table K-9. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 1 through 8 (page 2 of 2).[a,b]

	Uranium metal				Uranium oxide			
					Zirconium clad (intact)			Stainless steel/hastelloy clad (intact)
Radionuclide	Zirconium clad LEU Group 1 (Ci)	Non-zirconium clad LEU Group 2 (Ci)	Uranium-zirconium Group 3 (Ci)	Uranium-molybdenum Group 4 (Ci)	HEU Group 5 (Ci)	MEU Group 6 (Ci)	LEU Group 7 (Ci)	HEU Group 8 (Ci)
Pu-240	1.7E+5	3.5E+3	5.2E+3	7.1E+1	7.3E+1	5.1E+2	4.4E+4	3.6E-1
Pu-241	4.5E+6	1.4E+5	9.1E+4	1.1E+3	3.5E+3	3.2E+4	3.2E+6	2.7E+0
Pu-242	1.1E+2	1.9E+0	1.3E+0	1.6E-2	1.9E-1	2.2E+0	1.7E+2	8.2E-6
Ra-226	5.6E-3	9.7E-4	7.4E-3	9.4E-5	1.0E-6	7.3E-6	6.0E-3	8.2E-9
Ra-228	4.9E-4	2.4E-5	7.4E-4	1.1E-5	1.9E-6	1.8E-7	5.7E-4	3.4E-8
Ru-106	4.4E-3	1.1E+3	2.1E-4	2.9E-5	2.1E-3	2.6E-1	5.1E+2	6.3E-7
Se-79	8.4E+1	3.1E+0	7.8E+0	1.5E+0	3.1E+0	4.2E-1	3.9E+1	5.5E-2
Sn-126	6.6E+0	2.5E+0	7.5E+0	3.4E+0	2.7E+0	8.5E-1	7.2E+1	4.8E-2
Sr-90	6.7E+6	1.6E+5	7.9E+5	1.1E+5	3.2E+5	3.2E+4	3.4E+6	5.4E+3
Tc-99	2.8E+3	5.9E+1	2.8E+2	4.2E+1	1.1E+2	1.3E+1	1.2E+3	1.9E+0
Th-229	1.8E-3	1.8E-4	2.7E-3	3.8E-5	3.7E-6	4.0E-6	2.3E-3	6.4E-8
Th-230	5.6E-1	8.8E-2	6.7E-1	8.6E-3	9.6E-5	6.9E-4	5.5E-1	7.3E-7
Th-232	4.9E-4	2.4E-5	7.5E-4	1.1E-5	1.9E-6	1.8E-7	5.8E-4	3.5E-8
Tl-208	3.0E-2	2.0E-2	2.9E-2	8.7E-4	5.5E-3	6.0E-3	5.1E-1	8.8E-5
U-232	8.2E-2	5.4E-2	7.8E-2	2.3E-3	1.5E-2	1.6E-2	1.4E+0	2.4E-4
U-233	3.9E-1	3.9E-2	5.7E-1	8.0E-3	8.0E-4	8.5E-4	5.0E-1	1.3E-5
U-234	1.4E+3	1.9E+2	1.5E+3	1.9E+1	2.6E-1	1.7E+0	1.2E+3	1.6E-3
U-235	4.8E+1	8.2E-2	6.0E-3	2.0E+0	9.9E-1	2.0E-1	2.3E+0	3.9E-1
U-236	9.7E+1	2.8E+0	1.7E+1	1.3E+0	3.7E+0	2.6E-1	3.3E+1	6.7E-2
U-238	7.0E+2	2.1E+0	3.3E-1	1.0E+0	2.1E-2	6.0E-1	3.0E+1	4.7E-3

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.

Table K-10. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 9 through 16 (page 1 of 2).[a,b]

	Uranium oxide							Uranium-aluminum
	Stainless steel clad (intact)		Not aluminum clad nonintact or declad			Aluminum clad		
Radionuclide	HEU Group 9 (Ci)	LEU Group 10 (Ci)	HEU Group 11 (Ci)	MEU Group 12 (Ci)	LEU Group 13 (Ci)	HEU Group 14 (Ci)	MEU and LEU Group 15 (Ci)	HEU Group 16 (Ci)
Ac-227	1.4E-4	9.5E-4	5.6E-3	8.5E-4	4.2E-3	8.8E-4	1.3E-5	1.0E-3
Am-241	1.1E+0	1.8E+4	1.9E+4	1.5E+3	4.7E+4	4.9E+3	4.8E+1	5.2E+3
Am-242m	1.1E-4	8.8E+0	3.8E+1	3.0E+0	1.1E+2	9.9E-1	1.6E-2	1.6E+0
Am-243	1.2E-5	4.5E+0	3.7E+1	6.5E+0	2.3E+2	1.5E+1	5.4E-2	1.8E+1
C-14	2.7E+0	1.9E+3	2.8E+2	1.5E+1	8.5E+1	1.6E-2	2.1E-4	3.0E-1
Cl-36	1.5E-2	3.6E+1	5.2E+0	8.4E-2	6.5E-1	1.7E-25	4.7E-28	2.7E-4
Cm-243	4.2E-6	1.4E+0	2.0E+0	2.7E+0	1.1E+2	2.5E+0	7.9E-3	3.7E+0
Cm-244	4.9E-5	6.3E+1	3.9E+2	5.3E+2	2.6E+4	2.1E+3	1.7E+0	3.3E+3
Co-60	1.1E+4	4.4E+5	1.0E+5	1.6E+4	8.1E+4	5.1E+1	1.1E+0	3.6E+2
Cs-134	1.7E+2	5.2E+0	6.8E+2	7.1E+0	4.4E+2	7.4E+4	1.3E+4	1.3E+6
Cs-135	3.6E-1	1.1E+0	1.8E+0	2.0E+0	1.4E+1	5.5E+0	1.2E-1	9.7E+0
Cs-137	2.4E+4	1.6E+5	1.0E+5	1.3E+5	1.2E+6	3.2E+6	9.6E+4	6.9E+6
Eu-154	3.2E+1	8.1E+2	3.0E+3	3.3E+2	1.7E+4	5.9E+4	2.5E+3	2.1E+5
Eu-155	1.3E+2	2.4E+2	6.1E+2	2.0E+2	3.4E+3	2.0E+4	1.1E+3	1.1E+5
Fe-55	8.5E+3	4.6E+3	3.5E+4	1.1E+3	5.4E+3	4.6E+3	1.9E+2	3.7E+4
H-3	7.3E+1	3.9E+3	7.3E+2	5.1E+2	1.4E+4	7.5E+3	3.3E+2	2.3E+4
I-129	8.7E-3	9.7E-2	4.4E-2	5.6E-2	5.7E-1	1.1E+0	2.7E-2	2.0E+0
Kr-85	1.4E+3	4.4E+3	4.8E+3	5.2E+3	4.2E+4	1.8E+5	8.9E+3	6.0E+5
Np-237	1.4E-2	1.7E+0	4.5E-1	1.9E-1	4.1E+0	2.2E+1	3.4E-1	3.4E+1
Pa-231	3.4E-4	2.0E-3	7.3E-3	2.0E-3	9.9E-3	2.7E-3	4.6E-5	3.5E-3
Pb-210	2.4E-9	3.5E-4	5.5E-5	8.4E-7	1.2E-5	6.4E-5	1.4E-6	8.7E-5
Pm-147	7.5E+3	1.7E+3	3.0E+4	1.0E+3	6.6E+3	1.4E+5	7.1E+4	4.2E+6
Pu-238	3.9E+0	3.1E+3	7.1E+3	8.0E+2	2.9E+4	7.8E+4	7.2E+2	1.1E+5
Pu-239	8.0E+0	5.7E+3	9.7E+2	1.6E+2	4.4E+3	7.4E+2	1.5E+1	1.3E+3

Table K-10. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 9 through 16 (page 2 of 2).[a,b]

	Uranium oxide							Uranium-aluminum
	Stainless steel clad (intact)		Not aluminum clad nonintact or declad			Aluminum clad		
Radionuclide	HEU Group 9 (Ci)	LEU Group 10 (Ci)	HEU Group 11 (Ci)	MEU Group 12 (Ci)	LEU Group 13 (Ci)	HEU Group 14 (Ci)	MEU and LEU Group 15 (Ci)	HEU Group 16 (Ci)
Pu-240	1.0E+0	2.3E+3	6.7E+2	1.6E+2	5.5E+3	4.1E+2	8.8E+0	7.1E+2
Pu-241	1.8E+1	1.2E+5	1.1E+5	1.0E+4	5.2E+5	1.0E+5	2.2E+3	2.3E+5
Pu-242	2.4E-5	1.4E+0	5.6E+0	6.7E-1	2.3E+1	1.5E+0	1.3E-2	2.0E+0
Ra-226	8.5E-9	9.4E-4	1.5E-4	2.3E-6	4.2E-5	2.9E-4	4.8E-6	3.6E-4
Ra-228	9.2E-8	1.9E-5	1.4E-3	5.6E-7	4.3E-6	1.9E-8	2.3E-10	1.2E-6
Ru-106	3.8E+2	2.1E+0	1.6E+3	3.3E-2	2.7E-1	1.6E+3	5.1E+3	3.6E+5
Se-79	1.6E-1	2.7E+0	7.9E-1	9.5E-1	8.3E+0	1.9E+1	4.7E-1	3.4E+1
Sn-126	1.4E-1	2.0E+0	6.9E-1	9.8E-1	1.2E+1	1.7E+1	4.2E-1	3.0E+1
Sr-90	2.3E+4	1.2E+5	9.6E+4	1.2E+5	9.3E+5	3.0E+6	9.2E+4	6.5E+6
Tc-99	5.6E+0	4.7E+1	2.8E+1	3.3E+1	2.8E+2	6.2E+2	1.5E+1	1.1E+3
Th-229	1.0E-7	1.7E-4	4.0E-3	1.8E-6	3.4E-5	7.6E-6	1.1E-7	9.7E-6
Th-230	1.2E-6	8.6E-2	1.3E-2	2.2E-4	5.3E-3	5.2E-2	9.1E-4	6.8E-2
Th-232	9.9E-8	1.9E-5	1.4E-3	5.7E-7	4.4E-6	2.9E-8	4.2E-10	1.5E-6
Tl-208	2.9E-4	1.3E-2	2.0E-1	3.3E-3	7.6E-2	7.0E-2	1.6E-3	1.2E-1
U-232	8.0E-4	3.6E-2	5.4E-1	9.0E-3	2.1E-1	1.9E-1	4.7E-3	3.4E-1
U-233	3.7E-5	3.6E-2	8.2E-1	4.5E-4	9.7E-3	4.2E-3	7.8E-5	6.7E-3
U-234	4.4E-3	1.9E+2	2.9E+1	5.4E-1	1.7E+1	2.3E+2	6.6E+0	4.3E+2
U-235	2.7E-1	1.8E-1	2.4E+0	1.3E-1	4.6E+0	7.8E+0	6.2E-2	1.3E+1
U-236	1.9E-1	2.6E+0	9.8E-1	1.1E+0	7.5E+0	2.4E+1	5.6E-1	4.2E+1
U-238	1.9E-1	2.6E-1	3.6E-1	1.3E-1	2.7E+1	1.3E-1	8.3E-2	3.2E-1

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.

Table K-11. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 17 through 24 (page 1 of 2).[a,b]

			Thorium/uranium carbide		Plutonium/ uranium carbide	Mixed oxide		
Radionuclide	Uranium-aluminum MEU Group 17 (Ci)	Uranium silicide Group 18 (Ci)	TRISO or BISO particles in graphite Group 19 (Ci)	Mono-pyrolytic carbon particles Group 20 (Ci)	Not graphite nonsodium bonded Group 21 (Ci)	Zirconium clad Group 22 (Ci)	Stainless steel clad Group 23 (Ci)	Non-stainless steel non-zirconium clad Group 24 (Ci)
Ac-227	6.1E-5	2.7E-4	2.6E+0	2.3E-1	2.1E-8	1.6E-1	4.2E-2	4.9E-3
Am-241	1.9E+3	8.6E+3	2.3E+3	1.8E+2	8.9E+2	5.8E+5	2.5E+5	3.0E+4
Am-242m	1.3E+0	6.1E+0	2.2E+0	1.4E-1	1.7E+1	1.2E+3	2.1E+3	2.8E+2
Am-243	1.1E+0	4.4E+0	4.0E+1	2.7E+0	9.0E-1	1.1E+3	4.4E+2	6.1E+1
C-14	3.0E-2	1.2E+0	2.0E+1	1.4E+0	2.2E-1	8.3E+3	2.6E+3	3.7E+2
Cl-36	2.5E-5	1.2E-3	9.2E-1	6.2E-2	2.9E-6	1.6E+2	4.9E+1	7.0E+0
Cm-243	4.3E-1	2.0E+0	3.0E+1	1.5E+0	4.9E+0	7.7E+1	5.8E+2	7.4E+1
Cm-244	3.3E+1	1.3E+2	9.0E+3	3.8E+2	2.1E+1	1.2E+4	7.7E+3	1.2E+3
Co-60	3.0E+1	9.1E+2	2.3E+3	2.7E+1	8.9E+1	1.9E+6	3.5E+6	6.4E+5
Cs-134	1.3E+5	2.6E+5	3.7E+3	1.5E+1	2.0E+2	9.4E+1	4.1E+4	5.1E+3
Cs-135	1.3E+0	4.8E+0	2.1E+1	1.4E+0	4.0E-1	3.2E+1	4.9E+1	6.4E+0
Cs-137	9.1E+5	2.5E+6	1.5E+6	7.8E+4	1.6E+4	1.5E+6	2.3E+6	3.2E+5
Eu-154	2.4E+4	9.2E+4	3.9E+4	9.3E+2	3.0E+2	8.6E+4	1.1E+5	1.8E+4
Eu-155	1.1E+4	3.7E+4	5.9E+3	6.3E+1	3.8E+2	5.3E+3	6.7E+4	9.0E+3
Fe-55	1.0E+4	4.7E+4	1.6E+0	5.3E-3	2.6E+1	2.0E+4	4.8E+5	5.5E+4
H-3	3.3E+3	8.8E+3	6.9E+3	2.3E+2	6.0E+1	1.7E+4	1.7E+4	2.7E+3
I-129	2.4E-1	6.6E-1	8.7E-1	5.9E-2	1.1E-2	7.8E-1	1.3E+0	1.7E-1
Kr-85	8.7E+4	2.2E+5	7.9E+4	2.3E+3	4.7E+2	4.2E+4	8.5E+4	1.2E+4
Np-237	2.3E+0	4.7E+0	1.1E+1	7.3E-1	2.5E-2	1.1E+1	5.6E+0	7.6E-1
Pa-231	3.4E-4	1.2E-3	4.1E+0	2.8E-1	5.7E-8	2.0E-1	6.1E-2	8.7E-3
Pb-210	1.0E-6	1.2E-5	7.3E-4	8.3E-5	4.1E-9	1.6E-3	3.2E-4	1.1E-5
Pm-147	7.5E+5	1.8E+6	5.2E+3	1.7E+1	1.1E+3	1.9E+3	2.2E+5	2.8E+4
Pu-238	4.8E+3	8.8E+3	1.5E+5	9.5E+3	2.2E+2	1.5E+5	3.8E+4	3.0E+3

Table K-11. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 17 through 24 (page 2 of 2).[a,b]

			Thorium/uranium carbide		Plutonium/ uranium carbide	Mixed oxide		
Radionuclide	Uranium-aluminum MEU Group 17 (Ci)	Uranium silicide Group 18 (Ci)	TRISO or BISO particles in graphite Group 19 (Ci)	Mono-pyrolytic carbon particles Group 20 (Ci)	Not graphite nonsodium bonded Group 21 (Ci)	Zirconium clad Group 22 (Ci)	Stainless steel clad Group 23 (Ci)	Non-stainless steel non-zirconium clad Group 24 (Ci)
Pu-239	1.3E+3	6.7E+3	1.2E+2	7.9E+0	1.0E+3	2.2E+4	1.5E+5	0.0E+0
Pu-240	7.1E+2	3.5E+3	2.2E+2	1.6E+1	8.4E+2	1.3E+4	1.1E+5	3.9E+3
Pu-241	1.0E+5	4.9E+5	3.1E+4	1.1E+3	2.3E+4	1.3E+6	4.2E+6	2.6E+4
Pu-242	4.5E-1	2.0E+0	3.4E+0	2.3E-1	2.7E-1	1.3E+2	4.4E+1	1.8E+0
Ra-226	9.0E-6	4.7E-5	1.2E-3	1.6E-4	1.5E-8	4.4E-3	9.2E-4	5.1E-5
Ra-228	1.2E-7	4.9E-6	7.8E-1	5.4E-2	8.1E-13	4.1E-2	1.2E-2	1.7E-3
Ru-106	6.4E+4	1.7E+5	6.5E-1	7.9E-2	5.9E+1	7.4E-1	1.2E+4	1.5E+3
Se-79	4.1E+0	1.1E+1	1.8E+1	1.2E+0	8.5E-2	1.4E+1	1.3E+1	1.7E+0
Sn-126	3.7E+0	1.0E+1	1.9E+1	1.3E+0	3.7E-1	1.3E+1	4.0E+1	5.2E+0
Sr-90	8.6E+5	2.3E+6	1.5E+6	7.4E+4	5.8E+3	1.4E+6	1.2E+6	1.7E+5
Tc-99	1.4E+2	3.9E+2	2.9E+2	1.9E+1	3.3E+0	4.8E+2	4.8E+2	6.2E+1
Th-229	5.5E-7	5.1E-6	5.8E+0	6.2E-1	1.6E-8	1.2E-1	2.9E-2	2.7E-3
Th-230	3.6E-3	8.4E-3	1.2E-1	1.1E-2	3.1E-6	4.0E-1	9.6E-2	9.1E-3
Th-232	1.4E-7	6.4E-6	2.5E+0	1.7E-1	1.2E-12	4.1E-2	1.3E-2	1.8E-3
Tl-208	9.8E-3	1.7E-2	5.8E+2	3.5E+1	4.3E-3	6.0E+0	2.5E+0	3.7E-1
U-232	2.9E-2	4.8E-2	1.6E+3	9.4E+1	1.2E-2	1.6E+1	6.7E+0	1.0E+0
U-233	5.0E-4	4.3E-3	1.8E+3	1.2E+2	2.5E-6	2.5E+1	7.7E+0	1.1E+0
U-234	3.7E+1	4.7E+1	2.4E+2	1.7E+1	2.2E-2	8.7E+2	2.7E+2	3.9E+1
U-235	4.4E-1	1.2E+0	3.6E+0	2.4E-1	1.9E-4	4.0E+1	1.2E+1	1.8E+0
U-236	4.7E+0	1.2E+1	7.4E+0	5.0E-1	1.1E-3	1.6E+1	5.1E+0	7.3E-1
U-238	7.9E-1	2.2E+0	4.5E-2	3.0E-3	1.8E-2	8.0E+0	5.0E+0	3.9E-1

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.

Table K-12. Radionuclide inventories in the year 2010 for DOE spent nuclear fuel groups 25 through 34 (page 1 of 3).[a,b]

	Thorium/uranium oxide		Uranium/zirconium hydride					
			Stainless steel/incoloy clad		Aluminum clad			
Radionuclide	Zirconium clad Group 25 (Ci)	Stainless steel clad Group 26 (Ci)	HEU Group 27 (Ci)	MEU Group 28 (Ci)	MEU Group 29 (Ci)	Declad Group 30 (Ci)	Naval spent nuclear fuel Group 32[c] (Ci)	Miscellaneous Group 34 (Ci)
Ac-227	3.9E+1	7.4E+0	2.1E-5	6.5E-5	2.1E-5	2.7E-4	3.9E-2	5.0E-3
Am-241	1.1E+2	7.1E+3	3.8E+2	1.1E+2	3.0E+1	1.1E+2	2.0E+4	2.7E+3
Am-242m	7.3E-1	1.6E+1	8.2E-1	7.2E-2	1.9E-2	3.3E-2	1.8E+2	6.9E+0
Am-243	1.5E-1	1.5E+1	1.1E+0	7.7E-3	2.4E-3	4.2E-3	2.7E+2	1.5E+1
C-14	4.4E+1	1.2E+2	4.4E+0	6.7E+0	4.4E-1	3.6E+0	6.4E+3	3.9E+1
Cf-252	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	4.8E-4	0.0E+0
Cl-36	8.5E-1	2.2E+0	9.3E-2	1.5E-1	4.3E-4	8.0E-2	2.8E+2	7.0E-1
Cm-242	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	5.6E+2	0.0E+0
Cm-243	1.8E-1	1.0E+0	1.1E+0	8.8E-3	2.4E-3	1.7E-3	3.2E+2	8.1E-1
Cm-244	9.8E+0	2.2E+2	1.1E+2	8.2E-2	2.6E-2	8.6E-3	2.5E+4	5.4E+1
Cm-245	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.9E+0	0.0E+0
Cm-246	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	5.6E-1	0.0E+0
Cm-247	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	3.8E-6	0.0E+0
Cm-248	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	1.0E-5	0.0E+0
Co-60	1.5E+3	9.5E+4	2.3E+4	5.8E+4	2.2E+2	9.8E+1	1.5E+6	1.1E+4
Co-60 (Crud)	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.3E+3	0.0E+0
Cs-134	3.5E+2	1.1E+1	9.8E+3	4.0E+3	7.1E+2	7.0E-4	3.4E+7	8.8E+1
Cs-135	1.3E+1	2.6E+0	6.9E-1	1.7E+0	3.2E-1	9.1E-1	1.8E+3	4.4E+0
Cs-137	8.8E+5	1.4E+5	8.0E+4	1.4E+5	2.4E+4	2.8E+4	1.8E+8	2.1E+5
Eu-154	9.1E+3	3.2E+3	2.7E+3	7.1E+2	1.0E+4	1.2E+1	0.0E+0	5.1E+2
Eu-155	1.3E+3	3.0E+2	9.8E+2	1.3E+3	3.1E+3	1.6E+0	0.0E+0	2.3E+3
Fe-55	1.6E+1	3.8E+3	1.2E+4	3.4E+4	6.0E+1	1.4E-1	0.0E+0	3.7E+2
H-3	1.8E+3	5.5E+2	2.5E+2	5.2E+2	8.5E+1	2.5E+1	5.6E+5	1.1E+3
I-129	7.5E-1	1.3E-1	2.5E-2	3.8E-2	7.4E-3	2.1E-2	4.8E+1	1.1E-1
Kr-85	5.6E+4	5.8E+3	5.8E+3	1.2E+4	1.9E+3	3.9E+2	1.4E+7	1.3E+4

Table K-12. Radionuclide inventories in the year 2010 for DOE pent nuclear fuel groups 25 through 34 (page 2 of 3).[a,b]

	Thorium/uranium oxide		Uranium/zirconium hydride					
			Stainless steel/incoloy clad		Aluminum clad			
Radionuclide	Zirconium clad Group 25 (Ci)	Stainless steel clad Group 26 (Ci)	HEU Group 27 (Ci)	MEU Group 28 (Ci)	MEU Group 29 (Ci)	Declad Group 30 (Ci)	Naval spent nuclear fuel Group 32[c] (Ci)	Miscellaneous Group 34 (Ci)
Nb-93m	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	1.4E+3	0.0E+0
Nb-94	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	7.2E+4	0.0E+0
Ni-59	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.5E+4	0.0E+0
Ni-63	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	3.1E+6	0.0E+0
Np-237	5.9E-2	1.5E-1	4.2E-1	6.5E-2	1.5E-2	3.7E-2	6.4E+2	3.6E-1
Pa-231	5.7E+1	9.1E+0	5.3E-5	2.3E-4	5.6E-5	4.4E-4	2.1E-1	1.2E-2
Pb-210	5.6E-3	1.1E-3	1.9E-8	1.2E-9	9.8E-10	2.0E-8	3.6E-4	7.7E-6
Pd-107	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	2.4E+1	0.0E+0
Pm-147	1.7E+3	2.3E+2	1.8E+4	9.3E+4	1.4E+4	4.1E-1	0.0E+0	2.2E+4
Pu-238	2.2E+2	2.9E+3	1.8E+3	5.3E+1	1.3E+1	2.1E+1	4.8E+6	8.6E+2
Pu-239	1.3E+1	3.8E+2	4.9E+1	2.9E+2	5.7E+1	1.6E+2	4.8E+3	2.1E+3
Pu-240	7.6E+0	2.7E+2	4.0E+1	1.1E+2	2.3E+1	6.0E+1	5.6E+3	1.9E+2
Pu-241	1.1E+3	7.1E+4	1.1E+4	4.9E+3	1.0E+3	3.3E+2	1.6E+6	1.7E+4
Pu-242	1.9E-2	2.2E+0	1.7E-1	1.2E-2	3.1E-3	6.6E-3	3.2E+1	7.2E-1
Ra-226	6.8E-3	1.7E-3	7.8E-8	5.4E-9	3.0E-9	4.8E-8	2.2E-3	2.0E-5
Ra-228	2.2E+0	3.5E-1	7.3E-7	1.0E-5	2.0E-6	7.2E-6	7.2E-5	3.1E-4
Rh-102	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	1.1E+1	0.0E+0
Ru-106	1.8E-2	3.5E-3	1.4E+3	4.0E+3	6.4E+2	9.7E-11	2.4E+6	3.9E+1
Se-79	1.7E+1	2.9E+0	4.5E-1	6.8E-1	1.3E-1	3.7E-1	1.4E+2	1.6E+0
Sm-151	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	5.6E+5	0.0E+0
Sn-126	1.9E+1	3.2E+0	4.2E-1	6.3E-1	1.2E-1	3.5E-1	4.8E+2	3.6E+0
Sr-90	8.9E+5	1.4E+5	7.5E+4	1.3E+5	2.3E+4	2.5E+4	1.8E+8	1.9E+5
Tc-99	1.5E+2	3.1E+1	1.4E+1	2.3E+1	4.4E+0	1.3E+1	2.8E+4	4.5E+1
Th-229	2.2E+1	4.9E+0	5.1E-6	9.0E-6	2.7E-6	2.2E-5	3.8E-3	1.8E-3
Th-230	4.9E-1	9.0E-2	1.6E-5	1.2E-6	4.1E-7	3.7E-6	7.2E-1	1.9E-3

Table K-12. Radionuclide inventories in the Year 2010 for DOE spent nuclear fuel groups 25 through 34 (page 3 of 3).[a,b]

	Thorium/uranium oxide		Uranium/zirconium hydride					
			Stainless steel/incoloy clad		Aluminum clad			
Radionuclide	Zirconium clad Group 25 (Ci)	Stainless steel clad Group 26 (Ci)	HEU Group 27 (Ci)	MEU Group 28 (Ci)	MEU Group 29 (Ci)	Declad Group 30 (Ci)	Naval spent nuclear fuel Group 32[c] (Ci)	Miscellaneous Group 34 (Ci)
Th-232	4.5E+0	8.0E-1	8.5E-7	1.3E-5	2.4E-6	7.2E-6	9.2E-5	2.7E-2
Tl-208	7.2E+3	1.1E+3	5.0E-3	8.7E-4	1.9E-4	3.4E-4	0.0E+0	4.5E-1
U-232	2.0E+4	2.9E+3	1.4E-2	2.5E-3	5.3E-4	9.1E-4	2.2E+2	1.2E+0
U-233	1.4E+4	2.5E+3	2.4E-3	6.3E-3	1.3E-3	3.5E-3	1.2E+0	8.7E+1
U-234	3.9E+2	7.4E+1	1.2E-1	8.7E-3	2.1E-3	8.1E-3	6.0E+3	4.4E+0
U-235	3.0E-2	5.3E-1	2.1E-1	5.0E-1	1.3E-1	2.6E-2	1.2E+2	2.1E-1
U-236	6.3E-2	2.2E-1	4.7E-1	6.6E-1	1.3E-1	3.6E-1	1.0E+3	1.3E+0
U-238	1.8E-3	1.1E-1	1.6E-2	3.9E-1	9.7E-2	1.5E-2	4.8E-1	8.6E-2
Zr-93	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	0.0E+0	4.4E+3	0.0E+0

a. LEU = low enriched uranium; MEU = medium enriched uranium; HEU = high enriched uranium.
b. Source: Compiled from data contained in DIRS 169354-DOE 2004, Volume II, Appendix C.
c. Radionuclide inventory is for 400 casks. Single cask Naval spent fuel inventory is from DIRS 155857-McKenzie 2001, Table 3.
Note: There would be no shipments of group 31 or group 33 spent nuclear fuel under the Proposed Action.

Table K-13. Radionuclide inventories for commercial spent nuclear fuel shipped in rail casks.[a]

Radionuclide	Pressurized water reactor commercial spent nuclear fuel assembly inventory (Ci)[b]	Pressurized water reactor commercial spent nuclear fuel total inventory (Ci)[b]	Boiling water reactor commercial spent nuclear fuel assembly inventory (Ci)[c]	Boiling water reactor commercial spent nuclear fuel total inventory (Ci)[c]
Am-241	1.28E+03	1.11E+08	3.73E+02	4.61E+07
Am-242m	7.99E+00	6.96E+05	2.88E+00	3.56E+05
Am-243	3.93E+01	3.42E+06	8.63E+00	1.07E+06
C-14	4.35E-01	3.79E+04	1.69E-01	2.09E+04
Cd-113m	2.34E+01	2.03E+06	6.23E+00	7.69E+05
Ce-144	6.99E+01	6.09E+06	1.73E+01	2.14E+06
Cm-242	6.60E+00	5.75E+05	2.38E+00	2.94E+05
Cm-243	2.48E+01	2.16E+06	5.55E+00	6.86E+05
Cm-244	5.85E+03	5.09E+08	9.23E+02	1.14E+08
Cm-245	8.16E-01	7.10E+04	9.07E-02	1.12E+04
Cm-246	4.07E-01	3.54E+04	4.26E-02	5.26E+03
Co-60	2.17E+03	1.89E+08	1.14E+02	1.41E+07
Co-60 (Crud)	1.69E+01	1.47E+06	5.66E+01	6.99E+06
Cs-134	5.43E+03	4.73E+08	1.31E+03	1.62E+08
Cs-137	7.16E+04	6.23E+09	2.41E+04	2.98E+09
Eu-154	3.01E+03	2.62E+08	7.79E+02	9.62E+07
Eu-155	6.42E+02	5.59E+07	1.93E+02	2.39E+07
Fe-55 (Crud)	2.09E+02	1.82E+07	9.84E+01	1.22E+07
H-3	3.05E+02	2.66E+07	1.05E+02	1.30E+07
I-129	2.76E-02	2.40E+03	9.22E-03	1.14E+03
Kr-85	3.39E+03	2.95E+08	1.17E+03	1.45E+08
Np-237	2.94E-01	2.56E+04	8.74E-02	1.08E+04
Pm-147	6.06E+03	5.28E+08	2.11E+03	2.61E+08
Pu-238	3.98E+03	3.46E+08	1.02E+03	1.26E+08
Pu-239	1.75E+02	1.52E+07	5.41E+01	6.68E+06
Pu-240	3.63E+02	3.16E+07	1.27E+02	1.57E+07
Pu-241	5.64E+04	4.91E+09	1.57E+04	1.94E+09
Pu-242	2.48E+00	2.16E+05	7.08E-01	8.75E+04
Ru-106	4.04E+02	3.52E+07	9.05E+01	1.12E+07
Sb-125	5.20E+02	4.53E+07	1.45E+02	1.79E+07
Sr-90	4.51E+04	3.93E+09	1.66E+04	2.05E+09
U-232	3.61E-02	3.14E+03	8.74E-03	1.08E+03
U-234	5.24E-01	4.56E+04	2.39E-01	2.95E+04
U-236	1.77E-01	1.54E+04	7.45E-02	9.20E+03
U-238	1.46E-01	1.27E+04	6.24E-02	7.71E+03
Y-90	4.51E+04	3.93E+09	1.66E+04	2.05E+09

a. Sources: DIRS 169061-BSC 2004, all; DIRS 164364-BSC 2003, all.
b. Total inventory for pressurized water reactor spent nuclear fuel shipped in rail casks is based on 87,057 assemblies (calculated from rail shipments and cask capacities from DIRS 181377-BSC 2007, Section 7.
c. Total inventory for boiling water reactor spent nuclear fuel shipped in rail casks is based on 123,537 assemblies (calculated from rail shipments and cask capacities from DIRS 181377-BSC 2007, Section 7.

Table K-14. Radionuclide inventories for high-level radioactive waste (page 1 of 2).

Radionuclide	Hanford high-level radioactive waste[a] (Ci)	Idaho high-level radioactive waste[b] (Ci)	Savannah River Site high-level radioactive waste[c] (Ci)	West Valley high-level radioactive waste[d] (Ci)
Ac-227	0.00E+00	7.38E+01	0.00E+00	4.92E+01
Am-241	5.41E+03	1.08E+05	7.98E+05	4.58E+04
Am-242	7.86E-03	0.00E+00	0.00E+00	6.56E+02
Am-242m	7.86E-03	0.00E+00	4.55E+02	6.58E+02
Am-243	6.42E-03	1.13E+01	1.29E+03	6.10E+02
Ba-137m	4.76E+06	2.80E+07	2.18E+08	4.80E+06
C-14	1.29E-02	0.00E+00	0.00E+00	0.00E+00
Cd-113m	0.00E+00	7.79E+03	8.96E-08	0.00E+00
Ce-144	0.00E+00	0.00E+00	6.30E+03	0.00E+00
Cf-249	0.00E+00	0.00E+00	1.25E+01	0.00E+00
Cf-251	0.00E+00	0.00E+00	2.87E+01	0.00E+00
Cm-242	7.86E-03	0.00E+00	0.00E+00	5.43E+02
Cm-243	3.99E-04	8.28E+00	1.45E+03	0.00E+00
Cm-244	1.24E-02	1.57E+02	6.51E+06	6.15E+03
Cm-245	1.71E-06	0.00E+00	5.22E+02	0.00E+00
Cm-246	4.02E-08	0.00E+00	1.52E+02	0.00E+00
Cm-247	1.43E-14	0.00E+00	5.99E-03	0.00E+00
Cm-248	4.32E-15	0.00E+00	0.00E+00	0.00E+00
Co-60	3.98E+02	1.87E+03	2.50E+06	0.00E+00
Cs-134	6.75E+01	6.71E+02	8.40E+05	0.00E+00
Cs-135	7.53E+01	0.00E+00	9.17E+02	1.93E+02
Cs-137	4.90E+06	2.80E+07	2.33E+08	5.08E+06
Eu-152	0.00E+00	7.74E+02	0.00E+00	0.00E+00
Eu-154	2.08E+04	5.03E+04	5.88E+06	0.00E+00
Eu-155	1.41E+02	1.82E+03	2.35E+03	0.00E+00
H-3	6.70E+03	0.00E+00	0.00E+00	0.00E+00
I-129	2.61E+00	3.61E+01	2.57E-01	0.00E+00
Nb-93m	6.42E+02	2.00E+03	5.15E+02	2.03E+02
Nb-94	2.48E-03	0.00E+00	0.00E+00	0.00E+00
Ni-59	0.00E+00	1.03E+03	7.56E+02	1.19E+02
Ni-63	0.00E+00	9.06E+04	4.94E+04	9.64E+03
Np-237	2.85E+00	1.06E+02	1.19E+02	3.55E+01
Np-238	0.00E+00	0.00E+00	0.00E+00	2.97E+00
Np-239	0.00E+00	0.00E+00	0.00E+00	6.10E+02
Pa-231	0.00E+00	2.05E+02	0.00E+00	4.91E+01
Pd-107	0.00E+00	0.00E+00	4.52E+00	0.00E+00
Pm-147	9.15E+03	0.00E+00	1.70E+07	0.00E+00
Pr-144	0.00E+00	0.00E+00	6.30E+03	0.00E+00
Pu-238	5.04E+04	3.42E+03	2.08E+07	5.19E+03
Pu-239	8.37E+02	5.20E+04	1.72E+05	1.56E+03
Pu-240	7.26E+02	9.25E+03	1.17E+05	1.11E+03
Pu-241	2.98E+04	6.10E+04	1.22E+07	2.67E+04
Pu-242	1.58E+00	7.53E-01	3.89E+02	3.04E-03
Ra-226	2.60E-03	6.78E-02	0.00E+00	0.00E+00
Ra-228	0.00E+00	1.58E+01	0.00E+00	2.07E+00

Table K-14. Radionuclide inventories for high-level radioactive waste (page 2 of 2).

Radionuclide	Hanford high-level radioactive waste[a] (Ci)	Idaho high-level radioactive waste[b] (Ci)	Savannah River Site high-level radioactive waste[c] (Ci)	West Valley high-level radioactive waste[d] (Ci)
Ru-106	0.00E+00	1.51E+00	1.65E+04	0.00E+00
Sb-125	2.72E+02	1.86E+03	0.00E+00	0.00E+00
Sb-126	0.00E+00	0.00E+00	0.00E+00	7.59E+00
Sb-126m	0.00E+00	0.00E+00	0.00E+00	5.42E+01
Se-79	0.00E+00	9.19E+01	2.07E+02	0.00E+00
Sm-151	0.00E+00	2.46E+06	4.27E+05	5.08E+04
Sn-126	4.12E+01	4.36E+02	1.08E+02	5.42E+01
Sr-90	6.01E+06	3.06E+07	2.67E+08	2.89E+06
Tc-99	1.58E+03	2.24E+04	5.46E+04	8.90E+02
Th-229	0.00E+00	1.51E+00	3.07E-01	7.51E-03
Th-230	1.72E-01	0.00E+00	2.76E-02	3.28E-04
Th-232	4.48E-08	6.02E+00	3.30E+00	2.54E+00
Tl-208	0.00E+00	0.00E+00	0.00E+00	6.65E-01
U-232	2.75E-03	3.01E+01	1.29E+00	0.00E+00
U-233	2.76E-04	3.84E+02	9.63E+01	6.10E+00
U-234	4.28E+01	1.66E+02	2.84E+02	2.65E+00
U-235	2.73E-01	6.78E+00	2.10E+00	2.15E-05
U-236	7.12E-01	4.52E+00	2.64E+01	4.58E-04
U-237	0.00E+00	0.00E+00	0.00E+00	6.40E-01
U-238	1.36E-02	1.50E+02	1.81E+02	0.00E+00
Y-90	6.01E+06	3.06E+07	2.67E+08	2.89E+06
Zr-93	0.00E+00	3.62E+03	6.58E+02	2.03E+02

a. The Hanford high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 5,325 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 8).

b. The Idaho high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 550 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 19).

c. The Savannah River Site high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 3,500 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 3).

d. The West Valley high-level radioactive waste radionuclide inventory represents the radionuclide inventory in 300 canisters (DIRS 181377-BSC 2007, Section 7; DIRS 180471-BSC 2007, Table 17.

Table K-15. Spent nuclear fuel groups, spent nuclear fuel descriptions, and release fraction groups (page 1 of 2).

Spent nuclear fuel group	Description	Release fraction group
1	Uranium metal, zirconium clad, low enriched uranium	1
2	Uranium metal, non-zirconium clad, low enriched uranium	1
3	Uranium-zirconium	1
4	Uranium-molybdenum	1
5	Uranium oxide, zirconium clad (intact), high enriched uranium	2
6	Uranium oxide, zirconium clad (intact), medium enriched uranium	2
7	Uranium oxide, zirconium clad (intact), low enriched uranium	2
8	Uranium oxide, stainless steel/hastelloy clad (intact), high enriched uranium	2
9	Uranium oxide, stainless steel clad (intact), high enriched uranium	2

Table K-15. Spent nuclear fuel groups, spent nuclear fuel descriptions, and release fraction groups (page 2 of 2).

Spent nuclear fuel group	Description	Release fraction group
10	Uranium oxide, stainless steel clad (intact), low enriched uranium	2
11	Uranium oxide, non-aluminum clad (nonintact or declad), high enriched uranium	3
12	Uranium oxide, non-aluminum clad (nonintact or declad), medium enriched uranium	3
13	Uranium oxide, non-aluminum clad (nonintact or declad), low enriched uranium	3
14	Uranium oxide, aluminum clad, high enriched uranium	3
15	Uranium oxide, aluminum clad, medium enriched uranium and low enriched uranium	3
16	Uranium-aluminum, high enriched uranium	4
17	Uranium-aluminum, medium enriched uranium	4
18	Uranium silicide	4
19	Thorium/uranium carbide, TRISO- or BISO-coated particles in graphite	5
20	Thorium/uranium carbide, mono-pyrolytic carbon-coated articles in graphite	6
21	Plutonium/uranium carbide, nongraphite clad, not sodium bonded	3
22	Mixed oxide, zirconium clad	2
23	Mixed oxide, stainless steel clad	2
24	Mixed oxide, non-stainless steel/non-zirconium clad	2
25	Thorium/uranium oxide, zirconium clad	2
26	Thorium/uranium oxide, stainless steel clad	2
27	Uranium-zirconium hydride, stainless steel/incoloy clad, high enriched uranium	7
28	Uranium-zirconium hydride, stainless steel/incoloy clad, medium enriched uranium	7
29	Uranium-zirconium hydride, aluminum clad, medium enriched uranium	7
30	Uranium-zirconium hydride, aluminum clad, declad	7
31[a]	Metallic sodium bonded	–
32	Naval spent nuclear fuel	Navy
33[a]	Canyon stabilization	–
34	Miscellaneous	1
PWR	Pressurized water reactor	PWR
BWR	Boiling water reactor	BWR
HLW	Hanford, Idaho, Savannah River Site, and West Valley high-level radioactive waste	HLW

a. Under the Proposed Action in the Rail Alignment EIS, there would be no shipments of DOE groups 31 and 33 spent nuclear fuel.

Table K-16. Accident severity categories, conditional probabilities, and release fractions for commercial pressurized water reactor spent nuclear fuel (PWR Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.96E-1	5.87E-9	1.34E-7	1.34E-7	1.37E-3
3	4.91E-5	8.39E-1	1.68E-5	2.52E-7	2.52E-7	9.44E-3
4	5.77E-7	8.00E-1	8.71E-6	1.32E-5	1.32E-5	4.42E-3
5	1.10E-7	8.35E-1	3.60E-5	1.37E-5	1.37E-5	5.36E-3
6	8.52E-10	8.47E-1	5.71E-5	4.63E-5	1.43E-5	1.59E-2
one-group	--	4.93E-5	8.34E-10	2.67E-11	2.67E-11	5.20E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-26.

Table K-17. Accident severity categories, conditional probabilities, and release fractions for commercial boiling water reactor spent nuclear fuel (BWR Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	2.35E-2	7.04E-10	1.47E-8	1.47E-8	5.59E-4
3	4.91E-5	8.39E-1	1.68E-5	2.52E-7	2.52E-7	9.44E-3
4	5.77E-7	8.00E-1	8.71E-6	1.32E-5	1.32E-5	4.42E-2
5	1.10E-7	8.37E-1	4.12E-5	1.82E-5	1.82E-5	5.43E-3
6	8.52E-10	8.45E-1	7.30E-5	5.94E-5	1.96E-5	1.60E-2
one-group	--	4.27E-5	8.35E-10	2.26E-11	2.26E-11	5.11E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-27.

Table K-18. Accident severity categories, conditional probabilities, and release fractions for naval spent nuclear fuel (Navy Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99996	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	4.02E-5	1.52E-2	4.55E-9	9.10E-9	9.10E-9	1.37E-3
3	6.32E-6	8.39E-2	1.68E-6	2.52E-8	2.52E-8	9.44E-3
4	1.22E-7	8.00E-2	8.98E-7	1.34E-6	1.34E-6	4.47E-2
5	1.51E-8	9.44E-2	4.00E-6	1.80E-6	1.80E-6	5.36E-3
6	1.66E-10	9.04E-2	5.49E-6	4.67E-6	1.93E-6	2.86E-2
one-group	--	1.15E-6	1.10E-11	7.17E-13	7.16E-13	1.20E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-46.

Table K-19. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 1, 2, 3, 4, and 34 (Release Fraction Group 1).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	2.84E-4	1.71E-6	3.91E-7	1.10E-8	2.96E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-6	3.55E-6	3.55E-6	1.18E-2
5	1.10E-7	4.00E-3	7.87E-5	1.77E-5	9.68E-8	1.61E-4
6	8.52E-10	4.68E-2	9.63E-4	2.47E-4	2.73E-6	7.17E-3
one-group	--	1.27E-8	7.69E-11	1.93E-11	2.49E-12	8.00E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-33.

Table K-20. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 5, 6, 7, 8, 9, 10, 22, 23, 24, 25, and 26 (Release Fraction Group 2).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.96E-1	5.87E-9	1.34E-7	1.34E-7	1.37E-3
3	4.91E-5	8.39E-1	1.68E-5	2.52E-7	2.52E-7	9.44E-3
4	5.77E-7	8.00E-1	8.71E-6	1.32E-5	1.32E-5	4.42E-3
5	1.10E-7	8.35E-1	3.60E-5	1.37E-5	1.37E-5	5.36E-3
6	8.52E-10	8.47E-1	5.71E-5	4.63E-5	1.43E-5	1.59E-2
one-group	--	4.93E-5	8.34E-10	2.67E-11	2.67E-11	5.20E-7

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-26.

Table K-21. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 11, 12, 13, 14, 15, and 21 (Release Fraction Group 3).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.15E-4	3.44E-10	7.15E-9	7.15E-9	2.38E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-6	3.55E-6	3.55E-6	1.18E-2
5	1.10E-7	4.00E-3	3.14E-7	9.68E-8	9.68E-8	1.61E-4
6	8.52E-10	1.67E-2	2.68E-6	2.29E-6	2.04E-6	6.15E-3
one-group	--	6.12E-9	1.41E-12	2.34E-12	2.34E-12	7.78E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-35.

Table K-22. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 16, 17, and 18 (Release Fraction Group 4).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	2.84E-4	8.53E-5	1.10E-8	1.10E-8	4.11E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-6	3.55E-6	3.55E-6	1.18E-2
5	1.10E-7	4.00E-3	3.53E-3	9.68E-8	9.68E-8	4.26E-4
6	8.52E-10	4.68E-2	2.92E-2	2.73E-6	2.73E-6	1.03E-2
one-group	--	1.27E-8	3.72E-9	2.49E-12	2.49E-12	8.48E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-39.

Table K-23. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel group 19 (Release Fraction Group 5).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.02E-4	6.12E-11	6.12E-11	6.12E-11	0.00E+0
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	4.77E-3	7.89E-8	7.89E-8	7.89E-8	0.00E+0
5	1.10E-7	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
6	8.52E-10	1.70E-3	2.84E-8	2.62E-8	2.62E-8	0.00E+0
one-group	--	6.70E-9	4.79E-14	4.79E-14	4.79E-14	0.00E+0

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-41.

Table K-24. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel group 20 (Release Fraction Group 6).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	5.14E-1	3.70E-7	3.70E-7	3.70E-7	0.00E+0
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	4.77E-1	7.89E-6	7.89E-6	7.89E-6	0.00E+0
5	1.10E-7	7.64E-1	6.32E-6	5.73E-7	5.73E-7	0.00E+0
6	8.52E-10	7.45E-1	7.57E-6	5.82E-6	3.02E-6	0.00E+0
one-group	--	2.02E-5	1.96E-11	1.89E-11	1.89E-11	0.00E+0

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-43.

Table K-25. Accident severity categories, conditional probabilities, and release fractions for DOE spent nuclear fuel groups 27, 28, 29, and 30 (Release Fraction Group 7).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	1.15E-4	3.44E-8	7.15E-7	7.15E-7	2.38E-5
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	2.13E-3	2.36E-4	3.55E-4	3.55E-4	1.18E-2
5	1.10E-7	1.97E-2	1.97E-2	8.99E-5	1.93E-6	7.15E-4
6	8.52E-10	7.98E-2	7.91E-2	5.43E-4	1.76E-4	8.58E-3
one-group	--	7.91E-9	2.37E-9	2.43E-10	2.33E-10	7.84E-9

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-45.

Table K-26. Accident severity categories, conditional probabilities, and release fractions for Idaho, Hanford, and Savannah River Site high-level radioactive waste (HLW Release Fraction Group).[a]

Accident severity category	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
1	0.99991	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
2	3.87E-5	0.00E+0	6.22E-8	6.22E-8	6.22E-8	0.00E+0
3	4.91E-5	0.00E+0	0.00E+0	0.00E+0	0.00E+0	0.00E+0
4	5.77E-7	0.00E+0	7.89E-6	7.89E-6	7.89E-6	0.00E+0
5	1.10E-7	0.00E+0	9.29E-8	9.29E-8	9.29E-8	0.00E+0
6	8.52E-10	0.00E+0	2.74E-6	2.74E-6	2.74E-6	0.00E+0
one-group	--	0.00E+0	6.97E-12	6.97E-12	6.97E-12	0.00E+0

a. Source: DIRS 157144-Jason Technologies 2001, Table 5-48.

Table K-27. Accident severity categories, conditional probabilities, and unit risk factors for loss of shielding accidents for steel-lead-steel rail casks.[a]

Accident severity category	Conditional probability	Unit risk factor (person-rem per people/km^2)[b]
1	0.9999	3.86E-5
2	6.44E-6	7.22E-3
3	4.90E-5	2.03E-3
4	4.46E-7	1.24E-2
5	2.37E-5	2.41E-3
6	5.18E-9	2.97E-2
one-group	--	3.88E-5

a. Source: DIRS 155970-DOE 2002, Table J-19.
b. To convert person-rem per people/km^2 to person-rem per people/mile^2, multiply by 0.38610.

Table K-28. Accident severity categories, conditional probabilities, and unit risk factors for loss of shielding accidents for monolithic steel rail casks.[a]

Accident severity category	Conditional probability	Unit risk factor (person-rem per people/km^2)[b]
1	1.0000	3.86E-5
2	0	3.86E-5
3	0	3.86E-5
4	0	3.86E-5
5	0	3.86E-5
6	0	3.86E-5
one-group	--	3.86E-5

a. Source: DIRS 155970-DOE 2002, Table J-19.
b. To convert person-rem per people/km^2 to person-rem per people/mile^2, multiply by 0.38610.

K.2.4.5 Population Density Zones

DOE used three population density zones (urban, rural, and suburban) for the transportation risk assessment. The Department defined urban areas as areas with a population density greater than 3,326 people per square kilometer; rural areas as areas with a population density less than 139 people per square kilometer; and suburban areas as areas with a population density between 139 and 3,326 people per square kilometer. The Department based the actual population densities, which Table K-2 lists, on 2000 census data. The radiological impacts were escalated to the year 2067 using the escalation factors listed in Table K-4.

K.2.4.6 Exposure Pathways

DOE calculated radiological doses for an individual located near the scene of the accident and for populations within 80 kilometers (50 miles) of the accident. Dose calculations considered a variety of exposure pathways, including inhalation and direct exposure (immersion or cloudshine) from the passing cloud, ingestion of contaminated food, direct exposure (groundshine) from radioactivity deposited on the ground, and inhalation of resuspended radioactive particles from the ground (resuspension).

K.2.4.7 Unit Risk Factors and Radiation Dosimetry

As discussed in this section, DOE estimated the radiation doses from transportation accidents using unit risk factors. The Department estimated unit risk factors using the RADTRAN 5 computer code (DIRS 150898-Neuhauser and Kanipe 2000, all; DIRS 155430-Neuhauser, Kanipe, and Weiner 2000, all) for five pathways: (1) ingestion, (2) inhalation, (3) immersion, (4) resuspension, and (5) groundshine. Table K-29 lists the unit risk factors.

DOE estimated the unit risk factors listed in Table K-29 using the ICRP inhalation and ingestion dose coefficients (DIRS 172935-ICRP 2001, all) and the EPA groundshine and immersion dose coefficients (DIRS 175544-EPA 2002, all). These dose coefficients are based on the recommendations by the International Commission on Radiological Protection in ICRP Publication 60 (DIRS 101836-ICRP 1991, all) and incorporate the dose coefficients from ICRP Publication 72 (DIRS 152446-ICRP 1996, all). For each radionuclide, the dose coefficients used to estimate the unit risk factors in Table K-29 are listed in DIRS 176975-BMI 2006, Table 5 and include radioactive progeny (DIRS 176975-BMI 2006, Table 2). The lung absorption type and the value for the fractional absorption to blood from the small intestine (f_1) for each radionuclide are also listed in DIRS 176975-BMI 2006, Table 5.

Incident-free transportation unit risk factors are calculated using the RADTRAN 5 and RISKIND computer codes. These unit risk factors are estimates of the radiation dose from transporting one cask containing spent nuclear fuel or high-level radioactive waste over a unit distance (for example, 1 kilometer) through an area having a population density of one person per unit of area (for example, 1 person per square kilometer). As in the incident-free transportation analysis, using unit risk factors simplifies the analysis of transportation risks and also improves its transparency and traceability.

For transportation accidents, unit risk factors provide estimates of:

- The radiation dose to an average person in a surrounding unit area (for example, a population density of one person per square kilometer) that could result if one curie of a specified radionuclide were released;
- The dose to a general population from ingestion of contaminated food from the accidental release of one curie of a specified radionuclide. The unit risk factor includes the assumption that all contaminated food is consumed.

For transportation accidents where a portion of a cask's radiation shield was damaged or lost (loss-of-shielding accidents), and for cases in which the cask's shield might remain intact, unit risk factors provide estimates of the resulting radiation dose to a person in a surrounding unit area after an accident.

K.2.4.8 Accidents Involving Hazardous Chemicals

DOE would ship spent nuclear fuel and high-level radioactive waste on the proposed rail line using dedicated trains, and hazardous chemical cargos would not be present on the same train as the spent nuclear fuel or high-level radioactive waste. In addition, trains carrying other materials to or from the repository would pull off onto sidings to let cask trains pass, which would greatly reduce the potential for accidents, including those involving hazardous chemicals.

Table K-29. Unit risk factors used in the transportation risk assessment (page 1 of 3).

Radionuclide	Physical form	Ingestion pathway unit risk factor (person-rem/ Ci × Ci deposited)	Inhalation pathway unit risk factor (person-rem/ Ci per people/km^2)[a]	Immersion pathway unit risk factor (person-rem/ Ci per people/km^2)	Resuspension pathway unit risk factor (person-rem/ Ci per people/km^2)	Groundshine pathway unit risk factor (person-rem/ Ci per people/km^2)
Ac-227 plus progeny	Particulates	2.12E+6	6.34E+0	3.75E-6	2.76E+1	2.21E-1
Am-241	Particulates	3.50E+5	2.98E+0	1.45E-7	1.36E+1	1.98E-2
Am-242m plus progeny	Particulates	3.33E+5	2.63E+0	1.37E-7	1.19E+1	1.46E-2
Am-243 plus progeny	Particulates	3.51E+5	2.92E+0	1.90E-6	1.33E+1	1.77E-1
Be-10	Particulates	1.92E+3	2.50E-3	2.97E-8	1.14E-2	3.00E-3
C-14	Inert gas	1.01E+3	3.91E-6	4.98E-9	0.00E+0	0.00E+0
Cd-113m	Particulates	4.02E+4	2.21E-3	1.95E-8	9.37E-3	6.33E-4
Ce-144 plus progeny	Particulates	9.19E+3	2.55E-3	7.39E-7	5.09E-3	7.00E-3
Cf-252	Particulates	1.57E+5	1.42E+0	7.85E-10	4.69E+0	5.21E-5
Cl-36	Cesium	1.63E+3	5.18E-4	3.57E-8	2.37E-3	9.85E-3
Cm-242	Particulates	2.10E+4	3.69E-1	8.67E-10	5.18E-1	1.74E-5
Cm-243	Particulates	2.62E+5	2.21E+0	1.14E-6	9.73E+0	6.35E-2
Cm-244	Particulates	2.10E+5	1.92E+0	7.33E-10	8.28E+0	2.76E-4
Cm-245	Particulates	3.67E+5	2.98E+0	7.56E-7	1.36E+1	7.06E-2
Cm-246	Particulates	3.67E+5	2.98E+0	6.69E-10	1.36E+1	5.04E-4
Cm-247 plus progeny	Particulates	3.33E+5	2.76E+0	3.20E-6	1.26E+1	2.83E-1

Table K-29. Unit risk factors used in the transportation risk assessment (page 2 of 3).

Radionuclide	Physical form	Ingestion pathway unit risk factor (person-rem/ Ci × Ci deposited)	Inhalation pathway unit risk factor (person-rem/ Ci per people/km^2) [a]	Immersion pathway unit risk factor (person-rem/ Ci per people/km^2)	Resuspension pathway unit risk factor (person-rem/ Ci per people/km^2)	Groundshine pathway unit risk factor (person-rem/ Ci per people/km^2)
Cm-248	Particulates	1.35E+6	1.07E+1	5.08E-10	4.86E+1	3.88E-4
Co-58	Particulates	1.29E+3	1.49E-4	9.60E-6	1.10E-4	1.09E-2
Co-60	Particulates	5.95E+3	2.21E-3	2.56E-5	8.45E-3	3.97E-1
Co-60	Crud	5.95E+3	2.21E-3	2.56E-5	8.45E-3	3.97E-1
Cs-134	Cesium	3.32E+4	4.68E-4	1.52E-5	1.44E-3	1.21E-1
Cs-135	Cesium	3.50E+3	4.90E-5	2.05E-9	2.24E-4	2.37E-5
Cs-137 plus progeny	Cesium	2.27E+4	3.26E-4	5.50E-6	1.44E-3	3.04E-1
Eu-154	Particulates	3.50E+3	3.76E-3	1.24E-5	1.54E-2	3.05E-1
Eu-155	Particulates	5.60E+2	4.90E-4	4.63E-7	1.85E-3	8.80E-3
Fe-55	Particulates	5.77E+2	2.71E-5	0.00E+0	8.99E-5	0.00E+0
Fe-59	Particulates	3.15E+3	2.63E-4	1.21E-5	1.30E-4	8.21E-3
H-3	Inert gas	3.15E+1	1.71E-5	0.00E+0	0.00E+0	0.00E+0
I-129	Cesium	1.92E+5	2.55E-3	6.11E-8	1.17E-2	1.72E-2
Kr-85	Inert gas	0.00E+0	0.00E+0	4.60E-7	0.00E+0	0.00E+0
Mn-54	Particulates	1.24E+3	1.07E-4	8.26E-6	2.24E-4	3.28E-2
Nb-93m	Particulates	2.10E+2	3.63E-5	6.57E-10	1.54E-4	2.44E-4
Nb-94	Particulates	2.97E+3	7.81E-4	1.55E-5	3.57E-3	1.31E+0
Nb-95	Particulates	1.01E+3	1.07E-4	7.51E-6	4.27E-5	4.22E-3
Ni-59	Particulates	1.10E+2	9.24E-6	0.00E+0	4.22E-5	0.00E+0
Ni-63	Particulates	2.62E+2	3.42E-5	0.00E+0	1.54E-4	0.00E+0
Np-237 plus progeny	Particulates	1.94E+5	1.63E+0	2.04E-6	7.46E+0	1.86E-1
Pa-231	Particulates	1.24E+6	2.42E+0	3.38E-7	1.10E+1	3.33E-2
Pb-210 plus progeny	Particulates	3.31E+6	3.19E-1	6.52E-8	1.39E+0	1.79E-2
Pd-107	Particulates	6.47E+1	4.19E-5	0.00E+0	1.91E-4	0.00E+0
Pm-147	Particulates	4.55E+2	3.48E-4	1.87E-9	1.15E-3	2.77E-6
Pu-238	Particulates	4.02E+5	1.14E+0	7.56E-10	5.13E+0	4.63E-4
Pu-239	Particulates	4.37E+5	1.14E+0	7.51E-10	5.19E+0	2.50E-4
Pu-240	Particulates	4.37E+5	1.14E+0	7.39E-10	5.19E+0	5.27E-4
Pu-241	Particulates	8.40E+3	1.21E-2	1.37E-11	5.15E-2	6.40E-7
Pu-242	Particulates	4.21E-5	1.07E+0	6.28E-10	4.86E+0	4.37E-4
Ra-226 plus progeny	Particulates	4.90E+5	2.52E-1	1.80E-5	1.15E+0	1.47E+0
Ra-228 plus progeny	Particulates	1.21E+6	1.86E-1	9.66E-6	7.21E-1	1.74E-1
Rh-102	Particulates	4.55E+3	1.21E-3	2.09E-5	4.09E-3	2.16E-1
Ru-106 plus progeny	Ruthenium	1.22E+4	2.00E-3	2.28E-6	4.56E-3	1.62E-2
Sb-125 plus progeny	Particulates	2.27E+3	3.96E-4	4.04E-6	1.32E-3	4.25E-2
Se-79	Particulates	5.07E+3	7.81E-5	8.49E-10	3.57E-4	1.45E-5
Sm-151	Particulates	1.71E+2	2.84E-4	5.32E-12	1.28E-3	2.63E-6
Sn-126 plus progeny	Particulates	8.87E+3	2.02E-3	1.94E-5	9.20E-3	1.73E+0
Sr-90 plus progeny	Particulates	5.37E+4	2.67E-3	1.92E-7	1.18E-2	6.07E-2
Tc-99	Particulates	1.12E+3	2.84E-4	6.17E-9	1.30E-3	5.69E-5
Th-228 plus progeny	Particulates	2.51E+5	3.07E+0	1.65E-5	9.18E+0	1.11E-1
Th-229 plus progeny	Particulates	1.07E+6	6.11E+0	3.01E-6	2.79E+1	3.05E-1
Th-230	Particulates	3.67E+5	9.95E-1	3.21E-9	4.54E+0	5.61E-4
Th-232	Particulates	4.02E+5	1.78E+0	1.57E-9	8.11E+0	3.99E-4

Table K-29. Unit risk factors used in the transportation risk assessment (page 3 of 3).

Radionuclide	Physical form	Ingestion pathway unit risk factor (person-rem/ Ci × Ci deposited)	Inhalation pathway unit risk factor (person-rem/ Ci per people/km^2) [a]	Immersion pathway unit risk factor (person-rem/ Ci per people/km^2)	Resuspension pathway unit risk factor (person-rem/ Ci per people/km^2)	Groundshine pathway unit risk factor (person-rem/ Ci per people/km^2)
U-232	Particulates	5.77E+5	2.63E+0	2.54E-9	1.18E+1	5.76E-4
U-233	Particulates	8.92E+4	6.82E-1	3.05E-9	3.11E+0	5.28E-4
U-234	Particulates	8.57E+4	6.68E-1	1.32E-9	3.05E+0	5.14E-4
U-235 plus progeny	Particulates	8.28E+4	6.05E-1	1.50E-6	2.76E+0	1.37E-1
U-236	Particulates	8.22E+4	6.18E-1	8.32E-10	2.82E+0	4.43E-4
U-238 plus progeny	Particulates	8.47E+4	5.68E-1	3.49E-7	2.59E+0	1.04E-1
Zr-93	Particulates	1.92E+3	7.10E-4	0.00E+0	3.24E-3	0.00E+0

a. To convert person-rem/Ci per people/km^2 to person-rem/Ci per people/mile^2, multiply by 0.386102.

K.2.4.9 Criticality During Accidents

Criticality is the term used to describe an uncontrolled nuclear chain reaction. U.S. Nuclear Regulatory Commission regulations at 10 CFR 71 require that the casks used to ship spent nuclear fuel and high-level radioactive waste be able to survive accident conditions, such as immersion in water, without undergoing a criticality. To meet this requirement, casks are typically designed so that even if water were to fill the cask and the cask contained unirradiated nuclear fuel (the most reactive case from the perspective of a criticality), a criticality would not occur.

K.2.4.10 Aircraft Crash

An aircraft crash into a spent nuclear fuel or high-level radioactive waste cask would be extremely unlikely because the probability of a crash into such a relatively small object, whether stationary or moving, is extremely remote. Nevertheless, DOE analyzed the consequences of an accident in which a large commercial aircraft or a military aircraft is hypothesized to directly hit a cask (DIRS 155970-DOE 2002, Section J.3.3.1). The analysis showed that the heavy shield wall of a cask could not be breached by the penetrating force of the aircraft's center shaft. With the exception of engines, the relatively light structures of an aircraft would be much less capable of causing damage to a cask. A resulting fire would not be sustainable or able to engulf a cask long enough to breach the integrity of the cask.

System malfunctions or material failures that could result in either an accidental release of ordnance or release of a practice weapon were discussed in the *Renewal of the Nellis Air Force Range Land Withdrawal: Legislative Environmental Impact Statement* (DIRS 103472-USAF 1999), and the *Final Environmental Impact Statement, Withdrawal of Public Lands for Range Safety and Training Purposes, Naval Air Station Fallon, Nevada* (DIRS 148199-USN 1998). The Special Nevada Report (DIRS 153277-SAIC 1991) states that the probability of dropped ordnance resulting in injury, death, or property damage ranges from about 1 in 1 billion to 1 in 1 trillion per dropped ordnance incident, with an average of about 1 in 10 billion per dropped ordnance incident. Less than one accidentally dropped ordnance incident is estimated per year for all flight operations over the Nellis Air Force Range (now called the Nevada Test and Training Range) and Naval Air Station Fallon. All of these analyses are incorporated in the Rail Alignment EIS by reference. Spent nuclear fuel transportation would not affect the risk from dropped ordnance or aircraft crashes. The Rail Alignment EIS does not evaluate radiological consequences of an impact of accidentally dropped ordnance on a shipping cask because the probability of such an event (about 1 in 10 billion per year) is so extremely low that it is not reasonably foreseeable.

Accordingly, DOE believes there would be no need for associated mitigation measures and no impacts on military operations.

K.2.4.11 Baltimore Tunnel Fire

On July 18, 2001, a freight train carrying hazardous (non-nuclear) materials derailed and caught fire while passing through the Howard Street railroad tunnel in downtown Baltimore, Maryland. The possible impacts of this fire were evaluated by the Nuclear Regulatory Commission in *Spent Nuclear Fuel Transportation Package Response to the Baltimore Tunnel Fire Scenario* (DIRS 182014-Adkins et al. 2006, all).

This study evaluated the response of the three transportation casks, the HOLTEC Model No. HI-STAR 100, the TransNuclear Model No. TN-68, and the Nuclear Assurance Corporation (NAC) Legal Weight Truck (LWT), to the conditions that existed during the fire. This study concluded that larger transportation packages resembling the HI-STAR 100 and TN-68 would withstand a fire with thermal conditions similar to those that existed in the Baltimore tunnel fire event with only minor damage to peripheral components. This is due to their sizable thermal inertia and design specifications in compliance with currently imposed regulatory requirements.

For the TN-68 and the NAC LWT, the maximum temperatures predicted in the regions of the lid and the vent and drain ports exceed the seals' rated service temperatures, making it possible for a small release to occur, due to crud that might spall off the surfaces of the fuel rods. While a release is not expected to occur for these conditions, any release that could occur would be very small due to a number of factors. These include (1) the tight clearances maintained between the lid and cask body by the closure bolts, (2) the low pressure differential between the cask interior and exterior, (3) the tendency of such small clearances to plug, and (4) the tendency of crud particles to settle or plate out.

The radiological consequences of the package responses to the Baltimore tunnel fire were also evaluated. The analysis indicates that the regulatory dose rate limits specified in 10 CFR 71.51 for accident conditions would not be exceeded by releases or direct radiation from any of these packages in this fire scenario. All three packages are designed to maintain regulatory dose rate limits even with a complete loss of neutron shielding. While highly unlikely, the NAC LWT could experience some decrease in gamma shielding due to slump in the lead as a consequence of this fire scenario, but a conservative analysis shows that the regulatory dose rate limits would not be exceeded.

The results of this evaluation also strongly indicate that neither spent nuclear fuel particles nor fission products would be released from a spent fuel shipping cask carrying intact spent nuclear fuel involved in a severe tunnel fire such as the Baltimore Tunnel Fire. None of the three cask designs analyzed for the Baltimore Tunnel fire scenario (TN-68, HI-STAR 100, and NAC LWT) experienced internal temperatures that would result in rupture of the fuel cladding. Therefore, radioactive material (spent nuclear fuel particles or fission products) would be retained within the fuel rods.

There would be no release from the HI-STAR 100, because the inner welded canister remains leak tight. While a release is unlikely, the potential releases calculated for the TN-68 rail cask and the NAC LWT truck cask indicate that any release of crud from either cask would be very small—less than an A_2 quantity. The release of an A_2 quantity is approximately equivalent to a radiation dose of 5 rem.

The Nuclear Regulatory Commission also evaluated the response of the NAC LWT cask to the conditions present during the Caldecott Tunnel fire in *Spent Fuel Transportation Package Response to the Caldecott Tunnel Fire Scenario* (DIRS 181841-Adkins et al. 2007, all). This fire took place on April 7, 1982, when a tank truck and trailer carrying 8,800 gallons of gasoline was involved in an accident in the Caldecott Tunnel on State Route 24 near Oakland, California. The tank trailer overturned and subsequently caught fire. This event is one of the most severe of the five major highway tunnel fires involving shipments of hazardous material that have occurred world-wide since 1949.

This study concluded that small transportation casks similar to the NAC LWT cask would probably experience degradation of some seals in this severe accident scenario. The maximum temperatures predicted in the regions of the cask lid and the vent and drain ports exceed the rated service temperature of the tetrafluoroethylene (TFE) or Viton seals, making it possible for a small release to occur due to crud that might spall off the surfaces of the fuel rods. However, any release is expected to be very small due to a number of factors. These include (1) the metallic lid seal does not exceed its rated service temperature and therefore can be assumed to remain intact, (2) the tight clearances maintained by the lid closure bolts, (3) the low pressure differential between the cask interior and exterior, (4) the tendency for solid particles to plug small clearance gaps and narrow convoluted flow paths such as the vent and drain ports, and (5) the tendency of crud particles to settle or plate out and consequently not be available for release.

The radiological consequences of the package response to the Caldecott Tunnel fire were also evaluated. The results of this evaluation strongly indicate that neither spent nuclear fuel particles nor fission products would be released from a spent fuel shipping cask involved in a severe tunnel fire such as the Caldecott Tunnel fire. The NAC LWT cask design analyzed for the Caldecott Tunnel fire scenario does not reach internal temperatures that could result in rupture of the fuel cladding. Therefore, radioactive material (spent nuclear fuel particles or fission products) would be retained within the fuel rods. The potential release calculated for the NAC LWT cask in this scenario indicates that any release of crud from the cask would be very small—less than an A_2 quantity.

K.2.5 SEVERE TRANSPORTATION ACCIDENTS

In addition to analyzing the radiological risks of transporting spent nuclear fuel and high-level radioactive waste, the consequences of severe transportation accidents were assessed. Severe transportation accidents with frequencies of about 1×10^{-7} per year are considered to be maximum reasonably foreseeable transportation accidents.

In the Rail Alignment EIS, DOE assumed that these severe accidents could occur anywhere along the rail alignment. There are no urban areas along the Caliente rail alignment or the Mina rail alignment. However, there are suburban areas and rural areas. Suburban areas are defined as areas with a population density between 139 and 3,326 people per square mile. Rural areas were defined as areas with a population density less than 139 people per square mile. For the Caliente rail alignment, using alignment-specific 2000 Census population data escalated to the year 2067, the average population density in suburban areas along the rail alignment ranged from 223 to 226 people per square kilometer (see Table K-30). The average population density in rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (see Table K-30). For the Mina rail alignment, using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the rail alignment ranged from 542 to 589 people per square kilometer (see Table K-31). The average population density in rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (see Table K-31). Radiation doses were estimated out to 80 kilometers (50 miles) using these population densities.

DOE used the following assumptions to estimate the consequences of these accidents (DIRS 157144-Jason Technologies 2001, Section 5.3.3.3):

- A release height of the plume of 10 meters (33 feet) for both fire- and impact-related accidents. In the case of an accident with a fire, a 10-meter release height with no plume rise from the buoyancy of the plume due to fire conditions yields higher estimates of consequences than accounting for the buoyancy of the plume from the fire (DIRS 157144-Jason Technologies 2001, p. 176).

- A breathing rate for individuals of 10,400 cubic meters per year (367,000 cubic feet per year). This breathing rate was estimated from data contained in ICRP Publication 23 (DIRS 101074-ICRP 1975, page 346).
- All material released is assumed to be aerosolized and respirable (DIRS 157144-Jason Technologies 2001, p. 177). The deposition velocity for respirable material was 0.01 meters/sec.
- A short-term exposure time to airborne contaminants of 2 hours.
- A long-term exposure time to contamination deposited on the ground of 1 year, with no interdiction or cleanup.
- Consequences were determined using low wind speeds and stable atmospheric conditions (a wind speed of 0.89 meters per second and Class F stability). The severe accident scenario calculation methodology does not include a probabilistic component that includes the atmospheric stability, therefore stable conditions were assumed. Atmospheric conditions affect the dispersion of radionuclides that could be released from a severe accident. The atmospheric concentrations estimated from these atmospheric conditions would be exceeded only 5 percent of the time. Using these atmospheric conditions instead of neutral atmospheric conditions and moderate wind speeds reduces the probability associated with an accident scenario and increases the consequences associated with an accident scenario.
- Consequences were determined for a single rail cask containing 21 pressurized water reactor spent nuclear fuel assemblies.
- The spent nuclear fuel assembly has a burnup of 60 MWd/MTHM, an enrichment of 4 percent, and a decay time of 10 years (DIRS 169061-BSC 2004, all). The radionuclide inventory for a single spent nuclear fuel assembly is listed in Table K-13.

Table K-30. Projected population densities along the Caliente rail alignment in 2067.

Alignment	Escalated urban population density (people/km^2) [a,b]	Escalated suburban population density (people/km^2)	Escalated rural population density (people/km^2)
Highest population	--	224	0.585
Shortest distance	--	223	0.528
Longest distance	--	226	0.353
Lowest population	--	--	0.346

a. To convert people/km^2 to people/mile^2, multiply by 2.589988.
b. Note that there are no urban areas along the rail alignments.

Table K-31. Projected population densities along the Mina rail alignment in 2067.

Alignment	Escalated urban population density (people/km^2) [a,b]	Escalated suburban population density (people/km^2)	Escalated rural population density (people/km^2)
Highest population	--	549	4.19
Shortest distance	--	589	4.25
Longest distance	--	542	4.33
Lowest population	--	589	3.94

a. To convert people/km^2 to people/mile^2, multiply by 2.589988.
b. Note that there are no urban areas along the rail alignments.

DOE estimated radiation doses using the RISKIND computer code (DIRS 101483-Yuan et al. 1995, all) and determined them for the inhalation, groundshine, immersion, and resuspension pathways. RISKIND has been verified and validated for estimating radiation doses from transportation accidents involving radioactive material (DIRS 101845-Maheras and Pippen 1995, all; DIRS 102060-Biwer et al. 1997, all). Radiation doses were estimated using the ICRP inhalation dose coefficients (DIRS 172935-ICRP 2001, all) and the EPA groundshine and immersion dose coefficients (DIRS 175544-EPA 2002, all). These dose coefficients are based on the recommendations by the International Commission on Radiological Protection in ICRP Publication 60 (DIRS 101836-ICRP 1991, all) and incorporate the dose coefficients from ICRP Publication 72 (DIRS 152446-ICRP 1996, all). Table K-32 lists these dose coefficients. The dose coefficients include radioactive progeny (DIRS 176975-BMI 2006, Table 2). The lung absorption type and the value for the fractional absorption from the small intestine (f_1) for each radionuclide are listed in DIRS 176975-BMI 2006, Table 4.

DOE used release fraction and conditional probability data to estimate the consequences of severe transportation accidents (DIRS 152476-Sprung et al. 2000, p. 7-76). The following list describes the 20 accident severity categories involving releases of radioactive material from steel-lead-steel rail casks.

- Case 20: Case 20 is a long-duration (many hours), high-temperature fire that would engulf a cask.
- Cases 19, 18, 17, and 16: Case 19 is a high-speed (more than 120 miles per hour) impact into a hard object such as a train locomotive severe enough to cause failure of cask seals and puncture through the cask's shield wall. The impact would be followed by a very long duration (many hours), high-temperature engulfing fire. Case 18, Case 17, and Case 16 are accidents that would also involve very long duration fires, failures of cask seals, and punctures of cask walls. However, these accidents would be progressively less severe in terms of impact speeds. The impact speeds range from 90 to 120 miles for Case 18, 60 to 90 miles per hour for Case 17, and 30 to 60 miles per hour for Case 16.
- Cases 15, 12, 9, and 6: Case 15 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals. The impact would be followed by a long duration (many hours), high-temperature engulfing fire. Case 12, Case 9, and Case 6 are also accidents that would involve long duration fires, and failures of cask seals. However, these accidents would be progressively less severe in terms of impact speeds ranging from 90 to 120 miles for Case 12, 60 to 90 miles per hour for Case 9, and 30 to 60 miles per hour for Case 6.

Table K-32. RISKIND dose coefficients (page 1 of 3).

Radionuclide	Groundshine pathway dose conversion factor (rem-m^2/Ci-s)[a]	Immersion pathway dose conversion factor (rem-m^3/Ci-s)[b]	Inhalation pathway dose conversion factor (rem/Ci)	Ingestion pathway dose conversion factor (rem/Ci)
Ac-227 plus progeny	1.73E-03	6.45E-02	3.30E+08	4.47E+06
Am-241	8.62E-05	2.50E-03	1.55E+08	7.40E+05
Am-242m plus progeny	7.71E-05	2.80E-03	1.37E+08	7.04E+05
Am-243 plus progeny	7.47E-04	3.26E-02	1.52E+08	7.43E+05
Be-10	1.26E-05	5.11E-04	1.30E+05	4.07E+03
C-14	4.74E-08	9.62E-06	2.29E+01	2.15E+03
Cd-113m	6.55E-06	3.35E-04	1.15E+05	8.51E+04
Ce-144 plus progeny	6.72E-04	1.27E-02	1.33E+05	1.94E+04
Cf-252	1.94E-06	1.35E-05	7.40E+07	3.33E+05
Cl-36	4.14E-05	6.14E-04	2.70E+04	3.44E+03

Table K-32. RISKIND dose coefficients (page 2 of 3).

Radionuclide	Groundshine pathway dose conversion factor (rem-m^2/Ci-s)[a]	Immersion pathway dose conversion factor (rem-m^3/Ci-s)[b]	Inhalation pathway dose conversion factor (rem/Ci)	Ingestion pathway dose conversion factor (rem/Ci)
Cm-242	2.60E-06	1.49E-05	1.92E+07	4.44E+04
Cm-243	4.37E-04	1.96E-02	1.15E+08	5.55E+05
Cm-244	2.38E-06	1.26E-05	9.99E+07	4.44E+05
Cm-245	2.98E-04	1.30E-02	1.55E+08	7.77E+05
Cm-246	2.13E-06	1.15E-05	1.55E+08	7.77E+05
Cm-247 plus progeny	1.19E-03	5.50E-02	1.44E+08	7.03E+05
Cm-248	1.63E-06	8.73E-06	5.55E+08	2.85E+06
Co-58	3.42E-03	1.65E-01	7.77E+03	2.74E+03
Co-60	8.51E-03	4.40E-01	1.15E+05	1.26E+04
Co-60 (crud)	8.51E-03	4.40E-01	1.15E+05	1.26E+04
Cs-134	5.48E-03	2.62E-01	2.44E+04	7.03E+04
Cs-135	9.95E-08	3.52E-05	2.55E+03	7.40E+03
Cs-137 plus progeny	2.03E-03	9.45E-02	1.70E+04	4.81E+04
Eu-154	4.33E-03	2.13E-01	1.96E+05	7.40E+03
Eu-155	1.98E-04	7.96E-03	2.55E+04	1.18E+03
Fe-55	0.00E+00	0.00E+00	1.41E+03	1.22E+03
Fe-55 (crud)	0.00E+00	0.00E+00	1.41E+03	1.22E+03
Fe-59	4.07E-03	2.08E-01	1.37E+04	6.66E+03
H-3	0.00E+00	0.00E+00	9.99E+01	6.66E+01
I-129	7.25E-05	1.05E-03	1.33E+05	4.07E+05
Kr-85	3.89E-05	8.88E-04	0.00E+00	0.00E+00
Mn-54	2.92E-03	1.42E-01	5.55E+03	2.63E+03
Nb-93m	2.52E-06	1.13E-05	1.89E+03	4.44E+02
Nb-94	5.51E-03	2.66E-01	4.07E+04	6.29E+03
Nb-95	2.69E-03	1.29E-01	5.55E+03	2.15E+03
Ni-59	0.00E+00	0.00E+00	4.81E+02	2.33E+02
Ni-63	0.00E+00	0.00E+00	1.78E+03	5.55E+02
Np-237 plus progeny	7.81E-04	3.50E-02	8.51E+07	4.10E+05
Pa-231	1.40E-04	5.81E-03	1.26E+08	2.63E+06
Pb-210 plus progeny	1.38E-04	1.12E-03	1.66E+07	7.00E+06
Pd-107	0.00E+00	0.00E+00	2.18E+03	1.37E+02
Pm-147	1.04E-07	3.21E-05	1.81E+04	9.62E+02
Pu-238	2.32E-06	1.30E-05	5.92E+07	8.51E+05
Pu-239	1.05E-06	1.29E-05	5.92E+07	9.25E+05
Pu-240	2.22E-06	1.27E-05	5.92E+07	9.25E+05
Pu-241	6.36E-09	2.35E-07	6.29E+05	1.78E+04
Pu-242	1.84E-06	1.08E-05	5.55E+07	8.88E+05

Table K-32. RISKIND dose coefficients (page 3 of 3).

Radionuclide	Groundshine pathway dose conversion factor (rem-m^2/Ci-s)[a]	Immersion pathway dose conversion factor (rem-m^3/Ci-s)[b]	Inhalation pathway dose conversion factor (rem/Ci)	Ingestion pathway dose conversion factor (rem/Ci)
Ra-226 plus progeny	6.24E-03	3.10E-01	1.31E+07	1.04E+06
Ra-228 plus progeny	3.47E-03	1.66E-01	9.68E+06	2.55E+06
Rh-102	7.47E-03	3.59E-01	6.29E+04	9.62E+03
Ru-106 plus progeny	1.28E-03	3.92E-02	1.04E+05	2.59E+04
Sb-125 plus progeny	1.53E-03	6.95E-02	2.06E+04	4.80E+03
Se-79	6.11E-08	1.46E-05	4.07E+03	1.07E+04
Sm-151	1.31E-08	9.14E-08	1.48E+04	3.63E+02
Sn-126 plus progeny	7.28E-03	3.33E-01	1.05E+05	1.88E+04
Sr-90 plus progeny	4.13E-04	3.30E-03	1.39E+05	1.14E+05
Tc-99	2.40E-07	1.06E-04	1.48E+04	2.37E+03
Th-228 plus progeny	5.32E-03	2.83E-01	1.60E+08	5.30E+05
Th-229 plus progeny	1.28E-03	5.16E-02	3.18E+08	2.27E+06
Th-230	2.36E-06	5.51E-05	5.18E+07	7.77E+05
Th-232	1.68E-06	2.69E-05	9.25E+07	8.51E+05
U-232	2.99E-06	4.37E-05	1.37E+08	1.22E+06
U-233	2.22E-06	5.25E-05	3.55E+07	1.89E+05
U-234	2.17E-06	2.27E-05	3.48E+07	1.81E+05
U-235 plus progeny	5.76E-04	2.57E-02	3.15E+07	1.75E+05
U-236	1.86E-06	1.43E-05	3.22E+07	1.74E+05
U-238 plus progeny	4.50E-04	6.63E-03	2.96E+07	1.79E+05
Zr-93	0.00E+00	0.00E+00	3.70E+04	4.07E+03

a. To convert rem-m^2/Ci-s to rem-ft^2/Ci-s, multiply by 10.763910.
b. To convert rem-m^3/Ci-s to rem-ft^3/Ci-s, multiply by 35.314667.

- Cases 14, 11, 8, and 5: Case 14 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals. The impact would be followed by a high-temperature engulfing fire that burned for hours. Case 11, Case 8, and Case 5 are also accidents that would involve fires that would burn for hours, and failures of cask seals. However, these accidents would be progressively less severe in terms of impact speeds ranging from 90 to 120 miles for Case 11, 60 to 90 miles per hour for Case 8, and 30 to 60 miles per hour for Case 5.

- Cases 13, 10, 7, and 4: Case 13 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals. The impact would be followed by an engulfing fire lasting more than ½ hour up to a few hours. Case 10, Case 7, and Case 4 are accidents that would involve long duration fires, and failures of cask seals. However, these accidents are progressively less severe in terms of impact speeds ranging from 90 to 120 miles for Case 10, 60 to 90 miles per hour for Case 7, and 30 to 60 miles per hour for Case 4.

- Cases 3, 2, and 1: Case 3 is a high-speed (more than 120 miles per hour) impact into a hard surface such as granite severe enough to cause failure of cask seals—no fire. Case 2 and Case 1 are accidents that would also not involve fire but would have progressively lower impact speeds - 90 to 120 miles for Case 2 and 60 to 90 miles per hour for Case 1.

Each of the 20 accident cases listed above has an associated conditional probability of occurrence (DIRS 152476-Sprung et al. 2000, p. 7-76). These conditional probabilities were combined with the distances along the Caliente and Mina rail alignments and the accident rates discussed in Section K.2.5.1 to estimate the frequency of occurrence for each accident case. These frequencies are listed in Table K-33.

Cases 1, 4, and 20 have frequencies greater than 1×10^{-7} per year. Case 20 is estimated to have the highest consequences of these three accident cases (DIRS 155970-DOE 2002, Table J-22). Therefore, Case 20 is considered to be the maximum reasonably foreseeable transportation accident. Table K-34 lists the release fractions and conditional probabilities for this accident (DIRS 152476-Sprung et al. 2000, p. 7-76).

Table K-33. Annual frequencies for accident severity cases.

Accident severity case	Annual frequency (accidents per year)
1	1×10^{-7}
2	$7 \times 10^{-9} – 8 \times 10^{-9}$
3	6×10^{-11}
4	4×10^{-7}
5	1×10^{-8}
6	$1 \times 10^{-9} – 2 \times 10^{-9}$
7	$8 \times 10^{-10} – 9 \times 10^{-10}$
8	$2 \times 10^{-11} – 3 \times 10^{-11}$
9	3×10^{-12}
10	6×10^{-11}
11	2×10^{-12}
12	2×10^{-13}
13	5×10^{-13}
14	1×10^{-14}
15	2×10^{-15}
16	$5 \times 10^{-12} – 6 \times 10^{-12}$
17	3×10^{-15}
18	2×10^{-16}
19	2×10^{-18}

K.2.6 TRANSPORTATION SABOTAGE

In the Rail Alignment EIS, DOE assumed that a sabotage event could occur anywhere along the Caliente or Mina rail alignment. Radiation doses have been estimated out to 80 kilometers (50 miles) from each rail alignment using the population densities listed in Tables K-30 and K-31.

DOE used the following assumptions to estimate the consequences of transportation sabotage events (DIRS 157144-Jason Technologies 2001, Section 5.3.4.2):

- A breathing rate for individuals of 10,400 cubic meters per year (367,000 cubic feet per year). This breathing rate was estimated from data contained in ICRP Publication 23 (DIRS 101074-ICRP 1975, p. 346).
- A short-term exposure time to airborne contaminants of 2 hours.
- A long-term exposure time to contamination deposited on the ground of 1 year, with no interdiction or cleanup.
- Because it is not possible to estimate the specific atmospheric conditions that would exist during a sabotage event, consequences were determined using moderate wind speeds and neutral atmospheric conditions (a wind speed of 4.47 meters per second and Class D stability).
- The release of both respirable and nonrespirable material was evaluated. The deposition velocity for respirable material was 0.01 meter per second. The deposition velocity for nonrespirable material was 0.1 meter per second.
- It is expected that in a sabotage event, there would be an initial explosive release involving releases of radioactive material at varying release heights. For 4 percent of the release, a release height of 1 meter was estimated; for 16 percent of the release, a release height of 16 meters was estimated; for 25 percent of the release, a release height of 32 meters was estimated; for 35 percent of the release, a release height of 48 meters was estimated; and for 20 percent of the release, a release height of 64 meters was estimated.

DOE plans to operate the repository using a primarily canistered approach that calls for packaging most commercial spent nuclear fuel in TAD canisters, which would hold 21 pressurized-water reactor spent nuclear fuel assemblies. In the Rail Alignment EIS, DOE chose to estimate the consequences of a rail sabotage event based on the radionuclide inventory in 26 pressurized-water reactor spent nuclear fuel assemblies, which overestimated consequences by about 24 percent in comparison to the inventory in 21 pressurized-water reactor spent nuclear fuel assemblies. The radionuclide inventory for a single spent nuclear fuel assembly in this cask is listed in Table K-13.

In the Yucca Mountain FEIS, DOE evaluated the consequences of sabotage events using the release fraction data contained in Luna et al. (1999) (DIRS 104918-Luna, Neuhauser, and Vigil 1999, all; DIRS 155970-DOE 2002, Section 6.2.4.2.3). For rail casks, a sabotage event using the high energy density device denoted HEDD1 yielded the largest radiation doses. Additional data from sabotage experiments conducted in Germany were used by DOE to update the release fractions for HEDD1 (DIRS 181279-Luna 2006, all) used to estimate the consequences of sabotage events in the Rail Alignment EIS. Table K-35 lists these release fractions.

Radiation doses for the sabotage event scenario were estimated using the RISKIND computer code (DIRS 101483-Yuan et al. 1995, all). RISKIND has been verified and validated for estimating radiation doses from releases of radioactive material during transportation (DIRS 101845-Maheras and Pippen 1995, all; DIRS 102060-Biwer et al. 1997, all). Radiation doses were determined for the inhalation, groundshine, immersion, and resuspension pathways. Radiation doses were estimated using the ICRP inhalation dose coefficients (DIRS 172935-ICRP 2001, all) and the EPA groundshine and immersion dose coefficients (DIRS 175544-EPA 2002, all). These dose coefficients are based on the recommendations by the International Commission on Radiological Protection in ICRP Publication 60 (DIRS 101836-ICRP 1991, all) and incorporate the dose coefficients from ICRP Publication 72 (DIRS 152446-ICRP 1996, all). These dose coefficients are listed in Table K-33.

Table K-34. Conditional probabilities and release fractions for severe accident cases.[a]

Severe accident case	Conditional probability	Release fraction				
		Inert gas	Cesium	Ruthenium	Particulates	Crud
20	4.91×10^{-5}	0.84	1.7×10^{-5}	2.5×10^{-7}	2.5×10^{-7}	9.4×10^{-3}

a. Source: DIRS 152476-Sprung et al. 2000, p. 7-76.

Table K-35. Release fractions for transportation sabotage event.[a]

Material	Release fraction					
	Particulates	Ruthenium[b]	Cesium[c]	Iodine[c]	Gas	Crud
Respirable	7.19×10^{-7}	7.19×10^{-7}	7.15×10^{-6}[d]	7.15×10^{-6}[d]	4.05×10^{-4}[d]	5.17×10^{-7}
Nonrespirable	1.75×10^{-4}	1.75×10^{-4}				5.16×10^{-8}

a. Source: DIRS 181279-Luna 2006, all.
b. Ruthenium is modeled as particulate.
c. Cesium and iodine are modeled as volatiles.
d. All cesium, iodine, and gases were assumed to be respirable.

K.2.7 RESULTS FOR THE CALIENTE RAIL ALIGNMENT

K.2.7.1 Incident-Free Impacts

This section presents the radiological impacts of incident-free transportation for workers and members of the public. Impacts are presented for rail workers and escorts en route to the repository, for workers located at the Maintenance-of-Way Trackside Facility and at sidings, for workers at the Staging Yard, and for members of the public along the rail alignment and near the Staging Yard under the Proposed Action and the Shared-Use Option.

K.2.7.1.1 Workers and Members of the Public En Route to the Repository

K.2.7.1.1.1 Workers. During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente or Eccles Interchange Facility to the repository, workers would be exposed to direct radiation from 9,495 shipping casks.

Table K-36 lists the collective radiation doses and impacts for these workers. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Caliente or Eccles to the repository and under normal circumstances there would be no en route stops between the Staging Yard and the repository, therefore there would be no radiation doses at stops for rail workers (engineers and conductors) or escorts. Because rail workers would be working in the cab of the locomotive and situated at a distance of at least 150 feet from the nearest cask, and would be shielded from radiation by the locomotive, there would be no radiation doses for these workers while en route to the repository.

The collective radiation dose for these workers is estimated to be 310 to 320 person-rem, with longer alignments having higher estimated radiation doses. The radiation doses would be the same for the Proposed Action and the Shared-Use Option. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.19 or about 1 chance in 5. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

For workers who could be exposed to radiation when cask trains pass by the Maintenance-of-Way Trackside facility, the collective radiation dose was estimated to be 0.035 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 2.1×10^{-5} or about 1 chance in 40,000. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option. In addition, the impacts for these workers would not depend on the length of the rail alignment.

For workers exposed when a train containing loaded casks passed a train containing empty casks or other materials at a siding, the collective radiation dose is estimated to be 0.0024 person-rem for the Proposed Action and 0.0051 person-rem for the Shared-Use Option. The radiation dose is higher for the Shared-Use Option because there would be increased rail traffic and therefore more opportunities for a train to be passed at a siding and workers exposed. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 1.4×10^{-6} for the Proposed Action and 3.0×10^{-6} for the Shared-Use Option, corresponding to about 1 chance in 700,000 and about 1 chance in 300,000.

The total collective radiation dose for all workers exposed en route to the repository is estimated to range from 310 to 320 person-rem. The radiation dose for escorts accounts for over 99 percent of the total radiation dose to workers. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.19.

Table K-37 lists the maximally exposed individual radiation doses and impacts for all workers. The maximally exposed worker would be an escort. This worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and a person working for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

An individual worker at the Maintenance-of-Way Trackside facility was estimated to receive a radiation dose of 8.8×10^{-4} rem over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed the facility. The probability of a latent cancer fatality for this worker is estimated to be 5.3×10^{-7}, or about 1 chance in 1,800,000.

An individual worker at a siding passed by loaded cask trains was estimated to receive a radiation dose of 2.4×10^{-4} rem for the Proposed Action and 5.1×10^{-4} rem for the Shared-Use Option over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed a siding. The probability of a latent cancer fatality for this worker is estimated to be 1.4×10^{-7} (1 chance in 7,100,000) for the Proposed Action and 3.0×10^{-7} (1 chance in 3,300,000) for the Shared-Use Option.

K.2.7.1.1.2 Members of the Public. During the shipment of spent nuclear fuel and high-level radioactive waste from the Caliente or Eccles Interchange Facility to the repository, members of the public along the rail alignment could be exposed to direct radiation from 9,495 shipping casks.

Table K-36 lists the collective radiation doses and impacts for members of the public. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Caliente or Eccles to the repository and there would be no en route stops under normal circumstances, there would be no radiation doses at stops for members of the public. In addition, because two trains could not share the single railroad track simultaneously, there would be no on-link radiation doses for members of the public.

The collective radiation dose for members of the public exposed along the rail alignment (off-link) is estimated to range from 0.087 to 0.21 person-rem, with rail alignments having higher exposed populations also having higher estimated radiation doses. These radiation doses are based on the population in the year 2000 escalated to the year 2067. The radiation doses for members of the public would be the same for the Proposed Action and the Shared-Use Option. In the exposed population, the probability of a latent cancer fatality is estimated to range from 5.2×10^{-5} to 1.3×10^{-4}, or about 1 chance in 19,000 to about 1 chance in 7,000. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

Table K-37 lists the maximally exposed individual radiation doses and impacts for members of the public. The maximally exposed individual would be a resident who lives 18 meters (60 feet) from the rail line. This individual would be exposed to each of 9,495 shipping casks as they passed by en route to the repository. The radiation dose for this individual is estimated to be 0.0078 rem over the course of a shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 4.7×10^{-6} or 1 chance in 200,000.

K.2.7.1.2 Workers and Members of the Public at the Staging Yard

K.2.7.1.2.1 Workers. When shipping casks arrive at the Staging Yard, the railcars containing the shipping cask would be removed from the train, an inspection conducted, and the railcar transferred to the train to be transported to the repository. The escorts that had accompanied the shipping cask from its point of origin would also be present during this inspection. These railcar handling, escort, and inspection workers would be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository. Noninvolved workers at the Staging Yard would also be exposed to direct radiation from the casks.

Table K-38 lists the collective radiation doses and impacts for these workers. Because operations at the three potential Staging Yard locations at Caliente-Indian Cove, Caliente-Upload, and Eccles-North would be similar, the radiation doses to workers at each Staging Yard would be the same. In addition, the

Table K-36. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Caliente rail alignment (page 1 of 2).

		Collective radiation dose (person-rem)										
Rail alignment	Interchange location	En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Caliente	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0024	3.2E+2	2.1E-1	0.0E+0	0.0E+0	2.1E-1
Shortest distance	Caliente	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0024	3.1E+2	1.8E-1	0.0E+0	0.0E+0	1.8E-1
Longest distance	Eccles	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0024	3.2E+2	1.1E-1	0.0E+0	0.0E+0	1.1E-1
Lowest population	Eccles	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0024	3.1E+2	8.7E-2	0.0E+0	0.0E+0	8.7E-2
Shared-Use Option												
Highest population	Caliente	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0051	3.2E+2	2.1E-1	0.0E+0	0.0E+0	2.1E-1
Shortest distance	Caliente	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0051	3.1E+2	1.8E-1	0.0E+0	0.0E+0	1.8E-1
Longest distance	Eccles	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0051	3.2E+2	1.1E-1	0.0E+0	0.0E+0	1.1E-1
Lowest population	Eccles	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0051	3.1E+2	8.7E-2	0.0E+0	0.0E+0	8.7E-2

Table K-36. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Caliente rail alignment (page 2 of 2).

		Latent cancer fatalities										
Alignment	Interchange Location	En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	1.3E-4	0.0E+0	0.0E+0	1.3E-4
Shortest distance	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	1.1E-4	0.0E+0	0.0E+0	1.1E-4
Longest distance	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	6.4E-5	0.0E+0	0.0E+0	6.4E-5
Lowest population	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.4E-6	1.9E-1	5.2E-5	0.0E+0	0.0E+0	5.2E-5
Shared-Use Option												
Highest population	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	1.3E-4	0.0E+0	0.0E+0	1.3E-4
Shortest distance	Caliente	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	1.1E-4	0.0E+0	0.0E+0	1.1E-4
Longest distance	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	6.4E-5	0.0E+0	0.0E+0	6.4E-5
Lowest population	Eccles	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	3.0E-6	1.9E-1	5.2E-5	0.0E+0	0.0E+0	5.2E-5

a. Rail workers are engineers and conductors.
b. MOW = Maintenance-of-Way.

Table K-37. Incident-free maximally exposed individual radiation doses and latent cancer fatalities for en route workers and members of the public for the Caliente rail alignment.

Severe accident case	Radiation dose (rem)	Latent cancer fatalities
Proposed Action		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	2.4E-4	1.4E-7
Members of the public		
Resident near rail line	7.8E-3	4.7E-6
Shared-Use Option		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	5.1E-4	3.0E-7
Members of the public		
Resident near rail line	7.8E-3	4.7E-6

Table K-38. Incident-free collective radiation doses and latent cancer fatalities at the Caliente and Eccles Staging Yards for workers and members of the public.

	Collective radiation dose (person-rem)			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Caliente-Indian Cove	2.4E+2	1.2E+1	2.5E+2	2.6E-2
Caliente-Upland	2.4E+2	1.2E+1	2.5E+2	6.4E-3
Eccles-North	2.4E+2	1.2E+1	2.5E+2	3.9E-3
	Latent cancer fatalities			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Caliente-Indian Cove	1.4E-1	7.4E-3	1.5E-1	1.6E-5
Caliente-Upland	1.4E-1	7.4E-3	1.5E-1	3.9E-6
Eccles-North	1.4E-1	7.4E-3	1.5E-1	2.4E-6

radiation dose to workers at the Staging Yard would be the same for the Proposed Action and the Shared-Use Option because the number of shipping casks handled at the Staging Yard would be the same for the Proposed Action and the Shared-Use Option.

The collective radiation dose for involved workers at the Staging Yard is estimated to be 240 person-rem. These radiation doses are in large part dependent on the time that a cask spent in the Staging Yard, which is estimated to be 2 hours, and on the close proximity of the inspector to the cask, which is estimated to be 1 meter. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.14.

The collective radiation dose for noninvolved workers at the Staging Yard is estimated to be 12 person-rem. These radiation doses are in large part dependent on the time that a noninvolved worker is assumed to spend in the Staging Yard, which is estimated to be 2 hours, at an estimated distance of 100 meters from the casks. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0074.

The total collective radiation dose for involved and noninvolved workers at the Staging Yards is estimated to be 250 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15.

Table K-39 lists the maximally exposed individual radiation doses and impacts for workers at each potential Staging Yard location. The maximally exposed worker would be an inspector, rail worker, or escort. This individual is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit at repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) for a person working for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

Table K-39. Incident-free maximally exposed individual radiation doses and latent cancer fatalities at the Caliente and Eccles Staging Yards for workers and members of the public.

Proposed Action and Shared-Use Option	Radiation dose (rem)	Latent cancer fatalities
Workers		
Escort, rail worker, or inspector (one year of operation)	0.50	0.00030
Escort, rail worker, or inspector (50 years of operations)	25	0.015
Members of the public - resident near Staging Yard		
Caliente-Indian Cove	3.0E-6	1.8E-9
Caliente-Upland	2.7E-3	1.6E-6
Eccles-North	3.4E-6	2.1E-9

K.2.7.1.2.2 Members of the Public. Members of the public near the Caliente-Indian Cove, Caliente-Upland, or Eccles-North Staging Yard could be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository.

Table K-38 lists the collective radiation doses and impacts for these members of the public. The collective radiation dose for members of the public is estimated to range from 0.0039 to 0.026 person-rem. These radiation doses are based on the population in the year 2000 escalated to the year 2067. The highest radiation dose is for the Caliente-Indian Cove Staging Yard location, which also has the highest exposed population. The lowest radiation dose is for the Eccles-North Staging Yard location, which has the lowest exposed population. In the exposed populations around the Staging Yards, the probability of a latent cancer fatality is estimated to range from 2.4×10^{-6} to 1.6×10^{-5}, or about 1 chance in 400,000 to about 1 chance in 60,000.

Table K-39 lists the maximally exposed individual radiation doses and impacts for members of the public near the potential Staging Yard locations at Caliente-Indian Cove, Caliente-Upland, and Eccles-North. The maximally exposed individual at the Caliente-Indian Cove Staging Yard would be a resident who lives 1,600 meters (5,200 feet) from the Staging Yard. This individual would be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.0×10^{-6} rem over the shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 1.8×10^{-9}, or about 1 chance in 550,000,000.

The maximally exposed individual at the Caliente-Upland Staging Yard would be a resident who lives 400 meters (1,300 feet) from the Staging Yard. This individual would be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 2.7×10^{-3} rem over the shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 1.6×10^{-6}, or about 1 chance in 600,000.

The maximally exposed individual at the Eccles-North Staging Yard would be a resident who lives 1,500 meters (4,900 feet) from the Staging Yard. This individual would be exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The radiation dose for this individual is estimated to be 3.4×10^{-6} rem over the shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 2.1×10^{-9}, or about 1 chance in 480,000,000.

K.2.7.1.3 Summary of Incident-Free Impacts

Table K-40 lists the incident-free collective radiation doses and impacts for workers en route to the repository, workers and members of the public located along the rail alignment route, involved and noninvolved workers at the Staging Yards, and members of the public near the Staging Yards for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for en route workers and workers along the rail alignment route is estimated to range from 310 to 320 person-rem. For involved and noninvolved workers at the Staging Yards, the total collective radiation dose is estimated to be 250 person-rem. The total collective radiation dose for all workers (en route, along the rail alignment, and at the Staging Yards) is estimated to be 560 to 570 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.34. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for members of the public along the Caliente rail alignment exposed to radiation from cask trains en route to the repository was estimated to range from 0.087 to 0.21 person-rem. For members of the public near the Staging Yards, the total collective radiation dose is estimated to range from 0.0039 to 0.026 person-rem. The total collective radiation dose for all members of the public (along the rail alignment route and near the Staging Yards) is estimated to range from 0.091 to 0.24 person-rem. These radiation doses are based on the population in the year 2000 and escalated to the year 2067, and vary depending upon the location of the Staging Yard. The radiation doses are highest for those rail alignments and Staging Yard locations where the exposed populations are the highest. In the exposed population, the probability of a latent cancer fatality is estimated to range from 5.5×10^{-5} to 1.4×10^{-4}. The impacts for these members of the public would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for all workers and members of the public is estimated to be 560 to 570 person-rem. Over 99 percent of the radiation dose is to workers, less than 1 percent of the radiation dose is to members of the public. In the exposed population of workers and members of the public, the probability of a latent cancer fatality 0.34.

Table K-40. Summary of incident-free collective radiation doses and latent cancer fatalities for workers and members of the public for the Caliente rail alignment.

		Collective radiation dose (person-rem)						
Rail alignment	Staging Yard location	Total workers en route and along route	Total workers at Staging Yard	Total workers	Total public along route	Total public near Staging Yard	Total public	Total public and worker
Proposed Action and Shared-Use Option								
Highest population	Caliente-Indian Cove	3.2E+2	2.5E+2	5.7E+2	2.1E-1	2.6E-2	2.4E-1	5.7E+2
Highest population	Caliente-Upland	3.2E+2	2.5E+2	5.7E+2	2.1E-1	6.4E-3	2.2E-1	5.7E+2
Shortest distance	Caliente-Indian Cove	3.1E+2	2.5E+2	5.6E+2	1.8E-1	2.6E-2	2.1E-1	5.6E+2
Shortest distance	Caliente-Upland	3.1E+2	2.5E+2	5.6E+2	1.8E-1	6.4E-3	1.9E-1	5.6E+2
Longest distance	Eccles-North	3.2E+2	2.5E+2	5.7E+2	1.1E-1	3.9E-3	1.1E-1	5.7E+2
Lowest population	Eccles-North	3.1E+2	2.5E+2	5.6E+2	8.7E-2	3.9E-3	9.1E-2	5.6E+2
Highest population	Caliente-Indian Cove	1.9E-1	1.5E-1	3.4E-1	1.3E-4	1.6E-5	1.4E-4	3.4E-1
Highest population	Caliente-Upland	1.9E-1	1.5E-1	3.4E-1	1.3E-4	3.9E-6	1.3E-4	3.4E-1
Shortest distance	Caliente-Indian Cove	1.9E-1	1.5E-1	3.4E-1	1.1E-4	1.6E-5	1.2E-4	3.4E-1
Shortest distance	Caliente-Upland	1.9E-1	1.5E-1	3.4E-1	1.1E-4	3.9E-6	1.1E-4	3.4E-1
Longest distance	Eccles-North	1.9E-1	1.5E-1	3.4E-1	6.4E-5	2.4E-6	6.6E-5	3.4E-1
Lowest population	Eccles-North	1.9E-1	1.5E-1	3.4E-1	5.2E-5	2.4E-6	5.5E-5	3.4E-1

K.2.7.2 Transportation Accident Risks

This section presents the radiological transportation accident risks of shipping spent nuclear fuel and high-level radioactive waste from the Interchange Facility at Caliente or Eccles to the repository for the Proposed Action and the Shared-Use Option. Transportation risks were quantified in terms of dose risk, which is the sum of the products of the probabilities (dimensionless) and consequences (collective radiation doses in units of person-rem) of all potential transportation accidents. Transportation risks were also quantified in terms of latent cancer fatalities.

Table K-41 lists the dose risks for the four rail alignments evaluated in the Rail Alignment EIS. The dose risks are estimated to range from 1.1×10^{-3} to 2.2×10^{-3} person-rem. The rail alignments that have the higher exposed populations also have the higher dose risks. Also, because the number of shipping casks transported from Caliente or Eccles to the repository would be the same for the Proposed Action and for the Shared-Use Option, the dose risks are the same for the Proposed Action and Shared-Use Option. In the exposed populations along the rail alignments, the probability of a latent cancer fatality is estimated to range from 6.7×10^{-7} to 1.3×10^{-6}, or about 1 chance in 1,400,000 to about 1 chance in 700,000.

K.2.7.3 Severe Transportation Accidents

This section presents the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents, that could occur during the shipment of spent nuclear fuel and high-level radioactive waste to the repository from the Interchange Facility at Caliente or Eccles for the Proposed Action and the Shared-Use Option.

Because it is not possible to forecast the atmospheric conditions that might exist during a severe accident, consequences were determined using low wind speeds and stable atmospheric conditions (a wind speed of 0.89 meters per second and Class F stability). The severe accident scenario calculation methodology does not include a probabilistic component that includes the atmospheric stability, therefore stable conditions were assumed. The atmospheric concentrations estimated from these conditions would be exceeded only 5 percent of the time.

For the four rail alignments described in Table K-30, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 223 to 226 people per square kilometer (577 to 585 people per square mile) near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.51 people per square mile).

Table K-42 lists the impacts of the maximum reasonably foreseeable accident. This accident has a frequency of about 6×10^{-7} per year. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 770 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 0.46. If the maximum reasonably foreseeable accident were to occur in a rural area, the collective radiation dose would be 2 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 1.2E-3.

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the maximally exposed individual located 330 meters from the accident would be 34 rem. The probability of an LCF for that individual is estimated to be 0.020.

Table K-41. Radiological transportation accident risks for the Caliente rail alignment.

Rail alignment	Staging Yard location	Dose risk[a] (person-rem)	Latent cancer fatalities (LCFs)
Proposed Action and Shared-Use Option			
Highest population	Caliente	2.2E-3	1.3E-6
Shortest distance	Caliente	1.9E-3	1.1E-6
Longest distance	Eccles	1.3E-3	7.6E-7
Lowest population	Eccles	1.1E-3	6.7E-7

a. Dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of an LCF for this first responder is estimated to range from 8.2×10^{-5} to 0.0012.

Recovering rail casks loaded with spent nuclear fuel or high-level radioactive waste would use methods commonly used to recover railcars and locomotives following accidents. The capability to lift such weights exists and would be deployed as required. Railroads use emergency response contractors with the capability to lift derailed locomotives that could weigh as much as 150 tons. Difficult recoveries of equipment as heavy as spent nuclear fuel casks have been accomplished and DOE anticipates that if such a recovery was necessary, it would be accomplished using methods and equipment similar to those used in prior difficult recoveries.

Table K-42. Consequences of the maximum reasonably foreseeable accident in suburban and rural areas along the Caliente rail alignment.[a]

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	770	2.0
Latent cancer fatalities	0.46	1.2E-3
Maximally exposed individual (rem)	34	34
Probability of latent cancer fatality	0.020	0.020
First responder radiation dose (rem)	0.14 – 2.0	0.14 – 2.0
Probability of latent cancer fatality	8.2×10^{-5} – 0.0012	8.2×10^{-5} – 0.0012

a. Consequences based on low wind speeds and stable atmospheric conditions.
b. Population density in the suburban area is 226 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the rural area is 0.585 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.

K.2.7.4 Transportation Sabotage

This section presents the consequences of a sabotage event for shipments of spent nuclear fuel and high-level radioactive waste to the repository from the Interface with the Union Pacific Mainline on the Caliente alternative segment or the Eccles alternative segment.

For the four rail alignments described in Table K-30, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 223 to 226 people per square kilometer (577 to 586 people per square mile), near Caliente and Goldfield. The average population density along rural areas, escalated to the year 2067, ranged from 0.346 to 0.585 people per square kilometer (0.896 to 1.51 people per square mile).

Table K-43 lists the consequences of a potential sabotage event. The consequences would be the same for the Proposed Action and the Shared-Use Option. If the sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 1,800 person-rem. In the exposed population, the number of latent cancer fatalities is estimated to be 1.1.

If the sabotage event occurred in a rural area, the collective radiation dose is estimated to be 4.7 person-rem. In the exposed population, the risk of a latent cancer fatality is estimated to be 0.0028.

If the sabotage event were to occur in either a suburban area or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event, at the location of maximum downwind air concentration. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for this individual is estimated to be 0.016.

Table K-43. Consequences of a sabotage event in suburban and rural areas along the Caliente rail alignment.[a]

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	1,800	4.7
Latent cancer fatalities	1.1	0.0028
Maximally exposed individual (rem)	27	27
Probability of latent cancer fatality	0.016	0.016

a. Consequences based on moderate wind speeds and neutral atmospheric conditions.
b. Population density in the suburban area is 226 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the rural area is 0.585 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.

K.2.8 RESULTS FOR THE MINA RAIL ALIGNMENT

K.2.8.1 Incident-Free Impacts

This section presents the radiological impacts of incident-free transportation for workers and members of the public. Impacts for the Proposed Action and the Shared-Use Option are presented for rail workers and escorts en route to the repository, for workers located at the Maintenance-of-Way Trackside Facility and at sidings, for workers at the Staging Yard at Hawthorne, and for members of the public along the rail alignment and near the Staging Yard at Hawthorne.

K.2.8.1.1 Workers and Members of the Public En Route to the Repository

K.2.8.1.1.1 Workers. During the shipment of spent nuclear fuel and high-level radioactive waste from Hazen, Nevada to the repository, workers would be exposed to direct radiation from 9,495 shipping casks.

Table K-44 lists the collective radiation doses and impacts for these workers. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Hazen to the repository and under normal circumstances there would be no en route stops between Hazen and the repository, therefore there would be no radiation doses at stops for rail workers (engineers and conductors) or escorts. Because rail workers would be working in the cab of the locomotive and situated at a distance of at least 150 feet from the nearest cask, and would be shielded from radiation by the locomotive, there would be no radiation doses for these workers while en route to the repository.

The collective radiation dose for workers is estimated to be 310 to 340 person-rem, with longer alignments having higher estimated radiation doses. The radiation doses would be the same for the Proposed Action and the Shared-Use Option. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.18 to 0.20 or about 1 chance in 5. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

For workers who could be exposed to radiation when cask trains pass by the Maintenance-of-Way Trackside Facility, the collective radiation dose is estimated to be 0.035 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 2.1×10^{-5} or about 1 chance in 40,000. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option. In addition, the impacts for these workers would not depend on the length of the rail alignment.

For workers exposed when a train containing loaded casks passed a train containing empty casks or other materials at a siding, the collective radiation dose is estimated to be 0.0013 person-rem for the Proposed Action and 0.0028 person-rem for the Shared-Use Option. The radiation dose is higher for the Shared-Use Option because there would be increased rail traffic and therefore more opportunities for a train to be passed at a siding and workers exposed. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 7.7×10^{-7} for the Proposed Action and 1.7×10^{-6} for the Shared-Use Option, corresponding to about one chance in 1,200,000 to about one chance in 500,000.

The total collective radiation dose for all workers exposed en route to the repository is estimated to range from 310 to 340 person-rem. The radiation dose for escorts accounts for over 99 percent of the total radiation dose to workers. In the exposed population of workers, the probability of a latent cancer fatality is estimated to range from 0.18 to 0.20.

Table K-45 lists the maximally exposed individual radiation doses and impacts for all workers. The maximally exposed worker would be an escort. This worker is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit for repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) and a person working for up to 50 years escorting shipments. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

An individual worker at the Maintenance-of-Way Trackside Facility was estimated to receive a radiation dose of 8.8×10^{-4} rem over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed the facility. The probability of a latent cancer fatality for this worker is estimated to be 5.3×10^{-7}, or about 1 chance in 1,800,000.

An individual worker at a siding passed by loaded cask trains was estimated to receive a radiation dose of 1.3×10^{-4} rem for the Proposed Action and 2.8×10^{-4} rem for the Shared-Use Option over 50 years of operations and assuming that the worker was exposed to all loaded casks that passed a siding. The probability of a latent cancer fatality for this worker is estimated to be 7.7×10^{-8} (1 chance in 12,000,000) for the Proposed Action and 1.7×10^{-7} (1 chance in 5,800,000) for the Shared-Use Option.

K.2.8.1.1.2 Members of the Public. During the shipment of spent nuclear fuel and high-level radioactive waste from Hazen, Nevada, to the repository, members of the public along the rail alignment could be exposed to direct radiation from 9,495 shipping casks.

Table K-44 lists the collective radiation doses and impacts for members of the public along the rail alignment. Because dedicated trains would be used for transporting spent nuclear fuel and high-level radioactive waste from Hazen to the repository and there would be no en route stops under normal circumstances, there would be no radiation doses at stops for members of the public. In addition, because two trains could not share the single railroad track simultaneously, there would be no on-link radiation doses for members of the public.

The collective radiation dose for members of the public exposed along the rail alignment (off-link) is estimated to be 1.4 person-rem, for all rail alignments. These radiation doses are based on the population in the year 2000 escalated to the year 2067. The radiation doses for members of the public would be the same for the Proposed Action and the Shared-Use Option. In the exposed population, the probability of a latent cancer fatality is estimated to range from 8.1×10^{-4} to 8.5×10^{-4}, or about 1 chance in 1,000. For perspective, in the United States the lifetime risk of dying from cancer is about 1 in 5.

Table K-45 lists the maximally exposed individual radiation doses and impacts for members of the public. The maximally exposed individual would be a resident who lives 18 meters (60 feet) from the rail line. This individual would be exposed to each of 9,495 shipping casks as they passed by en route to the repository. The radiation dose for this individual is estimated to be 0.0078 rem over the course of a shipping campaign of 50 years. The probability of a latent cancer fatality for this individual is estimated to be 4.7×10^{-6} or 1 chance in 200,000.

K.2.8.1.2 Workers and Members of the Public at the Staging Yard

K.2.8.1.2.1 Workers. When shipping casks arrive at the Staging Yard at Hawthorne, the railcars containing the shipping cask would be removed from the train, an inspection conducted, and the railcar transferred to the train to be transported to the repository. The escorts that had accompanied the shipping cask from its point of origin would also be present during this inspection. These railcar handling, escort, and inspection workers would be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository. Noninvolved workers at the Staging Yard would also be exposed to direct radiation from the casks.

Table K-46 lists the collective radiation doses and impacts for these workers. The radiation dose to workers at the Staging Yard would be the same for the Proposed Action and the Shared-Use Option because the number of shipping casks handled at the Staging Yard would be the same for the Proposed Action and Shared-Use Option.

The collective radiation dose for involved workers at the Staging Yard is estimated to be 240 person-rem. These radiation doses are in large part dependent on the time that a cask spent in the Staging Yard, which is estimated to be 2 hours, and on the close proximity of the inspector to the cask, which is estimated to be 1 meter. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.14.

The collective radiation dose for noninvolved workers at the Staging Yard is estimated to be 10 person-rem. These radiation doses are in large part dependent on the time that a noninvolved worker is assumed to spend in the Staging Yard, which is estimated to be 2 hours, at an estimated distance of 100 meters from the casks. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.0063.

Table K-44. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Mina rail alignment (page 1 of 2).

Rail alignment	Interchange location	Collective radiation dose (person-rem)										
		En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Hazen	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0013	3.2E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Shortest distance	Hazen	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0013	3.1E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Longest distance	Hazen	0.0E+0	0.0E+0	3.4E+2	0.0E+0	3.5E-2	0.0013	3.4E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Lowest population	Hazen	0.0E+0	0.0E+0	3.3E+2	0.0E+0	3.5E-2	0.0013	3.3E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Shared-Use Option												
Highest population	Hazen	0.0E+0	0.0E+0	3.2E+2	0.0E+0	3.5E-2	0.0028	3.2E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Shortest distance	Hazen	0.0E+0	0.0E+0	3.1E+2	0.0E+0	3.5E-2	0.0028	3.1E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Longest distance	Hazen	0.0E+0	0.0E+0	3.4E+2	0.0E+0	3.5E-2	0.0028	3.4E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0
Lowest population	Hazen	0.0E+0	0.0E+0	3.3E+2	0.0E+0	3.5E-2	0.0028	3.3E+2	1.4E+0	0.0E+0	0.0E+0	1.4E+0

Table K-44. Incident-free collective radiation doses and latent cancer fatalities for en route workers and members of the public for the Mina rail alignment (page 2 of 2).

		Latent cancer fatalities										
Alignment	Interchange location	En route rail workers[a]	En route rail workers at stops	En route escorts	En route escorts at stops	MOW[b] Trackside Facility workers	Workers located at sidings	Total en route workers	Off-link public along route	On-link public along route	Stops public along route	Total public along route
Proposed Action												
Highest population	Hazen	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	7.7E-7	1.9E-1	8.5E-4	0.0E+0	0.0E+0	8.5E-4
Shortest distance	Hazen	0.0E+0	0.0E+0	1.8E-1	0.0E+0	2.1E-5	7.7E-7	1.8E-1	8.2E-4	0.0E+0	0.0E+0	8.2E-4
Longest distance	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	7.7E-7	2.0E-1	8.3E-4	0.0E+0	0.0E+0	8.3E-4
Lowest population	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	7.7E-7	2.0E-1	8.1E-4	0.0E+0	0.0E+0	8.1E-4
Shared-Use Option												
Highest population	Hazen	0.0E+0	0.0E+0	1.9E-1	0.0E+0	2.1E-5	1.7E-6	1.9E-1	8.5E-4	0.0E+0	0.0E+0	8.5E-4
Shortest distance	Hazen	0.0E+0	0.0E+0	1.8E-1	0.0E+0	2.1E-5	1.7E-6	1.8E-1	8.2E-4	0.0E+0	0.0E+0	8.2E-4
Longest distance	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	1.7E-6	2.0E-1	8.3E-4	0.0E+0	0.0E+0	8.3E-4
Lowest population	Hazen	0.0E+0	0.0E+0	2.0E-1	0.0E+0	2.1E-5	1.7E-6	2.0E-1	8.1E-4	0.0E+0	0.0E+0	8.1E-4

a. Rail workers were engineers and conductors.
b. MOW = Maintenance-of-Way.

Table K-45. Incident-free maximally exposed individual radiation doses and latent cancer fatalities for en route workers and members of the public for the Mina rail alignment.

Severe accident case	Radiation dose (rem)	Latent cancer fatalities
Proposed Action		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	1.3E-4	7.7E-8
Members of the public		
Resident near rail line	7.8E-3	4.7E-6
Shared-Use Option		
Workers		
Escort (one year of operation)	0.50	0.00030
Escort (50 years of operations)	25	0.015
Worker at Maintenance-of-Way Trackside Facility	8.8E-04	5.3E-07
Worker at siding	2.8E-4	1.7E-7
Members of the public		
Resident near rail line	7.8E-3	4.7E-6

Table K-46. Incident-free collective radiation doses and latent cancer fatalities at the Staging Yard at Hawthorne for workers and members of the public.

	Collective radiation dose (person-rem)			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Mina - Hawthorne	2.4E+2	1.0E+1	2.5E+2	0.0E+0
	Latent cancer fatalities			
Staging Yard location	Involved workers at Staging Yard	Noninvolved workers at Staging Yard	Total workers at Staging Yard	Public near Staging Yard
Proposed Action and Shared-Use Option				
Mina - Hawthorne	1.4E-1	6.3E-3	1.5E-1	0.0E+0

The total collective radiation dose for involved and noninvolved workers at the Staging Yard is estimated to be 250 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.15.

Table K-46 lists the maximally exposed individual radiation doses and impacts for workers at the Staging Yard. The maximally exposed worker would be an inspector, rail worker, or escort. This individual is estimated to receive a radiation dose of 25 rem over the 50 years of operation, based on a 0.5 rem per year administrative dose limit at repository facilities (DIRS 174942-BSC 2005, Section 4.9.3.3) for a person working for up to 50 years at the Staging Yard. The probability of a latent cancer fatality for this worker is estimated to be 0.015 or about 1 chance in 60.

K.2.8.1.2.2 Members of the Public. Members of the public near the Staging Yard at Hawthorne could be exposed to direct radiation from 9,495 shipping casks over 50 years of transporting spent nuclear fuel and high-level radioactive waste to the repository.

Tables K-46 and K-47 list the radiation doses and impacts for these members of the public. Based on 2000 census data, there is no resident population within 800 meters of the Staging Yard. Therefore, the collective radiation dose for members of the public is estimated to zero. There is, however, a business located 660 meters (2,100 feet) from the Staging Yard. The radiation dose for a person at this business is estimated to be 0.00018 rem, assuming that an individual was exposed to each of the 9,495 shipping casks for a period of 2 hours per cask. The probability of a latent cancer fatality for this individual is estimated to be 1.1×10^{-7}, or about 1 chance in 9,000,000.

Table K-47. Incident-free maximally exposed individual radiation doses and latent cancer fatalities at the Staging Yard at Hawthorne for workers and members of the public.

	Radiation dose (rem)	Latent cancer fatalities
Proposed Action and Shared-Use Option		
Workers		
Escort, rail worker, or inspector (one year of operation)	0.50	0.00030
Escort, rail worker, or inspector (50 years of operations)	25	0.015
Members of the public		
Business near Staging Yard	1.8E-4	1.1E-7

K.2.8.1.3 Summary of Incident-Free-Impacts

Table K-48 lists the incident-free collective radiation doses and impacts for workers en route to the repository, workers and members of the public located along the rail alignment route, involved and noninvolved workers at the Staging Yard at Hawthorne, and members of the public near the Staging Yard at Hawthorne for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for en route workers and workers along the rail alignment route is estimated to range from 310 to 340 person-rem. For involved and noninvolved workers at the Staging Yard at Hawthorne, the total collective radiation dose is estimated to be 250 person-rem. The total collective radiation dose for all workers (en route, along the rail alignment, and at the Staging Yard) is estimated to be 550 to 580 person-rem. In the exposed population of workers, the probability of a latent cancer fatality is estimated to be 0.33 to 0.35. The impacts for these workers would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for members of the public along the Mina rail alignment exposed to radiation from cask trains en route to the repository was estimated to be 1.4 person-rem. Since there are no members of the public near the Staging Yard at Hawthorne, the total collective radiation dose for members of the public near the Staging Yards is zero. The total collective radiation dose for all members of the public (along the rail alignment route and near the Staging Yard) is estimated be 1.4 person-rem. These radiation doses are based on the population in the year 2000 and escalated to the year 2067. In the exposed population, the probability of a latent cancer fatality is estimated to range from 8.1×10^{-4} to

Table K-48. Summary of incident-free collective radiation doses and latent cancer fatalities for workers and members of the public for the Mina rail alignment.

		Collective radiation dose (person-rem)						
Rail alignment	Staging Yard location	Total workers en route and along route	Total workers at Staging Yard	Total workers	Total public along route	Total public near Staging Yard	Total public	Total public and worker
Proposed Action and Shared-Use Option								
Highest population	Hawthorne	3.2E+2	2.5E+2	5.7E+2	1.4E+0	0.0E+0	1.4E+0	5.7E+2
Shortest distance	Hawthorne	3.1E+2	2.5E+2	5.5E+2	1.4E+0	0.0E+0	1.4E+0	5.5E+2
Longest distance	Hawthorne	3.4E+2	2.5E+2	5.8E+2	1.4E+0	0.0E+0	1.4E+0	5.8E+2
Lowest population	Hawthorne	3.3E+2	2.5E+2	5.8E+2	1.4E+0	0.0E+0	1.4E+0	5.8E+2
Highest population	Hawthorne	1.9E-1	1.5E-1	3.4E-1	8.5E-4	0.0E+0	8.5E-4	3.4E-1
Shortest distance	Hawthorne	1.8E-1	1.5E-1	3.3E-1	8.2E-4	0.0E+0	8.2E-4	3.3E-1
Longest distance	Hawthorne	2.0E-1	1.5E-1	3.5E-1	8.3E-4	0.0E+0	8.3E-4	3.5E-1
Lowest population	Hawthorne	2.0E-1	1.5E-1	3.5E-1	8.1E-4	0.0E+0	8.1E-4	3.5E-1

8.5×10^{-4}. The impacts for these members of the public would be the same for the Proposed Action and the Shared-Use Option.

The total collective radiation dose for all workers and members of the public is estimated to range from 550 to 580 person-rem. Over 99 percent of the radiation dose is to workers, less than 1 percent of the radiation dose is to members of the public. In the exposed population of workers and members of the public, the probability of a latent cancer fatality is estimated to range from 0.33 to 0.35.

K.2.8.2 Transportation Accident Risks

This section presents the radiological transportation accident risks of shipping spent nuclear fuel and high-level radioactive waste from Hazen, Nevada to the repository for the Proposed Action and the Shared-Use Option. Transportation risks were quantified in terms of dose risk, which is the sum of the products of the probabilities (dimensionless) and consequences (collective radiation doses in units of person-rem) of all potential transportation accidents. Transportation risks were also quantified in terms of latent cancer fatalities.

Table K-49 lists the dose risks for the four rail alignments evaluated in the Rail Alignment EIS. The dose risks are estimated to range from 1.2×10^{-2} to 1.3×10^{-2} person-rem. The rail alignments that have the higher exposed populations also have the higher dose risks. Also, because the number of shipping casks transported from Mina to the repository would be the same for the Proposed Action and for the Shared-Use Option, the dose risks are the same for the Proposed Action and Shared-Use Option. In the exposed populations along the tail alignments, the probability of a latent cancer fatality is estimated to range from 7.4×10^{-6} to 7.7×10^{-6}, or about 1 chance in 100,000.

K.2.8.3 Severe Transportation Accidents

This section presents the consequences of severe transportation accidents, known as maximum reasonably foreseeable transportation accidents, that could occur during the shipment of spent nuclear fuel and high-level radioactive waste to the repository from Hazen, Nevada, for the Proposed Action and the Shared-Use Option.

Because it is not possible to forecast the atmospheric conditions that might exist during a severe accident, consequences were determined using low wind speeds and stable atmospheric conditions (a wind speed of 0.89 meters per second and Class F stability). The severe accident scenario calculation methodology does not include a probabilistic component that includes the atmospheric stability, therefore stable conditions were assumed. The atmospheric concentrations estimated from these conditions would be exceeded only 5 percent of the time.

For the four rail alignments described in Table K-31, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 542 to 589 people per square kilometer (1,400 to 1,530 people per square mile), near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (10.2 to 11.2 people per square mile).

Table K-50 lists the impacts of the maximum reasonably foreseeable accident. This accident has a frequency of about 7×10^{-7} per year. If the maximum reasonably foreseeable accident were to occur in a suburban area, the population radiation dose would be 2000 person-rem. In the exposed population, it is estimated that there could be 1.2 latent cancer fatalities. If the maximum reasonably foreseeable accident

Table K-49. Radiological transportation accident risks for the Mina rail alignment.

Rail alignment	Staging Yard location	Dose risk[a] (person-rem)	Latent cancer fatalities (LCFs)
Proposed Action and Shared-Use Option			
Highest population	Mina	1.3E-2	7.7E-6
Shortest distance	Mina	1.2E-2	7.4E-6
Longest distance	Mina	1.3E-2	7.6E-6
Lowest population	Mina	1.2E-2	7.4E-6

a. Dose risk is the sum of the products of the probabilities and consequences in person-rem of all potential transportation accidents.

Table K-50. Consequences[a] of severe accident case scenarios in suburban and rural areas for the Mina rail alignment.

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	2,000	15
Latent cancer fatalities	1.2	8.9×10^{-3}
Maximally exposed individual (rem)	34	34
Probability of latent cancer fatality	0.020	0.020
First responder radiation dose (rem)	0.14 – 2.0	0.14 – 2.0
Probability of latent cancer fatality	8.2×10^{-5} – 0.0012	8.2×10^{-5} – 0.0012

a. Consequences based on low wind speeds and stable atmospheric conditions.
b. Population density in the suburban area is 589 people per square kilometer. To convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the low population density rural area is 4.33 people per square kilometer. To convert people per square kilometer to people per square mile, multiply by 2.589988.

were to occur in a rural area, the collective radiation dose would be 15 person-rem. The probability of a latent cancer fatality in the exposed population is estimated to be 8.9E-3.

In either a suburban area or rural area, the radiation dose from the maximum reasonably foreseeable transportation accident for the maximally exposed individual located 330 meters from the accident would be 34 rem. The probability of an LCF for that individual is estimated to be 0.020.

The radiation dose to a first responder would range from 0.14 to 2.0 rem. The probability of an LCF for this first responder is estimated to range from 8.2×10^{-5} to 0.0012.

Recovering rail casks loaded with spent nuclear fuel or high-level radioactive waste would use methods commonly used to recover railcars and locomotives following accidents. The capability to lift such weights exists and would be deployed as required. Railroads use emergency response contractors with the capability to lift derailed locomotives that could weigh as much as 150 tons. Difficult recoveries of equipment as heavy as spent nuclear fuel casks have been accomplished and DOE anticipates that if such a recovery was necessary, it would be accomplished using methods and equipment similar to those used in prior difficult recoveries.

K.2.8.4 Transportation Sabotage

This section presents the consequences of a potential sabotage event for shipments of spent nuclear fuel and high-level radioactive waste to the repository from Hazen, Nevada, for the Proposed Action and the Shared-Use Option.

For the four rail alignments described in Table K-31, there were no urban areas as defined in U.S. Census Bureau population data. However, there were suburban areas and rural areas. Using alignment-specific 2000 census population data escalated to the year 2067, the average population density in suburban areas along the alignments ranged from 542 to 589 people per square kilometer (1,400 to 1,530 people per square mile), near Silver Springs, Nevada. The average population density along rural areas, escalated to the year 2067, ranged from 3.94 to 4.33 people per square kilometer (10.2 to 11.2 people per square mile).

Table K-51 lists the consequences of a potential sabotage event. The consequences would be the same for the Proposed Action and the Shared-Use Option. If the sabotage event occurred in a suburban area, the collective radiation dose is estimated to be 4,700 person-rem. In the exposed population, the number of latent cancer fatalities is estimated to be 2.8.

If the sabotage occurred in a rural area, the collective radiation dose is estimated to be 35 person-rem. In the exposed population, the risk of a latent cancer fatality is estimated to be 0.021.

If the sabotage event were to occur in either a suburban area or rural area, the maximally exposed individual would be located 100 meters (330 feet) from the sabotage event, at the location of maximum downwind air concentration. The radiation dose for the maximally exposed individual is estimated to be 27 rem. The probability of a latent cancer fatality for this individual is estimated to be 0.016.

Table K-51. Consequences of a sabotage event in suburban and rural areas – Mina rail alignment.[a]

	Suburban area[b]	Rural area[c]
Proposed Action and Shared-Use Option		
Population radiation dose (person-rem)	4,700	35
Latent cancer fatalities	2.8	0.021
Maximally exposed individual (rem)	27	27
Probability of latent cancer fatality	0.016	0.016

a. Consequences based on moderate wind speeds and neutral atmospheric conditions.
b. Population density in the suburban area is 589 people per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.
c. Population density in the low population density rural area is 4.33 per square kilometer; to convert people per square kilometer to people per square mile, multiply by 2.589988.

K.3 Transportation Topical Areas

This section discusses additional topics identified during the scoping process for the Nevada Rail Corridor SEIS, the Rail Alignment EIS, and the Repository SEIS.

K.3.1 COST OF CLEANUP

According to the Nuclear Regulatory Commission report *Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000, pp. 7 to 76), in more than 99.99 percent of accidents radioactive material would not be released from the cask. After initial safety precautions had been taken, the cask would be recovered and removed from the accident scene. Because no radioactive material would be released, based on reported experience with two previous accidents (DIRS 156110-FEMA 2000, Appendix G, Case 4 and Case 5), the economic costs of these accidents would be minimal.

For the 0.01 percent of accidents severe enough to cause a release of radioactive material from a cask, a number of interrelated factors would affect costs of cleaning up resulting radioactive contamination after the accident. Factors included are the severity of the accident and the initial level of contamination; the weather at the time and following; the location and size of the affected land area and how the land is used; the standard established for the allowable level of residual contamination following cleanup and the decontamination method used; and the technical requirements for and location for disposal of contaminated materials.

Because it would be necessary to specify each of the factors to estimate clean up costs, any estimate for a single accident would be highly uncertain and speculative. Nonetheless, to provide a gauge of the costs that could be incurred, DOE examined past studies of costs of cleanup following hypothetical accidents that would involve uncontrolled releases of radioactive materials.

A study of the impacts of transporting radioactive materials conducted by the Nuclear Regulatory Commission in 1977 estimated that costs could range from about $1 million to $100 million for a transportation accident that involved a 600-curie release of a long-lived radionuclide (DIRS 101892-NRC 1977, Table 5-11). These estimates would be about 3 times higher if escalated for inflation from 1977 to the present. In 1980, Finley et al. estimated that costs could range from about $90 million to $2 billion for a severe spent nuclear fuel transportation accident in an urban area (DIRS 155054-Finley et al 1980, Table 6-9). Sandquist et al. (DIRS 154814-Sandquist et al 1985, Table 3-7) estimated that costs could range from about $200,000 to $620 million. In this study, Sandquist estimated that contamination would affect between 0.063 to 4.3 square kilometers (16 to 1,100 acres). A study by Chanin and Murfin (DIRS 152083-Chanin and Murfin 1996, Chapter 6) estimated the costs of cleanup following a transportation accident in which plutonium would be dispersed. This study developed cost estimates for cleaning up and remediating farmland, urban areas, rangeland, and forests. The estimates ranged from $38 million to $400 million per square kilometer that would need to be cleaned up. The study also evaluated the costs of expedited cleanups in urban areas for light, moderate, and heavy contamination levels. These estimates ranged from $89 million to $400 million per square kilometer.

The National Aeronautics and Space Administration studied potential accidents for the Cassini mission, which used a plutonium powered electricity generator. The Agency estimated costs of cleaning up radioactive material contamination on land following potential launch and reentry accidents. The estimate for the cost following a launch accident ranged from $7 million to $70 million (DIRS 155551-NASA 1995, Chapter 4) with an estimated contaminated land area of about 1.4 square kilometers (350 acres). The Agency assumed cleanup costs would be $5 million per square kilometer if removal and disposal of contaminated soil were not required and $50 million per square kilometer if those activities were required. For a reentry accident that would occur over land, the study estimated that the contaminated land area could range from about 1,500 to 5,700 square kilometers (370,000 to 1.4 million acres) (DIRS 155551-NASA 1995, Chapter 4) with cleanup costs possibly exceeding a total of $10 billion. In a more recent study of potential consequences of accidents that could involve the Cassini mission, NASA estimated that costs could range from $7.5 million to $1 billion (DIRS 155550-NASA 1997, Chapter 4). The contaminated land area associated with these costs ranged from 1.5 to 20 square kilometers (370 to 4,900 acres). As in the 1995 study, these estimates were based on cleanup costs in the range of $5 million to $50 million per square kilometer.

Using only the estimates provided by these studies, the costs of cleanup following a severe transportation accident involving spent nuclear fuel where radioactive material was released could be in the range from $300,000 (after adjusting for inflation from 1985 to the present) to $10 billion. Among the reasons for this wide range are different assumptions made regarding the factors that must be considered: 1) the severity of the assumed accident and resulting contamination levels, 2) accident location and use of affected land areas, 3) meteorological conditions, 4) cleanup levels and decontamination methods, and 5) disposal of contaminated materials. However, the extreme high estimates of costs are based on assumptions that all factors combine in the most disadvantageous way to create a “worst case.” Such worst cases are not reasonably foreseeable. Conversely, estimates as low as $300,000 may also not be realistic for all of the direct and indirect costs of cleaning up following an accident severe enough to cause a release of radioactive materials.

To gauge the range of costs that it could expect for severe accidents in transporting spent nuclear fuel to a Yucca Mountain repository, DOE considered the amount of radioactive material that could be released in the maximum reasonably foreseeable accident and compared this to the estimates of releases used by the various studies discussed above. During the maximum reasonably foreseeable accident, about 30 curies (mostly cesium) would be released. This is about 50 times less than used by Sandquist in his study (1,630 curies) and 20 times less than the release used in the estimates provided by the Nuclear Regulatory Commission in 1977 (600 curies). The estimated frequency for an accident this severe to occur is about 6 or 7 times in 10 million years. Based on the prior studies (where estimated releases exceeded those estimated in this appendix for a maximum reasonably foreseeable accident) and the amount of radioactive material that could be released in a maximum reasonably foreseeable accident, the Department believes that the cost of cleaning up following such an accident could be a few million dollars. Nonetheless, as stated above, the Department also believes that estimates of such costs contain great uncertainty and are speculative; they could be less or 10 times greater depending on the contributing factors.

For perspective, the current insured limit of responsibility for an accident involving releases of radioactive materials to the environment is $10.26 billion (see Appendix L).

Opposing View: Costs of Cleanup

The State of Nevada has provided analyses that assert that the costs of cleanup could be much higher than the estimates discussed in the Rail Alignment EIS, up $189.7 billion for accidents involving rail casks (DIRS 181756-Lamb, Resnikoff and Moore 2001, p. 48) and up to $299.4 billion for sabotage involving a rail cask (DIRS 181892-Lamb, Hintermann and Resnikoff 2002, p. 15).

DOE believes that these extremely high estimates of costs are based on assumptions that all factors combine in the most disadvantageous way to create a “worst case.” Such worst cases are not reasonably foreseeable.

K.3.2 UNIQUE LOCAL CONDITIONS

In scoping comments on the Rail Alignment EIS, the State of Nevada stated that the unique local conditions in Nevada require special consideration in the transportation accident analysis. In the Rail Alignment EIS, DOE does analyze a range of accidents that reflect the range of reasonably foreseeable “real-life conditions.” Real-life conditions that would involve various types of collisions, various natural disasters, specific locations (such as mountain passes), or various infrastructure accidents (such as track failure) in effect constitute a combination of cask failure mechanisms, impact velocities, and temperature ranges, which the Rail Alignment EIS does evaluate. Because it is impossible to predict what real-life conditions might be involved in any accidents that could occur, DOE has described the maximum reasonably foreseeable accident in terms of cask failure mechanisms and accident forces, and to ensure that the analysis accounts for all reasonably foreseeable real-life conditions. Accident scenarios are modeled in this fashion to accommodate the almost infinite number of variables that any given accident could involve.

K.3.3 COMPREHENSIVE RISK ASSESSMENT

The State of Nevada recommended that comprehensive risk assessment should be used as a substitute for probabilistic risk assessment in the transportation analysis.

The methods used to calculate transportation impacts are state-of-the-art. As a consequence, DOE believes that the Rail Alignment EIS adequately analyzes the environmental impacts that could result from shipping spent nuclear fuel and high-level waste. DOE believes the Rail Alignment EIS fulfills all legal obligations required for an EIS and a "comprehensive risk assessment" is neither required nor necessary.

K.3.4 USE OF NUREG/CR-6672 TO ESTIMATE ACCIDENT RELEASES

The evaluations of the radiological impacts of transportation accidents presented in the Yucca Mountain FEIS (DIRS 155970-DOE 2002, Chapter 6) are based on data presented in NUREG/CR-6672 *Reexamination of Spent Nuclear Fuel Shipment Risk Estimates* (DIRS 152476-Sprung et al. 2000) on conditional probabilities for the occurrence of severe accidents and on corresponding fractions of cask contents that could be released in such accidents.

In September of 1977, the Nuclear Regulatory Commission (NRC or the Commission) issued a generic EIS (*Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170 [DIRS 101892-NRC 1977]). That EIS addressed environmental impacts associated with the transport of all types of radioactive material by all transport modes (road, rail, air, and water), and provided the basis under NEPA for the NRC to issue general licenses for transportation of radioactive material under 10 CFR 71. Based in part on the findings of NUREG-0170, the Commission concluded that "present regulations are adequate to protect the public against unreasonable risk from the transport of radioactive materials" (46 *Federal Register* 21629, April 13, 1981) and stated that "regulatory policy concerning transportation of radioactive materials be subject to close and continuing review."

In 1996 the NRC decided to reexamine the risks associated with the shipment of spent power reactor fuel by truck and rail to determine whether the estimates of environmental impacts in NUREG-0170 remained valid. According to the Commission, the reexamination was initiated (1) because many spent fuel shipments are expected to be made during the next few decades, (2) because these shipments will be made to facilities along routes and in casks not specifically examined by NUREG-0170, and (3) because the risks associated with these shipments can be estimated using new data and improved methods of analysis. In 2000, the Commission published the results of the reexamination in a report prepared by the Sandia National Laboratories, *Reexamination of Spent Nuclear Fuel Shipment Risk Estimates* (NUREG/CR-6672).

Some have been critical of NUREG/CR-6672; for example, see *Review of NUREG/CR-6672, Reexamination of Spent Fuel Shipment Risk Estimates* (DIRS 181884-Lamb and Resnikoff 2000, all) and *Worst Case Credible Nuclear Transportation Accidents: Analysis for Urban and Rural Nevada* (DIRS 181756-Lamb, Resnikoff, and Moore 2001, Appendix A). However, the Commission has stated that many of the purported methodological flaws appear to be related to differing views regarding assumptions and that critical comments do not appear to recognize that many of the assumptions used overstated risks (DIRS 181603-Shankman 2001).

Supporting the NRC's assessment, in its review of NUREG/CR-6672 (see *Going the Distance? The Safe Transport of Spent Nuclear and High-Level Radioactive Waste in the United States* [DIRS 182032-National Research Council 2006]), the National Academy of Sciences Committee on Transportation of Radioactive Waste noted that the conservative assumptions used were reasonable for producing bounding estimates of accident consequences.

Conversely, the Committee indicated less confidence regarding the analysis of overall transport risks presented in the report. Here the Committee noted that the truck and rail routes used in the analyses were based on realistic, not bounding, characteristics. The Committee considered "many other uncertainties" and ultimately concluded that the overall results of the “Sandia analyses are likely to be neither realistic nor bounding and ‘probably’ overestimate transport risks.”

Based on the review by the National Academy of Sciences and NRC comments, DOE has concluded that NUREG/CR-6672 represents the best available information for use in estimating the consequences of transportation accidents involving spent nuclear fuel and high-level waste and has used NUREG/CR-6672 in the Rail Alignment EIS.

K.4 Glossary

absorbed dose	A measure of the energy deposited in a medium by ionizing radiation. It is equal to the energy deposited per unit mass of medium
alpha particle	A positively charged particle ejected spontaneously from the nuclei of some ***radioactive*** elements. It is identical to a helium ***nucleus*** and has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). See ***ionizing radiation.***
atomic number	The number of ***protons*** in an atom's ***nucleus***.
beta particle	A negatively charged ***electron*** or positively charged positron emitted from a ***nucleus*** during ***decay***. Beta decay usually refers to a ***radioactive*** transformation of a ***nuclide*** by electron emission, in which the ***atomic number*** increases by 1 and the mass number remains unchanged. In positron emission, the atomic number decreases by 1 and the mass number remains unchanged. See ***ionizing radiation.***
burnup	The total energy released per initial unit mass of nuclear fuel as a result of irradiation. The commonly used units of burnup are megawatt-days per metric ton of heavy metal (MWd/MTHM).
collective dose	See ***population dose***.
committed effective dose equivalent	Dose delivered to specified organs or tissues over a specified period of time following an acute intake of a radionuclide by ingestion, inhalation, or dermal absorption. Time period over which committed doses are calculated normally is 50 year for intakes by adult or from age at intake to age 70 for intakes by other age groups.
conditional probability	the probability of an accident of a given severity category, given that an accident occurs.
cosmic radiation	A variety of high-energy particles including ***protons*** that bombard the Earth from outer space. They are more intense at higher altitudes than at sea level, where the Earth's atmosphere is most dense and provides the greatest protection.
decay (radioactive)	The process in which one ***radionuclide*** spontaneously transforms into one or more different radionuclides called ***decay products***.
decay product	A ***nuclide*** resulting from the radioactive decay of a parent isotope or precursor nuclide.
decay time	The time since the spent nuclear fuel has been discharged from the reactor.

dose (radioactive)	The amount of ***radioactive*** energy taken into (absorbed by) living tissues. See ***effective dose equivalent***.
dose equivalent	(1) The number (corrected for background) zero and above that is recorded as representing an individual's ***dose*** from external ***radiation*** sources or internally deposited ***radioactive*** materials; (2) the product of the absorbed dose in ***rads*** and a quality factor; (3) the product of the absorbed dose, the quality factor, and any other modifying factor. The ***dose equivalent*** quantity is used for comparing the biological effectiveness of different kinds of radiation (based on the quality of radiation and its spatial distribution in the body) on a common scale; it is expressed in ***rem***.
dose rate	The ***dose*** per unit time.
effective dose equivalent	Often referred to simply as ***dose***, it is an expression of the ***radiation*** dose received by an individual from external radiation and from ***radionuclides*** internally deposited in the body.
electron	A stable elementary particle that is the negatively charged constituent of ordinary matter.
enrichment	The fraction of atoms of a specified isotope in a mixture of isotopes of the same element when this fraction exceeds that in the naturally occurring mixture. By convention, uranium enrichment is given on a weight basis.
gamma ray	The most penetrating type of radiant nuclear energy. It does not contain particles and can be stopped by dense materials such as concrete or lead. See ***ionizing radiation.***
hormesis	A dose response phenomenon characterized by a low dose stimulation, high dose inhibition, resulting in either a J-shaped or an inverted U-shaped dose response.
ion	An atom or group of atoms that carries a positive or negative charge as a result of having lost or gained one or more electrons.
ionizing radiation	(1) ***Alpha particles***, ***beta particles***, ***gamma rays***, ***X-rays***, ***neutrons***, high-speed ***electrons***, high-speed ***protons***, and other particles capable of producing ions. (2) Any ***radiation*** capable of displacing electrons from an atom or molecule, thereby producing ions.
irradiation	***Exposure*** to ***radiation***.
millirem	A unit of radiation dose that is equivalent to one one-thousandth of a rem.
neutron radiation	See ***ionizing radiation***.
nucleus	The central, positively charged, dense portion of an atom. Also known as ***atomic nucleus***.
nuclide	An atomic ***nucleus*** specified by its ***atomic weight***, ***atomic number***, and energy state; a ***radionuclide*** is a ***radioactive*** nuclide.
person-rem	A unit used to measure the ***radiation exposure*** to an entire group and to compare the effects of different amounts of radiation on groups of people; it is the product of the average ***dose equivalent*** (in ***rem***) to a given organ or tissue multiplied by the number of persons in the population of interest.

photon	Quantum of electromagnetic radiation, having no charge or mass, that exhibits both particle and wave behavior, such as a ***gamma*** or ***x-ray***.
proton	An elementary particle that is the positively charged component of ordinary matter and, together with the ***neutron***, is a building block of all ***atomic*** nuclei.
population dose	A summation of the ***radiation doses*** received by individuals in an exposed population; equivalent to ***collective dose***; expressed in ***person-rem***.
rad	A unit of absorbed radiation dose in terms of energy. One rad equals 100 ergs of energy absorbed per gram of tissue.
radiation	The emitted particles or ***photons*** from the nuclei of radioactive atoms. Some elements are naturally ***radioactive***; others are induced to become radioactive by ***irradiation*** in a reactor. Naturally occurring radiation is indistinguishable from induced radiation.
radioactive	Emitting ***radioactivity***.
radionuclide	See ***nuclide***.
release fraction	The fraction of material released during an accident.
rem	A unit of ***dose equivalent***. The dose equivalent in rems equals the absorbed dose in ***rads*** in tissue multiplied by the appropriate quality factor and possibly other modifying factors. Derived from roentgen equivalent man, referring to the dosage of ionizing ***radiation*** that will cause the same biological effect as one roentgen of ***X-ray*** or ***gamma ray*** exposure. One rem equals 0.01 sievert.
source term	Types and amounts of ***radionuclides*** that are the source of a potential release of ***radioactivity***.
subatomic particles	Any particle smaller than an atom.
total dose	The radiation dose to an individual or a group of people.
X-rays	Penetrating electromagnetic ***radiation*** having a wavelength much shorter than that of visible light. X-rays are identical to ***gamma rays*** but originate outside the ***nucleus***, either when the inner orbital ***electrons*** of an excited atom return to their normal state or when a metal target is bombarded with high-speed electrons.

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APPENDIX L

SUPPLEMENTAL TRANSPORTATION INFORMATION

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SUPPLEMENTAL TRANSPORTATION INFORMATION

L.1 Introduction

The U.S. Department of Energy (DOE or the Department) developed this appendix to provide general background information on transportation-related topics. Although this information is not essential for analysis of potential impacts from the transportation of spent nuclear fuel and high-level radioactive waste to a repository at Yucca Mountain, Nevada, it will help readers to understand how the transportation system would operate within the regulatory framework for the transportation of these materials. Section L.2 discusses transportation regulations, Section L.3 describes the components of a transportation system, and Section L.4 discusses operational practices. Section L.5 describes cask safety and testing. Section L.6 discusses emergency response, and Section L.7 describes available assistance for state, local, and American Indian tribal governments for emergency response planning. Section L.8 discusses DOE plans for transportation security, and Section L.9 describes potential liability under the Price-Anderson Act.

Spent nuclear fuel is fuel that has been withdrawn from a nuclear reactor following irradiation, the component elements of which have not been separated by reprocessing. In this document, the term refers to the special nuclear material, byproduct material, source material, and other radioactive materials associated with fuel assemblies and includes commercial spent nuclear fuel (including mixed-oxide fuel) from civilian nuclear power reactors, and DOE spent nuclear fuel from DOE and non-DOE production reactors, naval reactors, test and experimental reactors, and research reactors. Naval spent nuclear fuel shipments to the repository would be conducted under the authority of Presidential Executive Order 12344 and Public Law 106-65 and would be in compliance with applicable sections of the Code of Federal Regulations (CFR).

Most nuclear power reactors use solid uranium dioxide ceramic pellets of low-enriched uranium for fuel. The pellets are sealed in strong metal tubes, which are bundled together to form a nuclear fuel assembly. Depending on the type of reactor, typical fuel assemblies can be as long as 4.9 meters (16 feet) and weigh up to 540 kilograms (1,200 pounds). After a period in a reactor, the fuel is no longer efficient for the production of power and the assembly is removed from the reactor. After removal, the assembly (now called spent nuclear fuel) is highly radioactive and requires heavy shielding and remote handling to protect workers and the public.

High-level radioactive waste is the highly radioactive material that resulted from the reprocessing of spent nuclear fuel; it includes liquid waste that was produced directly in reprocessing and any solid material from such liquid waste that contains fission products in sufficient concentrations. High-level radioactive waste also includes other highly radioactive material that the U.S. Nuclear Regulatory Commission (NRC), consistent with existing law, has determined by rule to require permanent isolation. Immobilized surplus weapons-usable plutonium is part of the high-level radioactive waste inventory. All high-level radioactive waste would be in a solid form before DOE would ship it to Yucca Mountain.

L.2 Transportation Regulations

The shipment of spent nuclear fuel and high-level radioactive waste is highly regulated. For transportation of these materials to Yucca Mountain, DOE would meet or exceed U.S. Department of Transportation and NRC rules. DOE would also work with states, local government officials, federally recognized American Indian tribes, utilities, the transportation industry, and other interested parties in a cooperative manner to develop the transportation system.

The Hazardous Materials Transportation Act, as amended (49 United States Code [U.S.C.] 1801 *et seq.*), directs the U.S. Department of Transportation to develop transportation safety standards for hazardous materials, including radioactive materials. Title 49 of the Code of Federal Regulations contains U.S. Department of Transportation standards and requirements for the packaging, transporting, and handling of radioactive materials for all modes of transportation. NRC sets additional design and performance standards for packages that carry materials with higher levels of radioactivity.

The Nuclear Waste Policy Act, as amended (42 U.S.C. 10101 *et seq.*; NWPA), requires that all shipments of spent nuclear fuel and high-level radioactive waste to Yucca Mountain be in NRC-certified casks and in accordance with NRC regulations related to advance notification of state and local governments. In addition, DOE has committed to notification of American Indian tribal governments for these shipments (DIRS 171934-DOE 2002, p. 23). NRC rules do not require notification of local authorities, which is the responsibility of the individual state governments. This section discusses the key regulations that govern the transportation of spent nuclear fuel and high-level radioactive waste.

L.2.1 PACKAGING

The primary means for the protection of people and the environment during radioactive materials shipment is the use of radioactive materials packages that meet U.S. Department of Transportation and NRC requirements. Packages are selected based on activity, type, and form of the material to be shipped. All spent nuclear fuel and high-level radioactive waste shipments to Yucca Mountain would be in Type B casks, which have the most stringent design standards to prevent release of radioactive materials under normal conditions of transport and during hypothetical accidents (Section L.4.10 discusses accident conditions). NRC regulates and certifies the design, manufacture, testing, and use of Type B packages under regulations in 10 CFR Part 71. All shippers must properly package radioactive materials so that external radiation levels do not exceed regulatory limits. The packaging protects handlers, transporters, and the public from exposure to dose rates in excess of recognized safe limits. Regulations in 10 CFR 71.47 and 49 CFR 173.441 prescribe the external radiation standards for all packages. For shipments to the repository, the limiting radiation dose limit would be 10 millirem per hour at any point 2 meters (6.6 feet) from the outer edge of the railcar or truck trailer.

L.2.2 MARKING, LABELING, AND PLACARDING

U.S. Department of Transportation regulations in 49 CFR require that shippers meet specific hazard communication requirements in marking and labeling packages that contain radioactive materials and other hazardous materials. Markings, labels, and placards identify the hazardous contents to emergency responders in the event of an incident.

Markings provide the proper shipping name, a four-digit hazardous materials number, the shipper's name and address, gross weight, and type of packaging; other important information labels on opposite sides of a package identify the contents and radioactivity level. Shippers of radioactive materials use one of three labels—Radioactive White I, Yellow II, or Yellow III—as shown in Figure L-1. The use of a particular label is based on the radiation level at the surface of the package and the transport index. The transport index, determined in accordance with 49 CFR 173.403, is a number on the label of a package that indicates the degree of control the carrier must exercise during shipment. Packaging that previously contained Class 7 (radioactive) materials and has been emptied of its contents as much as practicable is exempted from marking requirements. However, 49 CFR 173.428 requires the application of an Empty label (not shown) to the cask.

Figure L-1 also shows a Fissile label, which shippers must apply to each package with fissile material (a material that is capable of sustaining a chain reaction of nuclear fission). Such labels, where applicable, must be affixed adjacent to the labels for radioactive materials. The Fissile label includes the Criticality Safety Index, which indicates how many fissile packages can be grouped together on a conveyance.

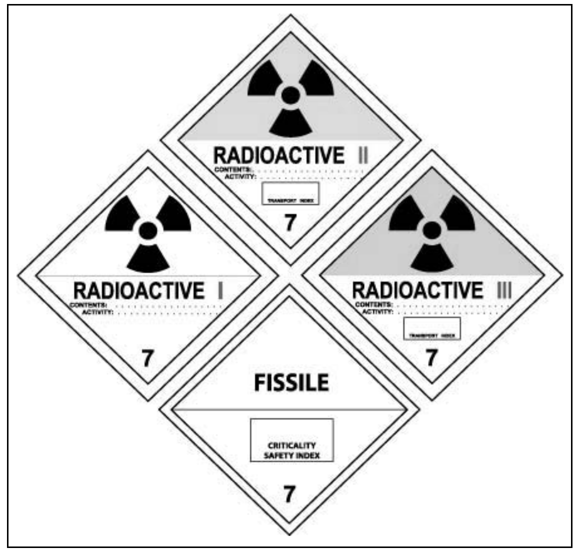

Figure L-1. Radioactive material shipment labels.

Shipments of spent nuclear fuel and high-level radioactive waste are usually classified as Highway Route-Controlled Quantities of Radioactive Materials, and 49 CFR 172.403(c) requires Radioactive Yellow-III labels for them regardless of the radiation dose rate. For Radioactive Yellow III shipments, 49 CFR 172.504 requires radioactive hazard communication placards (Figure L-2) on each side and each end of a freight container, transport vehicle, or railcar. In addition, for Highway Route-Controlled Quantities of Radioactive Materials shipments the placard must be on a white square background with a black border (49 CFR 172.507 through 172.527). In addition to the placard, a vehicle might have a United Nations Identification Number near the placard. The United Nations assigns these four-digit numbers, which shippers commonly use throughout the world to aid in the quick identification of materials in bulk containers. The number appears on either an orange plane or on a plain white square-on-point configuration similar to a placard. The usual identification number for spent nuclear fuel is UN3328.

Figure L-2. Radioactive hazard communication placard.

L.2.3 SHIPPING PAPERS

The shipper prepares shipping papers and gives them to the carrier. These documents contain additional details about the cargo and include a signed certification that the material is properly classified and in proper condition for transport. Shipping papers also contain emergency information that includes contacts and telephone numbers. Highway carriers must keep shipping papers readily available during transport for inspection by appropriate officials such as state or federal inspectors.

L.2.4 ROUTING

U.S. Department of Transportation regulations classify spent nuclear fuel and high-level radioactive waste as Highway Route-Controlled Quantities of Radioactive Materials shipments. Carriers of these materials are required to use preferred routes, which include interstate highway systems or alternative routes selected by state or tribal routing authorities in accordance with U.S. Department of Transportation regulations. Preferred routes generally use beltways and bypasses around cities to avoid highly populated urban centers.

States and tribes can designate alternative preferred routes by following U.S. Department of Transportation regulations for designation and performing a comparative route analysis that adequately considers overall risk to the public. Factors for the analysis can include accident rates, traffic counts, distance, vehicle speeds, population density, land use, timeliness, and availability of emergency response capabilities. States must also document required consultation with affected neighboring jurisdictions. U.S. Department of Transportation highway routing regulations preempt any conflicting routing requirements that state, local, or tribal governments might issue, such as prohibitions on radioactive waste shipments through local nuclear-free zones.

No federal routing rules govern spent nuclear fuel and high-level radioactive waste shipments by rail. Because railroads are privately owned and operated, route selection would involve discussions between DOE and the chosen railroad companies and other stakeholders. Key factors for selection of rail routes include time and distance in transit, the track class and capacity, operational input from carriers, and infrastructure capabilities.

The U.S. Department of Homeland Security and U.S. Department of Transportation issued rulemaking proposals in relation to railroad routing for radioactive materials shipments for security purposes on December 21, 2006; Section L.2.9 discusses the proposals.

L.2.5 ADVANCE NOTIFICATION

DOE Manual 460.2-1, *Radioactive Material Transportation Practices* (DIRS 171934-DOE 2002, all), which implements DOE Order 460.1B, Packaging and Transportation Safety, and NRC regulations (10 CFR 71.97 and 73.37), requires written notice to governors, or their designees, before shipment of spent nuclear fuel and high-level radioactive waste through their states. If sent by regular mail, the notice must be postmarked at least 7 days before the shipment; for messenger service, it must arrive 4 days before. The notification must contain the name, address, and telephone number of the shipper, the carrier, and the receiver; a description of the shipment; a list of the routes within the state; the estimated date and time of departure from the point of origin; the estimated date and time of entry into the state; and a statement on safeguarding schedule information. Federal regulations allow states to release certain advance information to local officials on a need-to-know basis. As required by Section 180 of the NWPA, all shipments to a repository would comply with NRC regulations on advance notification of state and local governments. In the event of a change in schedule that differs more than 6 hours from what was in the notification to the governor or their designee, DOE would provide the state with the new schedule by telephone. Although current regulations do not require notification of tribal authorities, DOE policy is to inform tribes of spent nuclear fuel and high-level radioactive waste shipments that would pass through their jurisdictions (DIRS 171934-DOE 2002, p. 23).

NRC issued an Advance Notice of Proposed Rulemaking (64 *Federal Register* [*FR*] 71331) on December 21, 1999, to invite early input from affected parties and the public on advance notification to American Indian tribes of spent nuclear fuel and high-level waste shipments. Although the Commission approved a rulemaking plan, it put the rulemaking on hold pending review of Commission rules in response to the events of September 11, 2001. NRC is coordinating the schedule for this rulemaking with other security rulemaking activities. The current schedule would result in a proposed rule in about 2010.

L.2.6 RAILROAD SAFETY PROGRAM

The Rail Safety Act of 1970 (Public Law 91-458) authorized states to work with the Federal Railroad Administration to enforce federal railroad safety regulations. States can enforce federal standards for track, signal and train control, motive power and equipment, and operating practices. In 1992, the State Safety Participation regulations (49 CFR Part 212) were revised to permit states to perform hazardous materials inspections of rail shipments. The Grade Crossing Signal System Safety regulations (49 CFR Part 234) were revised to authorize federal and state signal inspectors to ensure that railroad owners or operators were properly testing, inspecting, and maintaining automated warning devices at grade crossings. Before state participation can begin, each state agency must enter into a multiyear agreement with the Federal Railroad Administration for the exercise of specified authority. This agreement can delegate investigative and surveillance authority in relation to all or any part of federal railroad safety laws.

L.2.7 PERSONNEL TRAINING

U.S. Department of Transportation regulations require proper training for anyone involved in the preparation or transportation of hazardous materials, including radioactive materials. In accordance with 49 CFR Part 397, Subpart D, operators of vehicles that transport Highway Route-Controlled Quantities of Radioactive Materials receive special training that covers the properties and hazards of the materials, associated regulations, and applicable emergency procedures. In addition, DOE Orders require that driver or crew training covers operation of the specific package tie-down systems, cask recovery procedures, use of radiation detection instruments, use of satellite tracking systems and other communications equipment, adverse weather and safe parking procedures, public affairs awareness, first responder awareness (29 CFR 1910.120 [q]), and radiation worker "B" (or equivalent) training.

The U.S. Department of Transportation also requires training specific to the mode of transportation. Highway carriers are responsible for the development and maintenance of a qualification and training program that meets Department of Transportation requirements. Rail carriers must comply with Federal Railroad Administration regulations. Rail carriers are responsible for training and qualification of their crews, which includes application of 49 CFR Part 240 for locomotive engineer certification. If DOE decided to provide federal rail crews for waste shipments on the national rail system, the carriers would require a pilot, who would be an engineer familiar with the rail territory, unless the federal engineer was qualified on that route. The Federal Railroad Administration requires recurrent and function-specific training for personnel who perform specific work, such as train crews, dispatchers, and signal maintainers. In addition, the regulations require that each employee receives training that specifically addresses the job function.

L.2.8 OTHER REQUIREMENTS

Organizations that represent different transportation modes often establish mode-specific standards. For example, all North American shipments by rail that change carriers must meet Association of American Railroads interchange rules. Equipment in interchanges must also meet the requirements of the *Association of American Railroads Field Manual of the A.A.R. Interchange Rules* (DIRS 175727-AAR 2005, all).

On May 1, 2003, the Association released Standard S-2043, *Performance Specification for Trains Used To Carry High-Level Radioactive Material* (DIRS 166338-AAR 2003, all) to establish performance guidelines and specifications for trains that carry spent nuclear fuel or high-level radioactive waste. These guidelines apply to the individual railcars within the train, and they promote communication between railroads, spent nuclear fuel and high-level radioactive waste shippers, and railcar suppliers. The objectives of this standard are (1) to provide a cask, railcar, and train system that ensures safe transportation of casks in the railroad operating environment and allows timetable speeds with limited restrictions and (2) to use the best available technology to minimize the chances of derailment in transportation. This standard reflects the current technical understanding of the railroad industry in relation to optimum vehicle performance through application of current and prospective new railcar technologies. On December 20, 2005, the Association adopted two appendixes to AAR S-2043: Appendix A, "Maintenance Standards and Recommended Practices for Trains Used To Carry High-Level Radioactive Material," and Appendix B, "Operating Standard for Trains Used To Carry High-Level Radioactive Material" (DIRS 166338-AAR 2003, all). Changes and additions to this standard can be expected as specific vehicles are developed. All future changes will be based on the achievement of optimum performance within acceptable expectations for safe operations.

Association of American Railroads Circular No. OT-55, *Recommended Railroad Operating Practices for Transportation of Hazardous Materials* (DIRS 155658-AAR 2000, all), provides recommendations on operating practices that are adopted by Association of American Railroads and American Short Line and Regional Railroad Association members in the United States for these shipments. The current revision of the circular became effective July 17, 2006; its recommendations cover road operating practices, yard operating practices, storage and separation distances, transportation community awareness and emergency response program implementation, criteria for shipper notification, time-sensitive materials, and special provisions for spent nuclear fuel and high-level radioactive waste.

The Commercial Vehicle Safety Alliance has developed inspection procedures and out-of-service criteria for commercial highway vehicles that transport shipments of transuranic elements and Highway Route-Controlled Quantities of Radioactive Materials shipments (Section L.4.9). Under these procedures, each state through which a shipment passed would inspect each shipment to the repository, and a shipment would not begin or continue until inspectors determined that the vehicle and its cargo were free of defects.

Trucks that carry spent nuclear fuel or high-level radioactive waste and weigh over 36,300 kilograms (80,000 pounds) would exceed federal commercial vehicle weight limits for nondivisible loads (which cannot be separated into smaller loads). Most states require transportation companies to obtain permits when their vehicles exceed weight limits to control time and place of movement. Local jurisdictions also often require overweight permits. The criteria for the permitting process are not uniform among different jurisdictions. A number of factors affect issuance of these permits including traffic volumes and patterns, protection of state highways and structures such as bridges, zoning and general characteristics of the route, and safety of the motoring public.

L.2.9 PROPOSED RAIL REGULATIONS

The U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration, in consultation with the Federal Railroad Administration, has proposed revision of the current requirements in the Hazardous Materials Regulations applicable to the safe and secure transportation of hazardous materials by rail at 49 CFR Parts 172 and 174 (71 *FR* 76834; December 21, 2006). The proposed rulemaking includes "Radioactive Materials" and "Class 7- Highway Route-Controlled Quantities of Radioactive Materials." The proposal would require rail carriers to compile annual data on specified shipments of hazardous materials, to use the data to analyze safety and security risks along rail transportation routes where those materials are transported, to assess alternative routes, and to make routing decisions based on those assessments. The Pipeline and Hazardous Materials Safety Administration has also proposed clarifications of the current security plan requirements to address en route storage, delays in transit, delivery notification, and additional security inspection requirements for hazardous materials shipments.

The Transportation Security Administration has proposed new security requirements for 49 CFR Parts 1520 and 1580 for freight railroad carriers; intercity, commuter, and short-haul passenger train service providers; rail transit systems; and rail operations at certain, fixed-site facilities that ship or receive specified hazardous materials by rail (71 *FR* 76852; December 21, 2006). The proposal would codify the scope of the existing inspection program and require regulated parties to allow Transportation Safety Administration and Department of Homeland Security officials to enter, inspect, and test property, facilities, and records relevant to rail security. This proposed rule would also require regulated parties to designate rail security coordinators and to report significant security concerns to the Department of Homeland Security.

In addition, the Transportation Security Administration has proposed that freight rail carriers and certain facilities that handle hazardous materials be able, on request, to report location and shipping information to the Administration and that they should implement chain-of-custody requirements to ensure a positive and secure exchange of specified hazardous materials (71 *FR* 76852, December 21, 2006). The proposal would clarify and extend the sensitive security information protections to cover certain information associated with rail transportation.

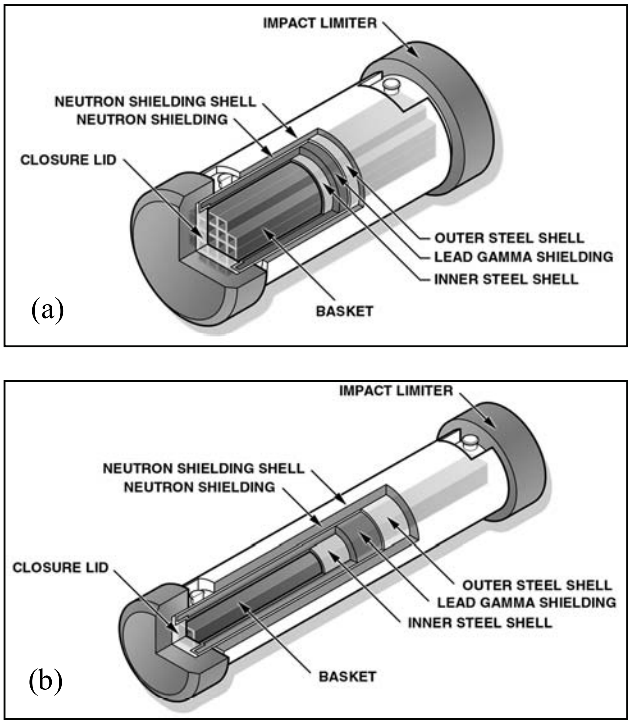

Figure L-3. Generic rail cask (a) and truck cask (b) for spent fuel.

L.3 Transportation System Components

The DOE transportation system would consist of hardware (shipping containers, handling equipment, railcars, and truck trailers), a transportation operations center, a Cask Maintenance Facility, and the Nevada rail line.

L.3.1 SHIPPING CONTAINERS

As required by the NWPA, the designs of the shipping casks for transportation of the spent nuclear fuel and high-level radioactive waste would be NRC-certified. The casks would be sealed containers that could weigh up to 180 metric tons (200 tons). The casks would consist of layers of steel and lead or other materials, which would provide shielding against the radiation from the waste and prevent the materials from escaping to the environment in the event of an incident.

The open end of the cylindrical cask would be sealed with a heavy lid. Impact limiters on each end of the cask would absorb most of the impact force and provide protection of the container and its contents in the event of an incident. Figure L-3 illustrates generic rail and truck casks.

DOE would procure NRC-certified casks from private industry. As required by Section 137 of the NWPA, DOE would use private industry to the fullest extent possible for each aspect of transportation. The Department has a preference for maximizing the use of existing cask designs rather than developing new ones. Existing cask designs would have to be modified to accommodate TAD canisters before NRC certification.

L.3.2 RAILCARS

The trains DOE would use to transport spent nuclear fuel and high-level radioactive waste to the repository would typically use locomotives, escort cars, one or more loaded cask railcars, and buffer railcars that would separate the cask railcars from occupied locomotives and escort railcars.

L.3.3 TRANSPORTATION OPERATIONS CENTER

The functions of a transportation operations center would include coordination between shipping sites and the repository, planning and scheduling of shipments, coordination with carriers, notifications to states and American Indian tribes, monitoring and tracking of shipments, en route communications, emergency management, and security coordination.

L.3.4 CASK MAINTENANCE FACILITY

Owners of rail and highway transportation casks and the associated equipment (for example, personnel barriers and impact limiters) must maintain them in proper condition to satisfy the requirements in their NRC certificates of compliance. The Cask Maintenance Facility would periodically remove casks from service and perform maintenance and inspection. The activities at the Cask Maintenance Facility would include but not be limited to testing, repair, minor decontamination, and approved modifications. The Cask Maintenance Facility would also serve as the primary recordkeeping facility for the cask fleet equipment.

L.3.5 TRANSPORT SERVICES

The U.S. freight railroad system consists of seven Class 1 railroads (mainline), 31 regional railroads, and over 500 local railroads (line-haul railroads smaller than regional railroads). Some origin sites of spent nuclear fuel and high-level radioactive waste have rail services, while others do not. DOE would use short-line or Class 1 railroads to transport casks from the origin sites. There are numerous short-line railroads that operate one or more relatively small sections of track that connect to the Class 1 rail network. Origin sites without rail service would require alternative intermodal delivery from the origin site to a nearby rail transfer facility, either by barge using a nearby dock or by heavy-haul truck using local highways.

At some sites with limited cask handling capability, DOE could use overweight trucks for smaller casks. After loading and preparation, DOE would pick up the cask and deliver it directly to the repository using the public highway network.

DOE would construct a branch rail line to transport casks from a Union Pacific mainline railroad in Nevada to the repository site, and the Department would contract the operation and maintenance of the branch rail line.

L.4 Operational Practices

DOE has adopted as policy the practices that were developed in consultation with stakeholders and are outlined in DOE Manual 460.2-1 (DIRS 171934-DOE 2002, all). The Manual establishes 14 standard transportation practices for Departmental programs to use in the planning and execution of shipments of radioactive materials including radioactive waste. It provides a standardized process and framework for planning and for interacting with state and tribal authorities and transportation contractors and carriers.

L.4.1 STAKEHOLDER INTERACTIONS

The Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions (DIRS 172433-DOE 2003, all) guides state and tribal government interactions, some of which are already underway. During planning and actual transportation operations, stakeholders are and would be involved in planning for route identification, funding approaches for emergency response planning and training, understanding safeguards and security requirements, operational practices, communications, and information access.

DOE is working collaboratively with states through State Regional Group committees, whose members are state officials responsible for transportation policy, law enforcement, emergency response, and oversight of hazardous materials shipments, and with American Indian tribal governments to assist them to prepare for the shipments.

In addition to coordination with State Regional Groups and tribal governments, a national cooperative effort is underway as part of the Transportation External Coordination Working Group, which involves a broad range of stakeholder organizations that routinely interact with DOE to provide input and recommendations on transportation planning and program information. DOE works with states, tribes, and industry to guide and focus emergency training, coordination with local officials, and other activities to prepare for shipments to the repository.

DOE is preparing a comprehensive national spent fuel transportation plan that accommodates stakeholder concerns to the extent practicable. The plan will outline the challenges and strategies for the development and implementation of the system required to transport the waste to Yucca Mountain.

L.4.2 ROUTE PLANNING PROCESS

An initial step in the planning process to ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain is to identify a national suite of routes, both rail and highway. Stakeholder groups in the DOE program are participating in this process by examining potential routing criteria in the route identification process. State Regional Groups, tribal governments, transportation associations, industry, federal agencies, and local government organizations are some of the groups that work collaboratively with DOE in this process. DOE is performing and would perform the work through a Topic Group of the Transportation External Coordination Working Group, which would seek broader public input and collect comments on routing criteria and the process for development of a set of routes. The process includes consideration of industry practices, DOE requirements, and analysis of regional routes that states have previously evaluated in the process to identify a preliminary set of routes. Public involvement is an essential element of a safe, efficient, and flexible transportation system.

L.4.3 PLANNING AND MOBILIZATION

DOE would use the methods and requirements this section describes to establish the baseline operational organization and practices for route identification, fleet planning and acquisition, carrier interactions, and operations.

DOE would develop a Transportation Operations Plan to provide the basis for planning shipments. This plan would describe the operational strategy and delineate the steps to ensure compliance with applicable regulatory and DOE requirements. It would include information on organizational roles and responsibilities, shipment materials, projected shipping windows, estimated numbers of shipments, carriers, packages, sets of routes, prenotification procedures, safe parking arrangements, tracking systems, security arrangements, public information, and emergency preparedness, response, and recovery.

The Department would develop individual site plans to include the information necessary to ship from specific sites that included roles and responsibilities of the participants in the shipping campaign, shipment materials, schedules, number of shipments, types and number of casks and other equipment, carriers, routes, in-transit security arrangements, safe parking arrangements for rail and truck shipments, communications including prenotification, public information, tracking, contingency planning, and emergency preparedness, response, and recovery.

In addition, DOE would issue an Annual Shipment Projection at least 6 months to a year in advance of the beginning of a shipment year and would identify the sites from which it would ship spent nuclear fuel and high-level radioactive waste in a given calendar year, the expected characteristics and quantities of waste to be delivered by each site, types of casks, and anticipated numbers of casks and shipments. The Annual Shipment Projection would not define specific shipment schedules or routes, but DOE would use it for schedule and route planning.

L.4.4 DEDICATED TRAIN SERVICE POLICY

On July 18, 2005, in a policy statement (DIRS 182833-Golan 2005, all), DOE decided that dedicated train service would be the usual manner of rail shipment of commercial and DOE spent nuclear fuel and high-level radioactive waste to Yucca Mountain. Dedicated indicates train service for one commodity (in this case, spent nuclear fuel and high-level radioactive waste). Past and current shipping campaigns have used dedicated train service to address issues of safety, security, cost, and operations. Analyses indicate that the primary benefit of dedicated train service would be significant cost savings over the lifetime of transportation operations. The added cost of dedicated train service would be offset by reductions in fleet size and its attendant operations and maintenance costs. In addition, the shorter times in transit and shorter layovers at switching yards would enhance safety and security. Use of dedicated train service would provide greater operational flexibility and efficiency because of the reduced transit time and greater predictability in routing and scheduling.

L.4.5 TRACKING AND COMMUNICATION

DOE would provide authorized state and tribal governments with the capability and training to monitor shipments to the repository through their jurisdictions using a satellite tracking system, such as the Transportation Tracking and Communication System, that would provide continuous, centralized monitoring and communications capability (DIRS 172433-DOE 2003, p. 5). Trained personnel could use such a system to monitor shipment progress and communicate with the dispatch center. A transportation operations center would be in contact with the carriers and the escorts throughout each shipment. In addition, all truck and rail escort cars would have communications equipment. The train control center would manage rail communications and signaling on the branch Nevada rail line.

DOE would develop detailed backup procedures to ensure safe operations in the event that the tracking system was temporarily unavailable. The procedures would be based on a telephone call-in system for operators to report shipment locations to DOE on a regular basis and before crossing state and tribal borders.

L.4.6 TRANSPORTATION OPERATIONAL CONTINGENCIES

DOE would obtain weather forecasts along routes as part of preshipment planning, notification, and dispatching. At the time of departure, current weather conditions, the weather forecast, and expected travel conditions would have to be acceptable for safe operations. If these conditions were not acceptable, DOE could delay the shipment until travel conditions became acceptable or reroute the shipment.

Shipments would not travel during severe weather or other adverse conditions that could make travel hazardous. DOE would obtain route conditions and construction information that could temporarily affect the planned route through consultation with the railroads and states along the planned route.

DOE would receive input from states and tribes on weather conditions through the satellite tracking system known as TRANSCOM, which they would also use to monitor shipments. Rail carriers use train control and monitoring systems to identify the locations of trains and to make informed decisions to avoid or minimize potentially adverse weather or track conditions. Truck dispatch centers and the transportation operations center would coordinate on weather conditions while shipments were en route.

Continuous communications with a transportation operations center would provide advance warning of potential adverse conditions along the route. If the shipment encountered unanticipated severe weather, the operators would contact this center to coordinate routing to a safe stopping area if it became necessary to delay the shipment until conditions improved.

L.4.7 CARRIER PERSONNEL QUALIFICATIONS

Carriers would develop and maintain qualification and training programs that met U.S. Department of Transportation requirements for drivers, operators, and security personnel. For truck drivers, qualifications include being at least 21 years of age, meeting physical standards, having a commercial driver's license, and successfully completing a road driving test in the shipment vehicle. In addition, drivers must have training on the properties and hazards of the shipment materials as well as the procedures to follow in the event of an emergency. Locomotive engineers must meet the Locomotive Engineer Certification requirements of 49 CFR Part 240, which include completion of an approved training program (Section L.2.7 addresses other training requirements),

L.4.8 NOTICE OF SHIPMENTS

The NRC requires advance notice, en route status, and other pertinent shipment information on DOE shipments (10 CFR Parts 71 and 73). Section L.2.5 addresses advance notification requirements. DOE and other stakeholders would use this information to support coordination of repository receipt operations, to support emergency response capabilities, to identify weather or road conditions that could affect shipments, to identify safe stopping locations, to schedule inspections, and to coordinate appropriate public information programs.

L.4.9 INSPECTIONS

To ensure safety, DOE would inspect shipments when they left their point of origin and when they arrived at the repository to verify vehicle safety and radiological safety of the shipping casks. These inspections would include radiological surveys of radioactive material packages to ensure that they met the radiation level limits of 49 CFR 173.441 and surface contamination limits of 49 CFR 173.443. DOE would inspect rail shipments in accordance with 49 CFR 174.9 and the Federal Railroad Administration High-Level Nuclear Waste Rail Transportation Inspection Policy in Appendix A of *Safety Compliance Oversight Plan for Rail Transportation of High-Level Radioactive Waste and Spent Nuclear Fuel* (DIRS 156703-DOT 1998, all), which includes motive power, signals, track conditions, manifests, and crew credentials. DOE would inspect highway shipments using the enhanced standards of the Commercial Vehicle Safety Alliance, which provide uniform inspection procedures for radiological requirements, drivers, shipping papers, vehicles, and casks (DIRS 175725-CVSA 2005, all).

Although DOE would minimize the number of stops to the extent practicable, under federal regulations states and tribes could order additional inspections when shipments entered their respective jurisdictions. DOE would attempt to coordinate those inspections with normal crew change locations whenever possible.

L.4.10 PROCEDURES FOR OFF-NORMAL CONDITIONS

Off-normal conditions are potentially adverse conditions that do not relate to accidents, incidents, or emergencies. They include but are not limited to mechanical breakdowns, fuel problems, tracking system failure, and illness, injury, or other incapacity of a member of the truck, train, or escort crew. DOE would require carriers to provide operators with specific written procedures that define detailed actions for off-normal events. Procedures would address notifications, deployment of appropriate hazard warnings, security, medical assistance, operator or escort replacement, and maintenance, repair, replacement, or recovery of equipment, as appropriate. Procedures would also cover selection of alternative routes and safe parking areas.

L.4.11 POSTSHIPMENT RADIOLOGICAL SURVEYS

DOE would visually inspect and radiologically survey the external surfaces of a cask after shipment in accordance with U.S. Department of Transportation, DOE, and NRC regulations. Receiving facility operators would survey each cask and transporter on arrival (before unloading) and determine if there was radiological contamination in excess of the applicable limits. The inspections would include the cask, tie-downs, and associated hardware to determine if physical damage occurred during transit.

L.4.12 SHIPMENT OF EMPTY TRANSPORT CASKS

Except before their first use, shipments of all empty transportation casks would comply with the requirements of the NRC certificate of compliance or 49 CFR 173.428, which addresses empty radioactive materials packages, whichever was applicable. DOE would ship casks that did not meet the criteria for “empty” in accordance with the applicable U.S. Department of Transportation hazardous materials regulations. Advance shipment notifications and en route inspections would not apply to the shipment of empty transportation casks; however, DOE would use dedicated train service to realize the cost benefits of a decreased fleet requirement.

L.5 Cask Safety

The purpose of the NRC regulations for transportation of spent nuclear fuel and high-level radioactive waste (10 CFR Part 71) is to protect the public health and safety from normal and off-normal conditions of transport and to safeguard and secure shipments of these materials. Over the years, NRC has amended its regulations to be compatible with the latest editions of the International Atomic Energy Agency and other standards (see 69 FR 3698, January 26, 2004).

In addition to the standard testing discussed below, NRC has committed to a package performance study for the full-scale testing of a spent nuclear fuel package of the kind DOE would likely use. The Commission approved the proposed test in June 2005 (DIRS 182896-Viette-Cook 2005, all; DIRS 182897-Reyes 2005, all). According to the proposal, the package would contain surrogate fuel elements and be mounted on a railcar placed at 90 degrees to a simulated rail crossing. The rail package would be subjected to a collision with a locomotive and several freight cars at 96 kilometers (60 miles) per hour. NRC is formulating the study to give the public greater confidence in the movement of spent nuclear fuel, to provide information on the methods and processes of transportation system qualification, and to validate the applicability of NRC regulations.

Regulations in 10 CFR Part 71 require that casks for shipping spent nuclear fuel and high-level radioactive waste must be able to meet specified radiological performance criteria for normal transport and for transport under severe accident conditions. Meeting these requirements is an integral part of the safety assurance process for transportation casks. The ability of a design to withstand these conditions can be demonstrated by comparing designs to similar casks, engineering analyses (such as computer-simulated tests), or by scale-model or full-scale testing. As shown in Figure L-4, these hypothetical accident conditions include, in sequence, a 9-meter (30-foot) drop onto an unyielding flat surface, a 1-meter (40-inch) drop onto a vertical steel bar, exposure of the entire package to fire for 30 minutes, and immersion in 0.9 meter (3 feet) of water. In addition, an undamaged cask must be able to survive submersion in the equivalent pressure of 15 and 200 meters (50 and 650 feet) of water.

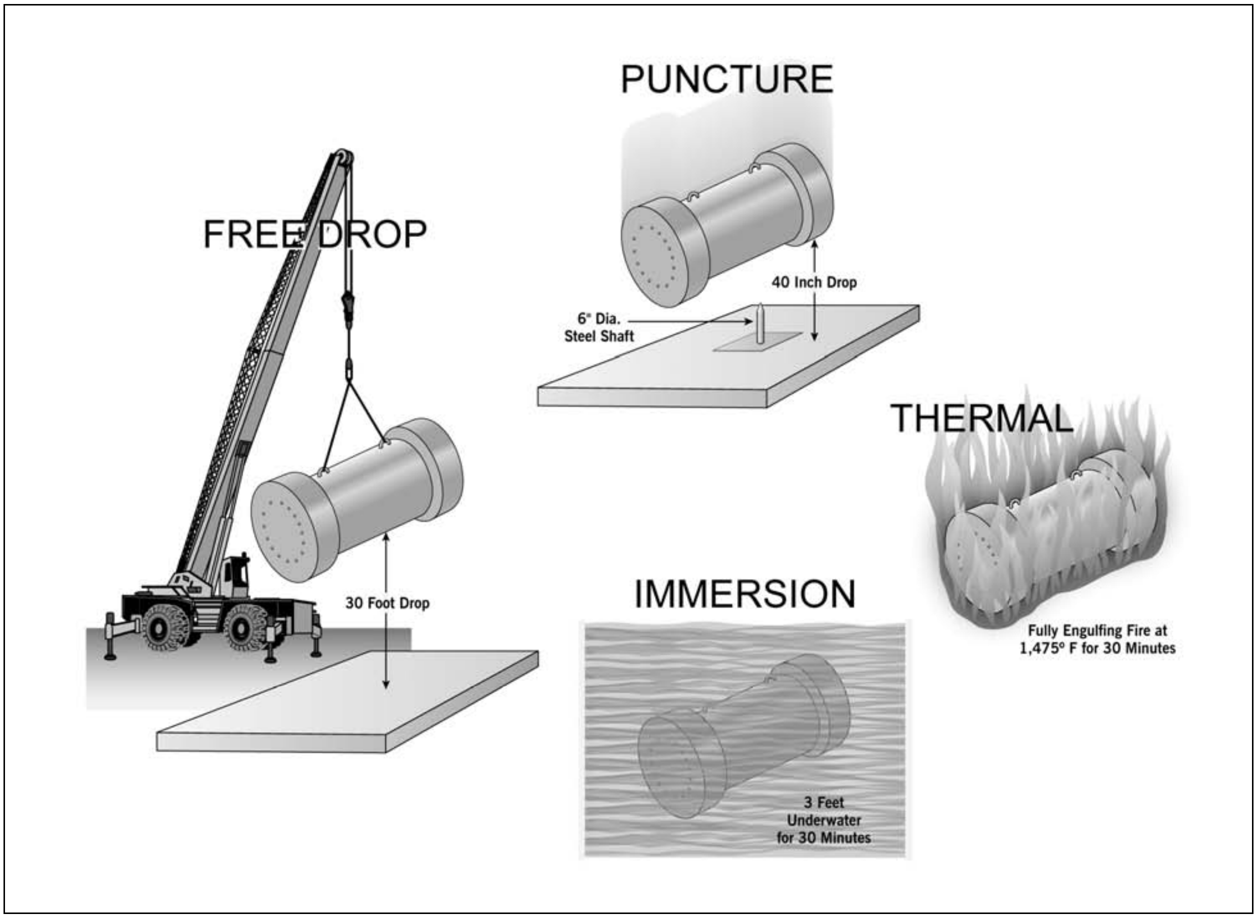

Figure L-4. Hypothetical accident conditions.

For most accidents more severe than those the hypothetical accident conditions simulate, NRC studies (DIRS 152476-Sprung et al. 2000, all; DIRS 181841-Adkins et al. 2007, all; DIRS 182014-Adkins et al. 2006, all) show that the radiological criteria for containment, shielding, and subcriticality would still be satisfied. The studies also show that for the few severe incidents in which these criteria could be exceeded, only containment and shielding would be affected, and the regulatory criteria could be exceeded only slightly. Based on the analyses of the *Final Environmental Impact Statement for a Geological Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada* (DIRS 155970-DOE 2002, all), casks would continue to contain spent nuclear fuel and high-level radioactive waste fully in more than 99.99 percent of all incidents (of the thousands of shipments over the last 30 years, none has resulted in an injury due to the release of radioactive materials). The following sections discuss each of these packaging performance criteria.

L.5.1 NINE-METER DROP ONTO AN UNYIELDING SURFACE

The first set of accident conditions in the sequence simulates impact and evaluation of a 9-meter (30-foot) free fall onto an unyielding surface with the cask striking the target in the most damaging orientation. The free fall results in a final velocity of 48 kilometers (30 miles) per hour. Although this velocity is less than the expected speed of interstate highway traffic, it is severe because the target surface is unyielding. This results in the cask absorbing all the energy of the drop, which is approximately equivalent to a 96-kilometer (60-mile)-per-hour impact with a medium hardness surface (such as shale or other relatively soft rock) and a 150-kilometer (90-mile)-per-hour impact with a soft surface (such as tillable soil).

L.5.2 ONE-METER DROP ONTO A STEEL BAR

The second set of accident conditions simulates a cask hitting a rod or bar-like object that could be present in an accident. This requires evaluation for a 1-meter (40-inch) drop onto a 15-centimeter (6-inch)-diameter rod on an unyielding surface. The cask must be in the orientation in which maximum damage would be likely. In addition, the bar must be long enough to cause maximum damage to the cask. This evaluates several impacts in which different parts of a cask strike the bar either by simulation or physical testing.

L.5.3 FIRE

The third set of accident conditions simulates a fire that occurs after the two impacts. This involves a hydrocarbon fire with an average flame temperature of 800°C (1,475°F) and requires the cask to be fully engulfed in the flame for 30 minutes.

L.5.4 WATER IMMERSION

The final set of accident conditions in the sequence is shallow immersion. The cask must be immersed in 0.9 meter (3 feet) of water. The purpose of this test is to ensure that water cannot leak into the cask after having passed through the challenges.

An undamaged version of the cask must also be able to survive immersion in the equivalent of 15 meters (50 feet) of water at a pressure of about 1,500 grams per square centimeter (22 pounds per square inch) to test for leakage. Furthermore, shipping casks for more than 1 million curies of radioactivity must be able to survive water pressure of about 20,000 grams per square centimeter (290 pounds per square inch) for 1 hour without collapsing, buckling, or leaking. That pressure is equivalent to a depth of about 200 meters (650 feet).

L.5.5 ACCEPTANCE CRITERIA

To be judged successful in meeting all but the 200-meter (650-foot) submersion requirement, a cask must not release more than limited amounts of radioactive material in 1 week. These release limits are set for each radionuclide based on dispersivity and toxicity. In addition, the cask must not emit radiation at a dose rate of greater than 1 rem per hour at a distance of 1 meter (3.3 feet) from the cask surface. Last, the contents of the cask must not be capable of undergoing a nuclear chain reaction, or criticality, as a result of the hypothetical accident conditions.

L.5.6 USE OF MODELS

Manufacturers can demonstrate the ability of a cask to survive these hypothetical accident conditions in several ways. They can subject a full-size model of the cask to the sequences, use smaller models of the casks (typically half- or quarter-scale), compare the cask design to previously licensed designs, or analyze the hypothetical accident scenarios with computer models. NRC approves what level of physical testing or analysis is necessary for each cask design. Because NRC generally accepts the results of scale-model testing, more expensive full-scale testing rarely occurs, although NRC sometimes requires such tests for specific cask components. For example, NRC could accept quarter-scale drop tests for a particular cask design but full-scale tests of the cask's impact limiters. Computer analysis could be sufficient for meeting the hypothetical fire and criticality control criteria.

L.6 Emergency Response

L.6.1 ROLES AND RESPONSIBILITIES

States and tribes along shipping routes have the primary responsibility for the protection of the public and environment in their jurisdictions. If an emergency that involved a DOE radioactive materials shipment occurred, incident command would be established based on the procedures and policies of the state, tribe, or local jurisdiction. When requested by civil authorities, DOE would provide technical advice and assistance including access to teams of experts in radiological monitoring and related technical areas. DOE staffs eight Regional Coordinating Offices 24 hours a day, 365 days a year with teams of nuclear engineers, health physicists, industrial hygienists, public affairs specialists, and other professionals (Section L.6.2 contains further detail on the DOE role). Under NWPA Section 180(c), DOE must provide technical assistance and funds to states for training for public safety officials of appropriate units of local government and American Indian tribes through whose jurisdiction DOE plans to transport spent nuclear fuel or high-level radioactive waste. Training must cover procedures for safe routine transportation of these materials as well as for emergency response situations.

DOE would require selected carriers to provide drivers and train crews with specific written procedures that defined detailed actions for an emergency or incident that involved property damage, injury, or the release or potential release of radioactive materials. Procedures would comply with U.S. Department of Transportation guidelines for emergency response in the 2004 *Emergency Response Guidebook* (DIRS 175728-DOT 2004, all) and would address emergency assistance to injured crew or others who were involved in identification and assessment of the situation, notification and communication requirements, securing of the site and controlling access, and technical help to first responders.

L.6.2 FEDERAL COORDINATION

The Department of Homeland Security coordinates the overall Federal Government response to radiological Incidents of National Significance in accordance with Homeland Security Presidential Directive 5 (DIRS 182271-DHS 2003, all) and the *National Response Plan* (DIRS 175729-DHS 2004, all). Based on Directive 5 criteria, an Incident of National Significance is an actual or potential high-impact event that requires a coordinated and effective response by, and appropriate combination of, federal, state, local, tribal, nongovernmental, or private-sector entities to save lives and minimize damage, and to provide the basis for long-term community recovery and mitigation activities.

In Directive 5, the President designates the Secretary of Homeland Security as the Principal Federal Official for domestic incident management and empowers the Secretary to coordinate federal resources used in response to terrorist attacks, major disasters, or other emergencies in specific cases (DIRS 182271-DHS 2003, all). The Directive establishes a single, comprehensive National Incident Management System that unifies federal, state, territorial, tribal, and local lines of government into one coordinated effort. This system encompasses much more than the Incident Command System, which is nonetheless a critical component of the National Incident Management System. That system also provides a common foundation for training and other preparedness efforts, communicating and sharing information with other responders and with the public, ordering resources to assist with a response effort, and integrating new technologies and standards to support incident management. The Incident Command System uses as its base the local first responder protocols; that use does not eliminate the required agreements and coordination among all levels of government.

In Directive 5 (DIRS 182271-DHS 2003, all), the President directed the development of the new *National Response Plan* (DIRS 175729-DHS 2004, all) to align federal coordination structures, capabilities, and resources into a unified approach to domestic incident management. The Plan is built on the template of the National Incident Management System. The Plan provides a comprehensive, all-hazards approach to domestic incident management. All federal departments and agencies must adopt the National Incident Management System and use it in their individual domestic incident management and emergency prevention, preparedness, response, recovery, and mitigation activities, as well as in support of all actions taken to assist state or local entities.

DOE supports the Department of Homeland Security as the coordinating agency for incidents that involve the transportation of radioactive materials by or for DOE. DOE is otherwise responsible for the radioactive material, facility, or activity in the incident. DOE is part of the Unified Command, which is an application of the Incident Command System for when there is more than one agency with incident jurisdiction or when incidents cross political jurisdictions. DOE coordinates the federal radiological response activities as appropriate. Agencies work together through the designated members of the Unified Command, often the senior person from agencies or disciplines that participate in the Unified Command, to establish a common set of objectives and strategies.

DOE, as the transporter of radiological material, would notify state and tribal authorities and the Homeland Security Operations Center. The Department of Homeland Security and DOE coordinate federal response and recovery activities for the radiological aspects of an incident. DOE reports information and intelligence in relation to situational awareness and incident management to the Homeland Security Operations Center.

The Department of Homeland Security and DOE are responsible for coordination of security activities for federal response operations. While spent nuclear fuel and high-level radioactive waste shipments are in transit, state, local, and tribal governments could provide security for a radiological transportation incident that occurred on public lands. The Department of Homeland Security, with DOE as the coordinating agency, approves issuance of all technical data to state, local, and tribal governments.

The Interagency Modeling and Atmospheric Assessment Center, is responsible for production, coordination, and dissemination of consequence predictions for an airborne hazardous material release. The Center generates the single federal prediction of atmospheric dispersions and their consequences using the best available resources.

Federal monitoring and assessment activities are coordinated with state, local, and tribal governments. Federal agency plans and procedures for implementation of this activity are designed to be compatible with the radiological emergency planning requirements for state and local governments, specific facilities, and existing memoranda of understanding and interagency agreements.

DOE maintains national and regional coordination offices at points of access to federal radiological emergency assistance. Requests for Radiological Assessment Program teams go directly to the DOE Emergency Operations Center in Washington, D.C. If the situation requires more assistance than a team can provide, DOE alerts or activates additional resources. DOE can respond with additional resources including the Aerial Measurement System to provide wide-area radiation monitoring and Radiation Emergency Assistance Center/Training Site medical advisory teams. Some participating federal agencies have radiological planning and emergency responsibilities as part of their statutory authority, as well as established working relationships with state counterparts. The monitoring and assessment activity, which DOE coordinates, does not alter these responsibilities but complements them by providing coordination of the initial federal radiological monitoring and assessment response activities.

The U.S. Department of Homeland Security and DOE, as the coordinating agency, oversee the development of Federal Protective Action Recommendations. In this capacity, they provide advice and assistance to state, tribal, and local governments, which can include advice and assistance on measures to avoid or reduce exposure of the public to radiation from a release of radioactive material and advice on emergency actions such as sheltering and evacuation.

State, local, and tribal governments are encouraged to follow closely the *National Response Plan* (DIRS 175729-DHS 2004, all), the Nuclear/Radiological Incident Annex, and the National Incident Management System protocols and procedures. As established, all federal, state, local and tribal responders agree to and follow the Incident Command System.

L.7 Technical Assistance and Funding for Training of State and American Indian Public Safety Officials

The NWPA requires DOE to provide technical assistance and funds to states and American Indian tribes for training public safety officials of appropriate units of local governments through whose jurisdictions the Department plans to transport spent nuclear fuel or high-level radioactive waste. Section 180(c) further provides that training must cover procedures for safe routing and emergency response situations. Section 180(c) encompasses all modes of transportation, and funding would come from the Nuclear Waste Fund. Once implemented, this program would provide funding and technical assistance to train firefighters, law enforcement officers, and other public safety officials in preparation for repository shipments through their jurisdictions.

To implement this requirement in the 1990s, DOE published four Federal Register notices to solicit public comment on its approach to implementing Section 180(c). DOE responded to the comments in subsequent notices through April 1998. In 2004, the changes in homeland security and DOE transportation practices made it timely for DOE to renew efforts to develop Section 180(c) policy and implementation procedures. DOE evaluated changes in emergency preparedness and funding for responders since 1998 as well as emergency preparedness grant programs that began after September 11, 2001. The evaluation considered programs the Department of Homeland Security and the Federal Emergency Management Agency developed and relevant DOE funding and emergency response training efforts such as the Waste Isolation Pilot Plant and Foreign Research Reactor transportation programs.

The revisitation of Section 180(c) implementation began with the formation of a Transportation External Coordination Working Group Topic Group in April 2004. DOE also worked with State Regional Groups and the Tribal Issues Topic Group of the Transportation External Coordination Working Group to solicit stakeholder input on the policy. Topic Group members wrote issue papers on specific Section 180(c) topics such as allowable activities, funding allocation method, timing and eligibility, and definitions. From these materials, DOE developed a draft policy that it issued in a Federal Register notice on July 23, 2007 (72 *FR* 40139) to request additional comments from stakeholders and the public. DOE plans to conduct a pilot test of the program and then issue the final Section 180(c) policy.

Under the proposed policy, DOE would make two grants available to eligible state and tribal governments. An initial assessment and planning grant would be available about 4 years before shipments through a jurisdiction began. Once the state or tribe completed the assessment and planning grant activities, they would be eligible for the training grant every year that shipments traveled through their jurisdiction.

L.8 Transportation Security

Transportation safeguards and security are among the highest DOE priorities as it plans for shipments of spent nuclear fuel and high-level radioactive waste to Yucca Mountain. DOE would build the security program for the shipments on the successful security program it developed and has successfully used in past decades for shipments of spent nuclear fuel to DOE facilities from foreign and domestic reactors.

An effective security program must protect members of the public near transportation routes as well as minimize potential threats to workers, and it must include security elements appropriate to each phase of transportation. DOE would continually test security procedures to identify improvements in the security system throughout transportation operations. The key elements of a secure transportation program include physical security systems, information security, materials control and accounting, personnel security, security program management, and emergency response capabilities.

DOE is working closely with other federal agencies including NRC and the Department of Homeland Security to understand and mitigate potential threats to shipments. In addition to domestic efforts, the Department is a member of the International Working Group on Sabotage for Transport and Storage Casks, which investigates the consequences of a potential act of sabotage and explores opportunities to enhance the physical protection of casks. As a result of these efforts, DOE would modify its methods and systems as appropriate between now and the time of shipments.

In coordination with other federal agencies, DOE is working with other stakeholders including state, local, and tribal governments; industry associations such as the Association of American Railroads, and technical advisory and oversight organizations such as the National Academies of Science and the Nuclear Waste Technical Review Board. This enables DOE to take advantage of the experience and practical recommendations of experts on a broad range of security-related technical, procedural, and operational matters.

L.9 Liability

The Price-Anderson Act (Section 170 of the Atomic Energy Act, as amended [42 U.S.C. 2011 *et seq.*]) provides indemnification for liability for nuclear incidents that apply to the proposed Yucca Mountain repository. The following sections address specific details or provisions of the Act.

L.9.1 THE PRICE-ANDERSON ACT

In 1957, Congress enacted the Price-Anderson Act as an amendment to the Atomic Energy Act to encourage the development of a commercial nuclear industry and to ensure prompt and equitable compensation in the event of a nuclear incident. The Price-Anderson Act establishes a system of financial protection for persons who could be liable for and persons who could be injured by a nuclear incident. The purposes of the Act are (1) to encourage growth and development of the nuclear industry through the increased participation of private industry and (2) to protect the public by ensuring that funds are available to compensate victims for damages and injuries sustained in the event of a nuclear incident. Congress renewed and amended the indemnification provisions in 1966, 1969, 1975, and 1988. The 1988 Price-Anderson Amendments Act extended the Act for 14 years until August 1, 2002 (Public Law 100-408, 102 Stat. 1066). Since then, Congress has extended the Act until December 31, 2025, and increased liability to $10.26 billion for an extraordinary nuclear occurrence (that is, any nuclear incident that causes substantial damage), subject to increase for inflation.

L.9.2 INDEMNIFICATION UNDER THE PRICE-ANDERSON ACT

For each shipper, DOE must include an agreement of indemnification in each contract that involves the risk of a nuclear incident. This indemnification (1) provides omnibus coverage of all persons who could be legally liable, (2) fully indemnifies all legal liability up to the statutory limit on such liability (currently $10.26 billion for a nuclear incident in the United States), (3) covers all DOE contractual activity that could result in a nuclear incident in the United States, (4) is not subject to the usual limitation on the availability of appropriated funds, and (5) is mandatory and exclusive.

L.9.3 COVERED AND EXCLUDED INDEMNIFICATION

The Price-Anderson Act indemnifies liability arising out of, or resulting from, a nuclear incident or precautionary evacuation, including all reasonable additional costs incurred by a state or a political subdivision of a state, in the course of responding to a nuclear incident or a precautionary evacuation. It excludes (1) claims under state or federal worker compensation acts of indemnified employees or persons who are at the site of, and in connection with, the activity where the nuclear incident occurs, (2) claims that arise out of an act of war, and (3) claims that involve certain property on the site.

L.9.4 PRICE-ANDERSON ACT DEFINITION OF A NUCLEAR INCIDENT

A nuclear incident is any occurrence, including an extraordinary nuclear occurrence, that causes bodily injury, sickness, disease, death, loss of or damage to property, or loss of use of property, that arises out of or results from the radioactive, toxic, explosive, or other hazardous properties of source, special nuclear, or byproduct material (42 U.S.C. 2014).

L.9.5 PROVISIONS FOR PRECAUTIONARY EVACUATION

A precautionary evacuation is an evacuation of the public within a specified area near a nuclear facility or the transportation route in the case of an incident that involves transportation of source material, special nuclear material, byproduct material, spent nuclear fuel, high-level radioactive waste, or transuranic waste. It must be the result of an event that is not classified as a nuclear incident but poses an imminent danger of injury or damage from the radiological properties of such nuclear materials and causes an evacuation. The evacuation must be initiated by an official of a state or a political subdivision of a state who is authorized by state law to initiate such an evacuation and who reasonably determined that such an evacuation was necessary to protect the public health and safety.

L.9.6 AMOUNT OF INDEMNIFICATION

The Price-Anderson Act establishes a system of private insurance and federal indemnification to ensure compensation for damage or injuries suffered by the public in a nuclear incident. The current amount of $10.26 billion reflects a threshold level beyond which Congress would review the need for additional payment of claims in the case of a nuclear incident with catastrophic damage. The limit for incidents that occur outside the United States is $500 million, and the nuclear material must be owned by, and used by or under contract with, the United States.

L.9.7 INDEMNIFICATION OF TRANSPORTATION ACTIVITIES

DOE indemnifies any nuclear incident that arises in the course of any transportation activities in connection with a DOE contractual activity, including transportation of nuclear materials to and from DOE facilities.

L.9.8 COVERED NUCLEAR WASTE ACTIVITIES

The indemnification specifically includes nuclear waste activities that DOE undertakes in relation to the storage, handling, transportation, treatment, disposal of, or research and development on spent nuclear fuel, high-level radioactive waste, or transuranic waste. It would cover liability for incidents that could occur while wastes were in transit from nuclear power plants, at a storage facility, or at Yucca Mountain.

If a DOE contractor or other indemnified person was liable for the nuclear incident or a precautionary evacuation that resulted from its contractual activities, that person would be indemnified for that liability. While DOE tort liability would be determined under the Federal Tort Claims Act (28 U.S.C. Sections 1346(b), 1402(b), 2401(b), and 2671 through 2680), the Department would use contractors to transport spent nuclear fuel and high-level radioactive waste and to construct and operate a repository. Moreover, if public liability arose out of activities that the Nuclear Waste Fund supported, the Fund would pay compensation up to the maximum amount of protection. The NWPA established the fund to support federal activities for the disposal of spent nuclear fuel and high-level radioactive waste.

L.9.9 INDEMNIFICATION FOR STATE, AMERICAN INDIAN, AND LOCAL GOVERNMENTS

State, American Indian, and local governments are persons in the sense that they might be indemnified if they incur legal liability. The Price-Anderson Act defines a person as including "(1) any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than [DOE or the Nuclear Regulatory] Commission, any state or any political subdivision of, or any political entity within a state, any foreign government or nation or any political subdivision of any such government or nation, or other entity; and (2) any legal successor, representative, agent, or agency of the foregoing" (42 U.S.C. 2214). A state or a political subdivision of a state could be entitled to indemnification for legal liability, which would include all reasonable additional costs of responding to a nuclear incident or an authorized precautionary evacuation. In addition, indemnified persons could include contractors, subcontractors, suppliers, shippers, transporters, emergency response workers, health professional personnel, workers, and victims.

L.9.10 PROCEDURES FOR CLAIMS AND LITIGATION

Numerous provisions ensure the prompt availability and equitable distribution of compensation, which would include emergency assistance payments, consolidation and prioritization of claims in one federal court, channeling of liability to one source of funds, and waiver of certain defenses in the event of a large incident. The Price-Anderson Act authorizes payments for immediate assistance after a nuclear incident. In addition, it provides for the establishment of coordinated procedures for the prompt handling, investigation, and settlement of claims that result from a nuclear incident.

L.9.11 FEDERAL JURISDICTION OVER CLAIMS

The U.S. District Court for the district in which a nuclear incident occurred would have original jurisdiction "with respect to any [suit asserting] public liability...without regard to the citizenship of any party or the amount in controversy" [42 U.S.C. 2210(n)]. If a case was brought in another court, it would be removed to the U.S. District Court with jurisdiction upon motion of a defendant, NRC, or DOE.

L.9.12 CHANNELING LIABILITY TO ONE SOURCE OF FUNDS

The Price-Anderson Act channels the indemnification (that is, the payment of claims that arise from the legal liability of any person for a nuclear incident) to one source of funds. This economic channeling eliminates the need to sue all potential defendants or to allocate legal liability among multiple potential defendants. Economic channeling results from the broad definition of indemnified persons to include any person who could be legally liable for a nuclear incident. Therefore, regardless of individual legal liability for a nuclear incident that resulted from a DOE contractual activity or NRC-licensed activity, the indemnity will pay the claim.

In the hearings on the original Act, "the question of protecting the public was raised where some unusual incident, such as negligence in maintaining an airplane motor, should cause an airplane to crash into a reactor and thereby cause damage to the public. Under this bill, the public is protected and the airplane company can also take advantage of the indemnification and other proceedings" (DIRS 155789-DOE 1999, p. 12).

L.9.13 LEGAL LIABILITY UNDER STATE TORT LAW

The Price-Anderson Act does not define legal liability, but the legislative history clearly indicates that state tort law determines the covered legal liabilities (DIRS 155789-DOE 1999, p. A-6). In 1988, public liability action was defined to state explicitly that "the substantive rules for decision in such action shall be derived from the law of the state in which the nuclear incident involved occurs, unless such law is inconsistent with the provisions of [Section 2210 of Title 42]" (42 U.S.C. 2014).

L.9.14 PROVISIONS WHERE STATE TORT LAW MAY BE WAIVED

The Price-Anderson Act includes provisions to minimize protracted litigation and to eliminate the need to prove the fault of or to allocate legal liability among various potential defendants. Certain provisions of state law may be superseded by uniform rules that the Act prescribes, such as a limitation on punitive damages. In the case of an extraordinary nuclear occurrence, the Act imposes strict liability by requiring the waiver of any defenses in relation to conduct of the claimant or fault of any indemnified person. Such waivers would result, in effect, in strict liability, the elimination of charitable and governmental immunities, and the substitution of a 3-year discovery rule in place of statutes of limitations that would normally bar all suits after a specified number of years.

L.9.15 COVERAGE AVAILABLE FOR INCIDENTS IF THE PRICE-ANDERSON ACT DOES NOT APPLY

If an incident does not involve the actual release of radioactive materials or a precautionary evacuation is not authorized, Price-Anderson Act indemnification does not apply. If the indemnification does not apply, liability is determined under state law, as it would be for any other type of transportation incident. Private insurance could apply. As noted above, however, the Act would cover all DOE contracts for transportation of spent nuclear fuel and high-level radioactive waste to a repository for nuclear incidents and precautionary evacuations. Indemnified persons under that DOE contractual activity would include the contractors, subcontractors, suppliers, state, American Indian, and local governments, shippers and transporters, emergency response workers, and all other workers and victims.

Carriers would have private insurance to cover liability from a nonnuclear incident and for environmental restoration for such incidents. The Motor Carrier Act (42 U.S.C. 10927) and its implementing regulations (49 CFR Part 387) require all motor vehicles that carry spent nuclear fuel or high-level radioactive waste to maintain financial responsibility of at least $5 million. Federal law does not require rail, barge, or air carriers of radioactive materials to maintain liability coverage, but these carriers often voluntarily cover such insurance. Private insurance policies often exclude coverage of nuclear incidents. Therefore, private insurance policies generally apply only to the extent that the Price-Anderson Act is not applicable.

L.10 National Academy of Sciences Findings and Recommendations

In 2006, the National Academy of Sciences Committee on Transportation of Radioactive Waste issued *Going the Distance? The Safe Transport of Spent Nuclear and High-Level Radioactive Waste in the United States* (DIRS 182032-National Research Council 2006, all). The following sections provide the findings and recommendations from this report that are relevant to the Rail Alignment EIS along with a discussion of the DOE position on or approach to the aspects of the findings and recommendations.

L.10.1 TRANSPORTATION SAFETY AND SECURITY

Principal Academy Finding on Transportation Safety

> The committee could identify no fundamental technical barriers to the safe transport of spent nuclear fuel and high-level radioactive waste in the United States. Transport by highway (for small-quantity shipments) and by rail (for large-quantity shipments) is, from a technical viewpoint, a low-radiological-risk activity with manageable safety, health, and environmental consequences when conducted with strict adherence to existing regulations. However, there are a number of social and institutional challenges to the successful initial implementation of large-quantity shipping programs that will require expeditious resolution as described in this report. Moreover, the challenges of sustained implementation should not be underestimated.

DOE agrees that the transportation of spent nuclear fuel and high-level radioactive waste has a low radiological risk with manageable safety. DOE also agrees that there are social and institutional challenges, but the Department believes it would meet these challenges successfully through a process that has transportation safety as its priority.

Principal Academy Finding on Transportation Security

> Malevolent acts against spent fuel and high-level waste shipments are a major technical and societal concern, especially following the September 11, 2001, terrorist attacks on the United States. The committee judges that some of its recommendations for improving transportation safety might also enhance transportation security. The Nuclear Regulatory Commission is undertaking a series of security studies, but the committee was unable to perform an in-depth technical examination of transportation security because of information constraints.

Academy Recommendation

> An independent examination of the security of spent fuel and high-level waste transportation should be carried out prior to the commencement of large-quantity shipments to a federal repository or to interim storage. This examination should provide an integrated evaluation of the threat environment, the response of packages to credible malevolent acts, and operational security requirements for protecting spent fuel and high-level waste while in transport. This examination should be carried out by a technically knowledgeable group that is independent of the government and free from institutional and financial conflicts of interest. This group should be given full access to the necessary classified documents and Safeguards Information to carry out this task. The findings and recommendations from this examination should be made available to the public to the fullest extent possible.

Transportation safeguards and security are among DOE’s highest priorities as it plans for shipments of spent nuclear fuel and high-level radioactive waste to the proposed repository. The Department would build the security program for the repository shipments on the security program that it has developed and successfully used in past decades for shipments of spent nuclear fuel to DOE facilities from foreign and domestic reactors.

An effective security program must protect members of the public near transportation routes as well as potential threats to workers, and it must include security elements appropriate to each phase of transportation. Continual testing of security procedures would result in improvements in the security system through completion of transportation operations for Yucca Mountain. The most important elements of a secure transportation program include physical security systems, information security, materials control and accounting, personnel security, security program management, and emergency response capabilities.

DOE is working closely with other Federal agencies including the NRC, and the U.S. Department of Homeland Security, and the Transportation Security Agency to understand and eliminate potential threats to repository shipments. In addition to its domestic efforts, the Department is a member of the International Working Group on Sabotage for Transport and Storage Casks, which is investigating the consequences of a potential act of sabotage and is exploring opportunities to enhance the physical protection of casks. As a result of these efforts, DOE would modify its methods and systems as appropriate between now and the time of shipments.

In coordination with other Federal agencies, DOE is working with other stakeholders including state, tribal, and local governments; industry associations such as the Association of American Railroads and technical advisory and oversight organizations such as the National Academy of Sciences and the Nuclear Waste Technical Review Board. This allows DOE to take advantage of the experience and practical recommendations of experts on a broad range of security-related technical, procedural, and operational matters.

L.10.2 TRANSPORTATION RISK

Academy Finding

> There are two types of transportation risk: health and safety risks and social risks. The health and safety risks arise from the potential exposure of transportation workers as well as other people who travel, work, or live near transportation routes to radiation that may be emitted or released from these loaded packages. Social risks arise from social processes and human perceptions and can have both direct socioeconomic impacts and perception-based impacts.
>
> There are two potential sources of radiological exposures from transporting spent fuel and high-level waste: (1) radiation shine from spent fuel and high-level waste transport packages under normal transport conditions; and (2) potential increases in radiation shine and release of radioactive materials from transport packages under accident conditions that are severe enough to compromise fuel element and package integrity. The radiological risks associated with the transportation of spent fuel and high-level waste are well understood and are generally low, with the possible exception of risks from releases in extreme accidents involving very long duration, fully engulfing fires. While the likelihood of such extreme accidents appears to be very small, their occurrence cannot be ruled out based on historical accident data for other types of hazardous material shipments. However, the likelihood of occurrence and consequences can be reduced further through relatively simple operational controls and restrictions and route-specific analyses to identify and mitigate hazards that could lead to such accidents.

Academy Recommendation

> To address radiological risk, the NAS stated there were clear transportation operations and safety advantages to be gained from shipping older (i.e. radiologically and thermally cooler) spent fuel first.
>
> Transportation planners and managers should undertake detailed surveys of transportation routes to identify potential hazards that could lead to or exacerbate extreme accidents involving very long duration, fully engulfing fires. Planners and managers should also take steps to avoid or mitigate such hazards before the commencement of shipments or shipping campaigns.

The Rail Alignment EIS evaluated the radiological risks of transportation accidents and found these risks to be very low, as did the Yucca Mountain FEIS. In addition, NRC has evaluated the response of spent nuclear fuel casks to the environments that existed during the Baltimore tunnel fire and the Caldecott tunnel fire, which would be representative of long duration, fully engulfing fires. These evaluations show that releases of radioactive material during these types of events, if they occurred at all, would be very small. Based on recommendations from the NRC, the Association of American Railroads has modified its operating standards to prohibit trains that carry flammable materials from being in a tunnel at the same time as a train that carries spent fuel. This administrative adjustment addresses some of the concerns of the Academy.

An initial step in the planning process to ship spent nuclear fuel and high-level radioactive waste to the Yucca Mountain repository would be to identify a national suite of rail and highway routes. Stakeholder groups in the DOE transportation program are participating in this process by examining routing criteria that DOE could use in the route identification process. State Regional Groups, American Indian tribes, transportation associations, industry, Federal agencies, and local government organizations are some of the groups that work collaboratively with DOE in this process.

Academy Finding

> The social risks for spent fuel and high-level waste transportation pose important challenges to the successful implementation of programs for transporting spent fuel and high-level waste in the United States. Such risks have received substantially less attention than health and safety risks, and some are difficult to characterize. Current research and practice suggest that transportation planners and managers can take early proactive steps to characterize, communicate, and manage the social risks that arise from their operations. Such steps may have additional benefits: they may increase the openness and transparency of transportation planning and programs; build community capacity to mitigate these risks; and possibly increase trust and confidence in transportation programs.

Academy Recommendation

> Transportation implementers should take early and proactive steps to establish formal mechanisms for gathering high-quality and diverse advice about social risks and their management on an ongoing basis. The committee makes two recommendations for the establishment of such mechanisms for the Department of Energy's program to transport spent fuel and high-level waste to a federal repository at Yucca Mountain: (1) expand the membership and scope of an existing advisory group (Transportation External Coordination Working Group; see Chapter 5) to obtain outside advice on social risk, including impacts and management; and (2) establish a transportation risk advisory group

> that is explicitly designed to provide advice on characterizing, communicating, and mitigating the social, security, and health and safety risks that arise from the transportation of spent fuel and high-level waste to a federal repository or interim storage. This group should be comprised of risk experts and practitioners drawn from the relevant technical and social science disciplines and should be convened under the Federal Advisory Committee Act or a similar arrangement to enhance the openness of its operations. Its members should receive security clearances to facilitate access to appropriate transportation security information. The existing federal Nuclear Waste Technical Review Board, which will cease operations no later than one year after the Department of Energy begins disposal of spent fuel or high-level waste in a repository, could be broadened to serve this function.

DOE has reviewed the Academy recommendation on involving social scientists in the Transportation External Coordination Working Group and on expert panels, and the Department has contacted some panel members to explore opportunities for future studies. DOE has sponsored studies by social scientists in the past on risk perception about transportation of radioactive materials and adjusted its programs to focus on local officials and support for emergency planning and training as a result. The Department needs to update this study and is in the process of reviewing literature to understand gaps in research to address some of the most pressing transportation issues. In addition, DOE has proposed a topic group within the Transportation External Coordination Working Group to address social risks. The Working Group membership has not yet indicated if that is an area they want to focus on at this time.

L.10.3 CURRENT CONCERNS ABOUT TRANSPORTATION OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

L.10.3.1 Package Performance

Academy Finding

> Transportation packages play a crucial role in the safety of spent fuel and high-level radioactive waste shipments by providing a robust barrier to the release of radiation and radioactive material under both normal transport and accident conditions. International Atomic Energy Agency package performance standards and associated Nuclear Regulatory Commission regulations are adequate to ensure package containment effectiveness over a wide range of transport conditions, including most credible accident conditions. However, recently published work suggests that extreme accident scenarios involving very long duration, fully engulfing fires might produce thermal loading conditions sufficient to compromise containment effectiveness. The consequences of such thermal loading conditions for containment effectiveness are the subject of ongoing investigations by the Nuclear Regulatory Commission and other parties, and this work is improving the understanding of package performance. Nonetheless, additional analyses and experimentation are needed to demonstrate a bounding-level understanding of package performance in response to very long duration, fully engulfing fires for a representative set of package designs.

Academy Recommendation

> The Nuclear Regulatory Commission should build on recent progress in understanding package performance in very long duration fires. To this end, the agency should undertake additional analyses of very long duration fire scenarios that bound expected

real world accident conditions for a representative set of package designs that are likely to be used in future large-quantity shipping programs. The objectives of these analyses should be to:

- Understand the performance of package barriers (spent fuel cladding and package seals);
- Estimate the potential quantities and consequences of any releases of radioactive material; and
- Examine the need for regulatory changes (e.g., package testing requirements) or operational changes (e.g., restrictions on trains carrying spent fuel) either to help prevent accidents that could lead to such fire conditions or to mitigate their consequences.

Strong consideration should also be given to performing well-instrumented tests for improving and validating the computer models used for carrying out these analyses, perhaps as part of the full-scale test planned by the Nuclear Regulatory Commission for its package performance study. Based on the results of these investigations, the Commission should implement operational controls and restrictions on spent fuel and high-level radioactive waste shipments as necessary to reduce the chances that such fire conditions might be encountered in service. Such effective steps might include, for example, additional operational restrictions on trains carrying spent fuel and high-level radioactive waste to prevent co-location with trains carrying flammable materials in tunnels, in rail yards, and on sidings.

As Section L.10.2 notes, NRC has addressed operating restrictions for tunnels by working with the Association of American Railroads to adjust rail operating practices. In addition, DOE has committed to supporting the NRC Package Performance Study to better understand severe accidents.

Academy Finding

The committee strongly endorses the use of full-scale testing to determine how packages will perform under both regulatory and credible extra-regulatory conditions. Package testing in the United States and many other countries is carried out using good engineering practices that combine state-of-the-art structural analyses and physical tests to demonstrate containment effectiveness. Full-scale testing is a very effective tool both for guiding and validating analytical engineering models of package performance and for demonstrating the compliance of package designs with performance requirements. However, deliberate full-scale testing of packages to destruction through the application of forces that substantially exceed credible accident conditions would be marginally informative and is not justified given the considerable costs for package acquisitions that such testing would require.

Academy Recommendation

Full-scale package testing should continue to be used as part of integrated analytical, computer simulation, scale-model, and testing programs to validate package performance.

> Deliberate full-scale testing of packages to destruction should not be required as part of this integrated analysis or for compliance demonstrations.

DOE would use NRC-certified casks for transportation of spent nuclear fuel and high-level radioactive waste to the proposed repository. Cask vendors would supply these NRC-certified casks to DOE under contractual requirements. To obtain the certificate, the vendors would conduct testing as NRC specifies.

L.10.3.2 Route Selection for Research Reactor Spent Fuel Transport

Academy Finding

> The Department of Energy's procedures for selecting routes within the United States for shipments of foreign research reactor spent fuel appear on the whole to be adequate and reasonable. These procedures are risk informed; they make use of standard risk assessment methodologies in identifying a suite of potential routes and then make final route selections by taking into account security, state and tribal preferences, and information from states and tribes on local transport conditions. The Department of Energy's procedures reflect the agency's position (which is consistent with Department of Transportation regulations) that the states are competent and responsible for selecting highway routes. For rail route selection, the Department of Energy's practice of negotiating routes with carriers in consultation with states is analogous to its interaction with states on highway routing.

Academy Recommendation

> The Department of Energy should continue to ensure the systematic, effective involvement of states and tribal governments in its decisions involving routing and scheduling of foreign and DOE research reactor spent fuel shipments.

For shipments to the repository, DOE would use its Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions (DIRS 172433-DOE 2003, all) to guide interactions with state and tribal governments. During planning and actual transportation operations, DOE would involve these stakeholders in route identification, funding approaches for emergency response planning and training, understanding safeguards and security requirements, operational practices, and communications and information access.

DOE is working collaboratively with states through State Regional Group committees (whose members are state officials responsible for transportation policy, law enforcement, emergency response, and oversight of hazardous materials shipments) and with American Indian tribal governments to assist them to prepare for the shipments.

In addition to State Regional Group and tribal coordination, a national cooperative effort is underway as part of the Transportation External Coordination Working Group and its various Topic Groups, which involves a broad range of stakeholder organizations that routinely interact with DOE to provide input and recommendations on transportation planning and program information. States, tribes, and industry are working with DOE to guide and focus emergency training, coordination with local officials, and other transportation activities to prepare for shipments to the repository.

Academy Finding

> Highway routes for shipment of spent nuclear fuel are dictated by DOT regulations (49 CFR Part 397). The regulations specify that shipments normally must travel by the

fastest route using highways designated by the states or the federal government. They do not require the carrier or shipper to evaluate risks of portions of routes that meet this criterion. These regulations are a satisfactory means of ensuring safe transportation, provided that the shipper actively and systematically consults with the states and tribes along potential routes and that states follow the route designation procedures prescribed by the DOT.

Academy Recommendation

DOT should ensure that states that designate routes for shipment of spent nuclear fuel rigorously comply with its regulatory requirement that such designations be supported by sound risk assessments. DOT and DOE should ensure that all potentially affected states are aware of and prepared to fulfill their responsibilities regarding highway route designations.

DOE is working collaboratively with states through State Regional Group committees (whose members are state officials responsible for transportation policy, law enforcement, emergency response, and oversight of hazardous materials shipments) and with American Indian tribal governments to assist them to prepare for the shipments.

As part of the routing discussions, DOE has provided training to officials of these stakeholders on its routing model (TRAGIS; DIRS 181276-Johnson and Michelhaugh 2003, all) and the risk model (RADTRAN 5; DIRS 150898-Neuhauser and Kanipe 2000, all). If states or tribes choose to designate alternative highway routes, technical assistance is available from the experts at the national laboratories who manage these two models. In addition, State Regional Group staff support their states with routing assistance as part of the cooperative efforts DOE supports.

L.10.4 FUTURE CONCERNS FOR TRANSPORTATION OF SPENT FUEL AND HIGH-LEVEL RADIOACTIVE WASTE

L.10.4.1 Mode for Transporting Spent Fuel and High-Level Radioactive Waste to a Federal Repository

Academy Finding

Transport of spent fuel and high-level waste by rail has clear safety, operational, and policy advantages over highway transport for large-quantity shipping programs. The committee strongly endorses DOE's selection of the "mostly rail" option for the Yucca Mountain transportation program for the following reasons:

- It reduces the total number of shipments to the federal repository by roughly a factor of five, which reduces the potential for routine radiological exposures, conventional traffic accidents, and severe accidents.
- Rail shipments have a greater physical separation from other vehicular traffic and reduced interactions with people along transportation routes, which also contributes to safety.
- Operational logistics are simpler and more efficient.
- There is a clear public preference for this option.

> The committee does not endorse the development of an extended truck transportation program to ship spent fuel cross-country or within Nevada should DOE fail to complete construction of the Nevada rail spur or procure the necessary rail equipment by the time the federal repository is opened.

Academy Recommendation

> DOE should fully implement its mostly rail decision by completing construction of the Nevada rail spur, obtaining the needed rail packages and conveyances, and working with commercial spent fuel owners to ensure that facilities are available at plants to support this option. These steps should be completed before DOE commences the large-quantity shipment of spent fuel and high-level waste to a federal repository to avoid the need to procure infrastructure and construct facilities to support an extended truck transportation program. DOE should also examine the feasibility of further reducing its needs for cross-country truck shipments of spent fuel through the expanded use of intermodal transportation (i.e., combining heavy-haul truck, legal-weight truck, and barge) to allow the shipment of rail packages from plants that do not have direct rail access.

In the Rail Alignment EIS, DOE analyzed the intermodal transfer of rail casks for generator sites that do not have direct rail access. The SEIS analysis identified nine such sites from which DOE would ship spent nuclear fuel or high-level radioactive waste using 2,650 truck shipments. In addition, DOE's transportation operational planning recognizes the value of barge and some heavy-haul truck shipments to maximize rail use to ship to the repository. DOE would address all modes of transportation in future transportation campaign plans.

L.10.4.2 Route Selection for Transportation to a Federal Repository

Academy Finding

> DOE has not made public a specific plan for selecting rail and highway routes for transporting spent fuel and high-level waste to a federal repository. DOE also has not determined the role of its program management contractors in selecting routes or specific plans for collaborating with affected states, tribes, and other parties.

Academy Recommendation

> DOE should identify and make public its suite of preferred highway and rail routes for transporting spent fuel and high-level waste to a federal repository as soon as practicable to support state, tribal, and local planning, especially for emergency responder preparedness. DOE should follow the practices of its foreign research reactor spent fuel transport program of involving states and tribes in these route selections to obtain access to their familiarity with accident rates, traffic and road conditions, and emergency responder preparedness within their jurisdictions. Involvement by states and tribes may improve the public acceptability of route selections and may reduce conflicts that can lead to program delays.

An initial step in the DOE planning process to ship spent nuclear fuel and high-level radioactive waste to the proposed Yucca Mountain repository would be to identify a national suite of routes, both rail and highway, that DOE could use. Stakeholder groups are participating with DOE in this process by examining routing criteria the Department could use in the route identification process. State Regional Groups, American Indian tribes, transportation associations, industry, federal agencies, and local government organizations are some of the groups that work collaboratively with DOE in this process. The work would be conducted through a topic group of the Transportation External Coordination Working Group. Broader public input would also be sought to collect comments on routing criteria and the process for developing a set of routes. Industry practices, DOE requirements, and analyses of regional routes that were evaluated by state organizations would be included in the process to identify a preliminary set of routes. Public involvement is central to contributing to a safe, efficient, and flexible transportation system.

L.10.4.3 Use of Dedicated Trains for Transport to a Federal Repository

Academy Finding

Studies carried out to date on transporting spent fuel by dedicated versus general trains have failed to show a clear radiological risk based advantage for either option. However, the committee finds that there are clear operational, safety, security, communications, planning, programmatic, and public preference advantages that favor dedicated trains. The committee strongly endorses DOE's decision to transport spent fuel and high-level waste to a federal repository using dedicated trains.

Academy Recommendation

DOE should fully implement its dedicated train decision before commencing the large-quantity shipment of spent fuel and high-level waste to a federal repository to avoid the need for a stop gap shipping program using general trains.

DOE made a decision to use dedicated trains for its usual mode of shipment, which offers benefits that include efficient use of casks and rail cars, lower dwell time in rail yards and, in combination with other service features, direct service from origin to destination. DOE agrees with the Academy's recommendation.

L.10.4.4 Acceptance Order for Commercial Spent Fuel Transport to a Federal Repository

Academy Finding

The order for accepting commercial spent fuel that is mandated by the Nuclear Waste Policy Act (NWPA) was not designed with the transportation program in mind. In fact, the acceptance order prescribed by the NWPA could require DOE to initiate its transportation program with long cross-country movements of younger (i.e., radiologically and thermally hotter) spent fuel from multiple commercial sites. There are clear transportation operations and safety advantages to be gained from shipping older (i.e., radiologically and thermally cooler) spent fuel first and for initiating the transportation program with relatively short, logistically simple movements to gain experience and build operator and public confidence.

Academy Recommendation

DOE should negotiate with commercial spent fuel owners to ship older fuel first to a federal repository or federal interim storage, except in cases (if any) where spent fuel storage risks at specific plants dictate the need for more immediate shipments of younger fuel. Should these negotiations prove to be ineffective, Congress should consider legislative remedies. Within the context of its current contracts with commercial spent fuel owners, DOE should initiate transport through a pilot program involving relatively short, logistically simple movements of older fuel from closed reactors to demonstrate the ability to carry out its responsibilities in a safe and operationally effective manner. DOE should use the lessons learned from this pilot activity to initiate its full-scale transportation program from operating reactors.

The terms of the "Standard Contract for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste" (10 CFR Part 961) require DOE to assign priority to those generator sites whose fuel was discharged earliest. This is usually called the "Oldest Fuel First" priority. DOE must pick up fuel from sites that were designated by those generators as those with the oldest fuel regardless of the location. At sites that were designated by the generators who own the oldest spent nuclear fuel, DOE must pick up fuel the generators have selected and that has cooled for at least 5 years.

Regardless of which fuel DOE would ship first, it would conduct the shipments safely in NRC-certified casks for that type of fuel.

L.10.4.5 Emergency Response Planning and Training

Academy Finding

Emergency responder preparedness is an essential element of safe and effective programs for transporting spent fuel and high-level waste. Emergency responder preparedness has so far received limited attention from DOE, states, and tribes for the planned transportation program to the federal repository. DOE has the opportunity to be innovative in carrying out its responsibilities for emergency responder preparedness. Emergency responders are among the most trusted members of their communities. Well-trained responders can become important emissaries for DOE's transportation program in local communities and can enhance community preparedness to respond to other kinds of emergencies.

Academy Recommendation

DOE should begin immediately to execute its emergency responder preparedness responsibilities defined in Section 180(c) of the Nuclear Waste Policy Act. In carrying out these responsibilities, DOE should proceed to (1) establish a cadre of professionals from the emergency responder community who have training and comprehension of emergency response to spent fuel and high-level waste transportation accidents and incidents; (2) work with the Department of Homeland Security to provide consolidated "all-hazards" training materials and programs for first responders that build on the existing national emergency response platform; (3) include trained emergency responders on the escort teams that accompany spent fuel and high-level waste shipments; and (4) use emergency responder preparedness programs as an outreach mechanism to communicate broadly about plans and programs for transporting spent fuel and high-level waste to a federal repository with communities along planned shipping routes.

The NWPA requires DOE to provide technical assistance and funds to states and American Indian tribes for training public safety officials of appropriate units of local governments through whose jurisdictions the Department plans to transport spent nuclear fuel or high-level radioactive waste. Section 180(c) further provides that training cover procedures required for safe routing transportation of these materials, as well as procedures for dealing with emergency response situations. Section 180(c) indicates that funding for work under this subsection would come from the Nuclear Waste Fund. Once implemented, this program would provide the increment of funding and technical assistance necessary to train fire fighters, law enforcement officers, and other public safety officials in preparation for repository shipments through their jurisdictions.

To implement this requirement in the 1990s, DOE published four *Federal Register* notices soliciting public comments on its approach to implementing Section 180(c). Comments received in response to these notices were addressed in each subsequent Federal Register notice with the last notice issued in April 1998. In 2004, the changes in homeland security and DOE's transportation practices made it timely for DOE to renew efforts to develop Section 180(c) policy and implementation procedures. Changes in emergency preparedness and funding for responders since 1998 were reviewed and evaluated as well as emergency preparedness grant programs initiated after September 11, 2001. Programs developed by Department of Homeland Security and the Federal Emergency Management Agency were considered. Relevant DOE funding and emergency response training efforts such as the Waste Isolation Pilot Plant and Foreign Research Reactor transportation programs were also evaluated.

DOE's revisiting of Section 180(c) implementation began with the formation of the Transportation External Coordination Working Group 180(c) Topic Group in April 2005. DOE also worked with the state regional groups and the Tribal Issues Topic Group of the Transportation External Coordination Working Group to solicit stakeholder input on the policy. Topic Group members wrote issue papers on specific Section 180(c) topics such as allowable activities, funding allocation method, timing and eligibility, and definitions. From these materials, DOE developed a draft policy which it issued in a Federal Register Notice on July 23, requesting additional comments from stakeholders and the public. DOE plans to conduct a pilot to test the program, and then issue the final Section 180(c) Policy.

Under the proposed policy, two grants would be made available to eligible state and tribal governments. An initial assessment and planning grant would be available about four years prior to shipments commencing through a jurisdiction. Once the state or tribe completes the assessment and planning grant activities, they would be eligible for the training grant every year that shipments travel through their jurisdiction.

L.10.4.6 Information Sharing and Openness

Academy Finding

> There is a conflict between the open sharing of information on spent fuel and high-level waste shipments and the security of transportation programs. This conflict is impeding effective risk communication and may reduce public acceptance and confidence. Post-September 11, 2001, efforts by transportation planners, managers, and regulators to further restrict information about spent fuel shipments make it difficult for the public to assess the safety and security of transportation operations.

Academy Recommendation

> The Department of Energy, Department of Homeland Security, Department of Transportation, and Nuclear Regulatory Commission should promptly complete the job of developing, applying, and disclosing consistent, reasonable, and understandable criteria for protecting sensitive information about spent fuel and high-level waste transportation. They should also commit to the open sharing of information that does not require such protection and should facilitate timely access to such information: for example, by posting it on readily accessible Web sites.

Interactions with state and tribal governments would be guided by the Office of Civilian Radioactive Waste Management Strategic Plan for the Safe Transportation of Spent Nuclear Fuel and High-Level

Radioactive Waste to Yucca Mountain: A Guide to Stakeholder Interactions (DIRS 172433-DOE 2003, all). During planning and actual transportation operations, states, tribes, industry, and other key stakeholders would be involved in route identification, funding approaches for emergency response planning and training, understanding safeguards and security requirements, operational practices, and communications and information access.

In addition to key stakeholder organizations and groups, the public has access to transportation information through the DOE web page and through the Transportation External Coordination Working Group web page. These two mechanisms allow program information that should be shared reach a broad audience.

L.10.4.7 Organizational Structure of the Federal Transportation Program

Academy Finding

> Successful execution of DOE's program to transport spent fuel and high-level waste to a federal repository will be difficult given the organizational structure in which it is embedded, despite the high quality of many current program staff. As currently structured, the program has limited flexibility over commercial spent fuel acceptance order (Section 5.2.4); it also has limited control over its budget and is subject to the annual federal appropriations process, both of which affect the program's ability to plan for, procure, and construct the needed transportation infrastructure. Moreover, the current program may have difficulty supporting what appears to be an expanding future mission to transport commercial spent nuclear fuel for interim storage or reprocessing. In the committee's judgment, changing the organizational structure of this program will improve its chances for success.

Academy Recommendation

> The Secretary of Energy and the U.S. Congress should examine options for changing the organizational structure of the Department of Energy's program for transporting spent fuel and high-level waste to a federal repository. The following three alternative organizational structures, which are representative of progressively greater organizational change, should be specifically examined: (1) a quasi-independent DOE office reporting directly to upper-level DOE management; (2) a quasi-government corporation; or (3) a fully private organization operated by the commercial nuclear industry. The latter two options would require changes to the Nuclear Waste Policy Act. The primary objectives in modifying the structure should be to give the transportation program greater planning authority; greater budgetary flexibility to make the multiyear commitments necessary to plan for, procure, and construct the necessary transportation infrastructure; and greater flexibility to support an expanding future mission to transport spent fuel and high-level waste for interim storage or reprocessing. Whatever structure is selected, the organization should place a strong emphasis on operational safety and reliability and should be responsive to social concerns.

The NWPA defines the Federal Government's responsibilities for disposal of spent nuclear fuel and high-level radioactive waste. The NWPA created the Office of Civilian Radioactive Waste Management within DOE to carry out these responsibilities, which include the development of a transportation system. The Act requires the Office to maximize use of the private sector to implement its transportation responsibilities. That collaborative development effort is underway, and would continue until the law changed.

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APPENDIX M

CULTURAL RESOURCES PROGRAMMATIC AGREEMENT

**PROGRAMMATIC AGREEMENT
AMONG
THE U.S. DEPARTMENT OF INTERIOR BUREAU OF LAND MANAGEMENT, NEVADA (BLM);
THE U.S. DEPARTMENT OF ENERGY (DOE);
SURFACE TRANSPORTATION BOARD (STB);
AND
THE NEVADA STATE HISTORIC PRESERVATION OFFICE (SHPO)
REGARDING THE NEVADA RAIL PROJECT (NRP)**

WHEREAS, Congress directed the United States Department of Energy (DOE) to characterize and evaluate the suitability of Yucca Mountain as a potential site for a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste, and if appropriate, construct and operate the facility; and

WHEREAS, on July 23, 2002, the President signed into law (PL107–200) a joint resolution of the U.S. House of Representatives and the U.S. Senate designating the Yucca Mountain site in Nye County, Nevada, for development as a geologic repository for the disposal of spent nuclear fuel and high-level radioactive waste; and

WHEREAS, in the event the Nuclear Regulatory Commission authorizes construction of the repository and receipt and possession of spent nuclear fuel and high-level radioactive waste at Yucca Mountain, DOE would be responsible for transporting these materials to the Yucca Mountain Repository as part of its obligations under the Nuclear Waste Policy Act; and

WHEREAS, on April 8, 2004, DOE selected the mostly rail transportation scenario analyzed in the "Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada," as the transportation mode both on a national basis and in the State of Nevada; and

WHEREAS, on April 8, 2004, DOE selected the Caliente rail corridor in which to examine potential alignments for construction of a rail line; and

WHEREAS, the BLM and DOE have determined that the proposed NRP in Southern Nevada may have an effect upon properties eligible for inclusion in the National Register of Historic Places (NRHP), and have consulted with the Nevada SHPO pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended (NHPA); and

WHEREAS, BLM may issue a rail line right-of-way for the NRP across BLM managed lands; and

WHEREAS, this Programmatic Agreement (PA) covers all aspects of the planning, construction, and operation of the NRP, including but not limited to the rail alignment, sidings, staging area, borrow, ballast, or quarry pits, access roads, the construction zone, extra work areas, and all ancillary facilities;

WHEREAS, the Advisory Council on Historic Preservation was offered the opportunity to participate as a consulting party to this Agreement and declined; and

NOW THEREFORE, the consulting parties agree that construction of the NRP shall be administered in accordance with the following stipulations to ensure that historic properties will be treated to avoid or mitigate effects to the extent practicable, regardless of surface ownership, and to satisfy DOE and BLM Section 106 responsibilities for all aspects of the undertaking.

I. ROLES AND RESPONSIBILITIES

The consulting parties: BLM; SHPO; STB; and DOE, agree that DOE will be the Lead Federal Agency for implementing this PA. The consulting parties agree that the consultation and compliance portions of the current *BLM/SHPO Statewide Protocol* will be used to implement this PA (Appendix E, State Protocol Agreement as amended through January 2005). The relevant portions of that protocol are incorporated by reference.

DOE, in consultation with BLM, is responsible for administering this PA. This includes but is not limited to: ensuring that the consulting parties carry out their responsibilities; overseeing all cultural resource work; assembling all submissions to the SHPO, including reports, determinations of eligibility and effect, and treatment or data recovery plans; and for seeking SHPO concurrence with all agency compliance decisions. Stipulation E.9 delegates BLM lead responsibilities to the Ely Field Office (EFO) authorized officer.

DOE will be responsible for reviewing reports and making determinations of eligibility, developing treatment options, and determining effects of the NRP on private land. BLM will be responsible for reviewing reports and making determinations of eligibility, developing treatment options, and determining effects of the NRP on public land.

II. AREA OF POTENTIAL EFFECT

The Area of Potential Effect (APE) shall be defined to include all potential direct and indirect effects to cultural resources and properties of traditional religious and cultural importance from any activities associated with the undertaking, regardless of land ownership.

The proposed rail alignment, and all access roads and work areas or other facilities for this project located outside the rail alignment, will be managed according to the provisions of this PA. The APE for the rail line will be 200 feet from the center line of the alignment or the actual ROW application submitted to BLM, whichever is greater. The APE for access roads outside of the alignment will be a minimum of 100 feet wide with at least 50 feet on either side of centerline. The minimum APE for any construction areas or other temporary use areas, outside of the alignment, will be the footprint of the area plus 100 feet outward in all directions from the perimeter of each area. The APE for assessing indirect effects on historic properties outside of the rail line alignment will extend at least one mile in all directions from the perimeter of the direct effects APE.

DOE, in coordination with BLM, may amend the APE as needed, or as requested by the SHPO, by amending this PA under the provisions of Section J. The initial study area is described and presented in Appendix A.

STIPULATIONS

DOE, in cooperation with the other consulting parties, shall ensure that the following stipulations are carried out:

A. Identification

1. DOE funds all appropriate cultural resource identification activities (Appendix D), including inventory, records research, informant interviews, archaeological, historic, or ethnographic report preparation, monitoring, and curation based on the APE for all activity areas, or portions thereof, in a manner consistent with the BLM/SHPO Statewide Protocol.

2. Each consulting party (DOE, BLM, and SHPO) will identify interested persons and tribes to DOE. Upon concurrence from the consulting parties, DOE will involve identified interested persons, tribes, or affected ethnic groups in all activities associated with the undertaking, as appropriate.

3. Required identification activities shall be completed regardless of the ownership (federal or private) of the lands involved, and DOE shall be responsible for gaining access to privately held lands by applying all reasonable means available including obtaining right of entry through courts.

4. Previously recorded sites will be updated using the Nevada IMACS site form. Sites recorded ten years previously will be re-evaluated for National Register significance.

5. In cooperation with the BLM, DOE, in accordance with the *American Indian and Alaska Native Tribal Government Policy* (DOE, 2000), shall make a good faith effort to consult with tribes and identified interested persons, or affected ethnic groups, to identify properties of traditional religious and cultural importance, and to inform the consulting parties of their eligibility and suggest appropriate treatment to avoid adverse effects to historic properties in accordance with the consultation procedures as specified in Appendix C.

6. Prior to initiating identification efforts, the consulting parties, including DOE and its cultural resource consultants, the BLM State Office, all appropriate BLM field Offices and the SHPO, will meet to finalize identification efforts, including the treatment of isolates, historic mining complexes, and linear resources. The results of those meetings which materially affect the nature of this Agreement are automatically appended to this Agreement.

B. Eligibility

1. DOE on private land, BLM on public land, and in consultation with SHPO, shall evaluate all cultural resources located within the APE for eligibility to the NRHP. Eligibility will be determined prior to the initiation of activities, within a construction segment, that may affect cultural resources. Eligibility will be determined in a manner compatible with the BLM/SHPO Statewide Protocol.

2. DOE, in consultation with BLM and SHPO, shall consult with appropriate tribes to evaluate the eligibility of properties of traditional religious and cultural importance. Consultation procedures are specified in Appendix C.

3. To the extent practicable, eligibility determinations shall be based on inventory information. If the information gathered in the inventory is inadequate to determine eligibility, DOE, through its cultural resource consultants, shall conduct limited subsurface testing or other evaluative techniques to determine eligibility.

   As needed, DOE, in consultation with the other consulting parties, will develop testing plans and submit them to the SHPO for concurrence. DOE shall provide identified tribes and interested parties with the same review opportunity as afforded the SHPO. Any proposed testing shall be limited to disturbing no more than 25 percent of the surface area of the resource being evaluated.

4. If any of the consulting parties, identified tribe or interested parties disagree regarding eligibility, DOE shall notify all consulting parties of the dispute and seek to resolve it among the parties. If the dispute cannot be resolved, DOE shall seek a formal determination of eligibility from the *Keeper of the National Register*. The Keeper will take 45 calendar days to make a determination or request additional information. The Keeper's determination will be considered final.

C. Treatment

1. In avoiding or mitigating effects, DOE on private land, BLM on public land and in consultation with SHPO, shall determine the precise nature of effects to historic properties identified in the APE. DOE, in consultation with BLM, shall develop a comprehensive treatment or data recovery plan and seek SHPO concurrence on the consolidated plan. At the same time, DOE shall provide identified tribes and interested parties with the same review timeframe as afforded the SHPO.

2. To the extent practicable, the consulting parties shall ensure that DOE avoids effects to historic properties through project design, or redesign, relocation of facilities, or by other means in a manner consistent with the BLM/SHPO Statewide Protocol. When avoidance is not practical, DOE, in consultation with the consulting parties, identified interested persons, and appropriate tribes, shall ensure that an appropriate Treatment or Data Recovery Plan designed to lessen or mitigate project-related effects to historic properties is developed and implemented.

3. For properties eligible under Criteria (a) through (c), mitigation other than data recovery may be considered in the Treatment Plan (e.g., Historic American Buildings Survey/Historic American Engineering recordation, oral history, historic markers, exhibits, interpretive brochures or publications, etc.). Where appropriate, Treatment Plans shall include provisions (content and number of copies) for a publication for the general public.

4. When data recovery is proposed, DOE, in consultation with BLM and SHPO, shall ensure that a Data Recovery Plan is developed and implemented that is consistent with the Secretary of the Interior's *Standards and Guidelines for Archaeology and Historic Preservation* (48 FR 44716), and *Treatment of Historic Properties: A Handbook* (Advisory Council on Historic Preservation 1980).

5. DOE, through its cultural resource consultants, shall implement and complete the fieldwork portions of any final Treatment or Data Recovery Plan prior to initiating any activities in any construction segment (Stipulation G) that may affect historic properties located within the area covered by the plan.

6. DOE shall ensure that all records and materials resulting from identification and treatment efforts are curated in accordance with 36 CFR 79 in a BLM-approved facility in Nevada. Materials covered by Native American Graves Protection and Repatriation Act (NAGPRA) will be handled in accordance with 43 CFR 10. All materials collected will be maintained in accordance with 36 CFR 79 or 43 CFR 10 until the final treatment report is complete and collections are curated or returned to their owners. DOE will encourage private owners to donate collections from their lands to an appropriate curation facility.

7. DOE shall ensure that all final archaeological reports resulting from actions pursuant to this PA will be provided to the consulting parties, tribes and other interested persons. All such reports shall be consistent with contemporary professional standards and the Secretary of the Interior's Standards for *Final Reports of Data Recovery Programs* (48 FR 44716-44740).

8. The consulting parties agree that visual impacts to landscapes or other historic properties that are mitigated to BLM Class II Visual Resource Management standards (substantially unnoticeable) shall be considered to have no adverse affect.

9. Any dispute concerning treatment will be resolved according to Stipulation I.

D. Discovery Situations

1. Human Remains

a. If anyone associated with the NRP encounters what appears to be human remains during construction or other project related activities, all activity will halt in the immediate vicinity of the discovery, and all project related activities will be kept at least 200 feet away from the discovery in all directions.

b. The BLM, DOE, and SHPO will be notified of the find as soon as possible.

c. The BLM shall notify its law enforcement staff, who will inform and work with local law enforcement and coroner, to determine if the human remains are associated with a crime.

d. Once it has been determined that the discovery is not the result of a crime scene, the BLM and DOE shall comply with the 43 CFR 10 on public land and Nevada Revised Statutes (NRS) 383 on private land.

2. Other Situations

a. Prior to initiating any activities within the APE, DOE will identify who will be responsible for notifying BLM of any discoveries. In addition to the stipulations here, the process detailed in Appendix B will be followed in all discovery situations, including human remains and other NAGPRA objects.

b. As soon as there is a discovery or unanticipated impact situation, all NRP related activities will halt in the immediate vicinity of the discovery. Once in a safe condition, activities would be directed away from an area at least 200 feet in all directions from the point of discovery. DOE will immediately notify BLM, the SHPO and other landowner as appropriate of the situation.

c. DOE shall notify the SHPO, BLM, tribes, and interested parties as appropriate within one working day of being notified of the discovery or unanticipated impact, and consider their initial comments on the situation. DOE will also initiate the procedures outlined in Appendix B. Within two working days after initial notification, the BLM for public lands, and DOE for private lands, shall notify all consulting parties, tribes, and interested parties, of the decision to either allow NRP activities to proceed or to require further evaluation or mitigation.

d. If, in consultation with the consulting parties, BLM determines that mitigation for discoveries or unanticipated impacts is required, DOE shall solicit comments from the consulting parties, tribes, and interested persons, as appropriate, to develop mitigating measures. The consulting parties, tribes, and interested persons, as appropriate, will be allowed two working days to provide DOE with comments to be considered when BLM or DOE, depending on land status, decides on the nature and extent of mitigative efforts. Within seven working days of initial notification, the BLM or DOE, depending on land status, will inform all consulting parties of the nature of the mitigation required, and ensure that such mitigative actions are implemented before allowing NRP activities to resume.

e. DOE, in consultation with BLM, may consider the following types of activities as categorical exclusions meaning SHPO consultations are not required:

1) Conducting non-archaeological data collection and monitoring activities, not associated with proposed undertakings, that involve new surface disturbance less than one square meter. Such activities include but are not limited to forage trend monitoring, stream gauges, weather gauges, research geophysical sensors, photoplots, traffic counters, animal traps, or other similar devices.
2) Installing facilities such as recreational, special designation, regulatory, or information signs, visitor registers, kiosks, cattle guards, gates, temporary corrals, or portable sanitation devices in previously disturbed areas outside of known historic properties.

3) Decisions and enforcement actions (that do not involve cultural resources) to ensure compliance with laws, regulations, orders, and all other requirements imposed as conditions of approval, when the original approval was subject to the NHPA Section 106 process.

3. DOE shall ensure that reports of mitigation efforts for discovery situations are completed in a timely manner and conform to the Secretary of Interior's *Format Standards for Final Reports of Data Recovery Programs* (42 FR 5377-79). Drafts of such reports shall be submitted to the SHPO for review and comment as set forth in Stipulation H.2 of this PA.

4. Any disputes or objections arising during a discovery situation that cannot be resolved by DOE, BLM and SHPO shall be handled in accordance with Stipulation I.

5. NRP related activities in the area of the discovery will be halted on public land until DOE is notified by the BLM Authorized Officer in writing that mitigation is complete and activities can resume.

E. Other Considerations, including but not limited to

1. DOE shall ensure that all stipulations of this PA are carried out by BLM, SHPO, and all contractors, subcontractors, cultural resource consultants, or other personnel involved with this undertaking.

2. DOE shall ensure that ethnographic, historic, architectural, and archaeological work conducted pursuant to this PA is carried out by or under the direct supervision of persons meeting qualifications set forth in the Secretary of the Interior's *Professional Qualification Standards* dated June 20, 1997 (62 FR 33707-33723), which are part of the larger Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (48 FR 44716) and who have been permitted for such work by the consulting parties.

3. DOE, in cooperation with BLM and SHPO, shall ensure that all its personnel and all the personnel of its contractors, subcontractors, and cultural resource consultants are trained and directed not to engage in the illegal collection of historic and prehistoric materials. DOE shall cooperate with the BLM to ensure compliance with the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470) on Federal lands and with NRS 381 for private lands.

4. DOE shall bear the expense of identification, evaluation, monitoring and treatment of all cultural resources directly or indirectly affected by NRP-related activity. Such costs shall include, but not be limited to, pre-field planning, fieldwork, post-fieldwork analysis, research and report preparation, interim and summary report preparation, publications for the general public, and the cost of curating project documentation and artifact collections.

5. Identification, evaluation, and treatment efforts may extend beyond the geographic limits of the APE when the resources being considered extend beyond the APE.

6. Properties of traditional religious and cultural importance will be identified, evaluated,

and treated through consultation with appropriate tribes or interested persons. DOE may contract for data gathering to assist in identifying, evaluating, and treating these properties. However, formal consultation, as needed, will be done by DOE in consultation with the other consulting parties. Identification, evaluation, and treatment efforts for properties of traditional religious and cultural importance shall be consistent with the BLM/SHPO Statewide Protocol and Appendix C.

7. Information on the location and nature of all cultural resources and will be made available consistent with the provisions of the Archaeological Resources Protection Act, the NHPA, and their associated implementing regulations. All information considered proprietary by tribes, will be held confidential by the consulting parties to the extent provided by Federal law.

8. DOE shall ensure that any human remains, grave goods, items of cultural patrimony, and sacred objects encountered during the undertaking are treated with the respect due such materials. In coordination with this PA, human remains and associated grave goods found on Federal land will be handled according to the provisions of the NAGPRA and its implementing regulations (43 CFR 10). Human remains and associated grave goods on private land will be handled according to the provisions of Nevada Revised Statutes NRS 383.

9. The lead and point of contact for BLM will be the EFO authorized officer. All DOE/SHPO activities will be coordinated through the EFO and all other BLM Field Offices (Las Vegas and Tonopah) will coordinate their determinations, comments, issues, and other matters through the EFO to ensure consistency among Field Offices. The EFO will consolidate all BLM comments and other communications into a single BLM communication. DOE will not interact with the BLM offices without explicit approval of the EFO. Any issues that cannot be resolved by the EFO will be referred to the BLM State Office for resolution.

F. Monitoring

1. Consulting parties may monitor actions carried out pursuant to this PA. To the extent practicable, all monitoring activities will be done so as to minimize the number of monitors involved in the undertaking.

2. Areas that DOE, in consultation with the SHPO, BLM, tribes, or interested party, identifies as sensitive historic properties or religiously or culturally important in a monitoring plan will be monitored by an appropriate professional or tribal representative during construction or operational activities that may impact the area. Monitors shall be empowered to stop work in the specific area of concern to protect resources and work will not proceed in identified sensitive areas without a monitor present.

G. Notices to Proceed

After compliance with Stipulation A.3, the BLM, in consultation with the other consulting parties may issue Notices to Proceed to DOE for individual construction segments, as defined by the Treatment Plan, which includes the approach for effects mitigation, under any of the following conditions:

1. DOE, BLM and SHPO have determined that there are no cultural resources within the APE for the construction segment; or

2. DOE, BLM and SHPO have determined that there are no historic properties within the APE for the construction segment; or

3. DOE, after consultation with the BLM, SHPO, tribes, and interested persons has implemented an adequate Treatment Plan for the construction segment, and

   a. The fieldwork phase of the treatment option has been completed; and

   b. DOE and BLM have accepted a letter summary description of the fieldwork performed and a reporting schedule for that work.

H. Time Frames

1. Reports: BLM, shall review and comment on any report submitted by DOE within 30 calendar days of receipt. DOE will consolidate all comments and send them to SHPO as needed.

2. SHPO Consultation: After review by the other consulting parties, DOE shall submit the results of all identification, evaluation, and treatment efforts, including Treatment or Data Recovery Plans to the SHPO for a 30-calendar-day review and comment period.

3. Consultation with Tribes or Interested Parties: Concurrent with SHPO review, DOE shall submit the results of all identification and evaluation efforts, including discovery situations, and Treatment Plans to tribes and other identified interested persons for a 30-calendar-day review and comment period.

4. If any consulting party to this PA, tribe, or other interested person fails to respond to DOE within 30 calendar days of the receipt of a submission, DOE shall presume concurrence with the findings and recommendations as detailed in the submission and proceed accordingly.

5. Reports: A draft final report of all identification, evaluation, treatment or other mitigative activities will be due to the BLM from DOE within nine months after the completion of the fieldwork associated with the activity, unless otherwise negotiated. Negative inventories will be documented on BLM Negative Inventory Forms and sent to BLM and SHPO in a timely manner.

6. Curation: All reports, records, photographs, maps, field notes, artifacts, and other materials collected or developed for any identification, evaluation, or treatment activities will be curated in a facility in accordance with 36 CFR 79 approved by the consulting parties at the time the final report associated with that activity is accepted by DOE, unless materials and artifacts must be returned to the owner.

7. Discovery Situations: As specified in Stipulation D.

I. Dispute Resolution

1. Should any party to this PA object to any action carried out or proposed with respect to the implementation of this PA, DOE shall consult with the objecting party to resolve the objection. If after initiating such consultation DOE determines that the objection cannot be resolved through consultation, DOE shall forward all documentation relevant to the objection to the State Director of the Bureau of Land Management. Such documentation shall include DOE's proposed response to the objection, with the expectation that within 30 days after receipt of all pertinent documentation, the State Director shall:

    a. Advise DOE that the BLM concurs in DOE's proposed final decision, whereupon DOE will respond to the objection accordingly; or,

    b. Provide DOE with an alternative to resolve the objection.

    The BLM State Director's decision shall be considered final.

2. In consultation with DOE, any determination made by the BLM State Director will be understood to pertain only to the subject of the dispute. DOE's responsibility to carry out actions required by this PA that are not subject of the dispute shall remain unchanged.

J. Amendment

Any consulting party to this PA may request that this PA be amended, whereupon the consulting parties will consult to consider such amendment.

K. Termination

Any consulting party to this PA may terminate the PA by providing 30 calendar days' advance written notice with cause to the other consulting parties, provided that the consulting parties will consult during the period prior to termination to seek agreement on amendments or other actions that would avoid termination.

L. Execution

1. Execution and implementation of this PA evidences that the consulting parties have satisfied their Section 106 responsibilities for all actions associated with the construction and installation of the NRP.

2. In the event that this PA is terminated, DOE in cooperation with BLM, shall follow the requirements of 36 CFR800 for the management of historic properties.

3. This PA shall become effective on the date of the last signature below and shall remain in effect until terminated as provided in Stipulation K, or until undertaking is completed, or a maximum five (5) years from the effective date.

CONSULTING PARTIES:

BUREAU OF LAND MANAGEMENT

By: ~~for~~ Wenker Date: 3/10/06

Title: BLM Nevada State Director

CONSULTING PARTIES:

DEPARTMENT OF ENERGY

By: *[signature]* Date: 9 FEB 2006

Title: Director, Office of National Transportation

CONSULTING PARTIES:

NEVADA STATE HISTORIC PRESERVATION OFFICE

By: Alice M. Baldrica Date: 4/17/06

Title: Deputy Nevada State Historic Preservation Officer

CONSULTING PARTIES:

SURFACE TRANSPORTATION BOARD

By: [signature] Date: Feb. 8, 2006

Title: Chief, Section of Environmental Analysis

APPENDIX N

DISTRIBUTION LIST

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APPENDIX N

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The Honorable Charlie Crist
Governor of Florida

The Honorable Chet Culver
Governor of Iowa

The Honorable James H. Douglas
Governor of Vermont

The Honorable Michael F. Easley
Governor of North Carolina

The Honorable David D. Freudenthal
Governor of Wyoming

The Honorable Christine O. Gregoire
Governor of Washington

The Honorable Charles Bradford "Brad" Henry
Governor of Oklahoma

The Honorable Jon M. Huntsman, Jr.
Governor of Utah
The Honorable Ted Kulongoski
Governor of Oregon

The Honorable Frank Murkowski
Governor of Alaska

The Honorable John H. Lynch
Governor of New Hampshire

The Honorable Martin O'Malley
Governor of Maryland

The Honorable Janet Napolitano
Governor of Arizona

The Honorable Sarah H. Palin
Governor of Alaska

The Honorable C. L. Butch Otter
Governor of Idaho

The Honorable Timothy Pawlenty
Governor of Minnesota

The Honorable Deval Patrick
Governor of Massachsetts

The Honorable Rick Perry
Governor of Texas

The Honorable Sonny Perdue
Governor of Georgia

The Honorable Edward G. Rendell
Governor of Pennsylvania

The Honorable M. Jodi Rell
Governor of Connecticut

The Honorable Robert "Bob" R. Riley
Governor of Alabama

The Honorable William "Bill" Richardson
Governor of New Mexico

The Honorable Bill Ritter, Jr.
Governor of Colorado

The Honorable Michael M. Rounds
Governor of South Dakota

The Honorable Arnold Schwarzenegger
Governor of California

The Honorable Mark Sanford
Governor of South Carolina

The Honorable Kathleen Sebelius
Governor of Kansas

The Honorable Brian Schweitzer
Governor of Montana

The Honorable Ted Strickland
Governor of Ohio

The Honorable Togiola Tulafono
Governor of American Samoa

The Honorable Eliot Spitzer
Governor of New York

N.5 Native American Tribes and Organizations

Mr. Kenny Anderson
Tribal Representative
Las Vegas Paiute Tribe

The Honorable Richard Arnold
Chairman
Pahrump Paiute Tribe

The Honorable John Azbil, Sr.
President
Round Valley Indian Tribal Council

Ms. Sandra Barela
Tribal Representative
Ely Shoshone Tribe

The Honorable Eleanor Baxter
Chairwoman
Omaha Tribe of Nebraska

The Honorable John A. Barrett
Chairman
Citizens Band of Potawatomi (OK)

The Honorable Kristi Begay
Tribal Chair

The Honorable Homer Bear, Jr.
Chairman

Wells Indian Colony Band Council

The Honorable Leonard Beowman
Chairman
Bear River Band of the Rohnerville Rancheria, California

The Honorable John Blackhawk
Chairman
Winnebago Tribe of Nebraska

The Honorable Diana Buckner
Chairwoman
Ely Shoshone Tribe

Ms. Ila Bullets
Tribal Representative
Kaibab Band of Southern Paiutes

The Honorable Delia Carlyle
Chairwoman
Ak Chin Indian Community Council

Mr. Lee Chavez
Tribal Representative
Bishop Paiute Indian Tribe

Mr. Vince Conway
Tribal Chairman
Yerington Paiute Tribe

Ms. Betty L. Cornelius
Tribal Representative
Colorado River Indian Tribes

The Honorable Carl Dahlberg
Chairman
Fort Independence Indian Tribe

Ms. Brenda Drye
Tribal Representative
Kaibab Band of Southern Paiutes

The Honorable Daniel Eddy, Jr.
Chairman
Colorado River Indian Tribes

The Honorable Blaine Edmo
Chairman, Business Council

Sac & Fox Tribal of the Mississippi in Iowa

The Honorable Audrey Bennett
President
Prairie Island Indian Community in the State of Minnesota

The Honorable Dennis Bill
Chairman
Yomba Shoshone Tribe

The Honorable Claudia Brundin
Chairwoman
Blue Lake Racheria Indian Tribe

Dr. Bonnie Eberhardt Bobb
Tribal Representative
Yomba Shoshone Tribe

The Honorable Fred Cantu
Chief
Saginaw-Chippewa Indian Tribe

Mr. Jerry Charles
Tribal Representative
Ely Shoshone Tribe

Mr. David Conrad
Executive Director
National Tribal Environmental Council (NTEC)

The Honorable Sherry Cordova
Chairwoman
Cocopah Tribe of Arizona

The Honorable Darrin Daboda
Chairman
Moapa Band of Paiute Indians

Ms. Darlene Dewey
Tribal Representative
Yomba Shoshone Tribe

Ms. Barbara Durham
Tribal Representative
Timbisha Shoshone Tribe

Mr. Atef Elzeftawy
Tribal Representative

Shoshone-Bannock Tribes of the Fort Hall Reservation of Idaho

Ms. Pauline Esteves
Tribal Representative
Timbisha Shoshone Tribe

The Honorable Darrell Flyingman
Chairman
Cheyenne-Arapaho Tribes of Oklahoma

The Honorable Harold Frank
Chairman
Forest County Potawatomi Community of Wisconsin

Ms. Grace Goad
Tribal Representative
Timbisha Shoshone Tribe

The Honorable Lori Harrison
Chairwoman of the Board of Directors
Las Vegas Indian Center

Mr. John A. James
Chairman, Cabazon General Council
Cabazon Band of Mission Indians

Mr. Mel Joseph
Tribal Representative
Lone Pine Paiute-Shoshone Tribe

Mr. Darryl King
Tribal Representative
Chemehuevi Tribe
Ms. Jacqueline Johnson
Executive Director
National Congress of American Indians

The Honorable Joe Kennedy
Chairman
Timbisha Shoshone Tribe

Mr. Bill R. Larson
Shoshone Nation/Tribe

Mr. Bill Larson
Western Shoshone Defense Project

Las Vegas Paiute Tribe

Mr. Ron Escobar
Tribal Representative
Chemehuevi Tribe

The Honorable John Feliz, Jr.
Chairwoman
Coyote Valley Band of Pomo Indians of California

Mr. Maurice Frank-Churchill
Tribal Representative
Duckwater Shoshone Tribe

The Honorable Elizabeth Hansen
Chairwoman
Redwood Valley Rancheria of Pomo Indians of California

Mr. Bill Helmer
Tribal Historic Preservation Officer
Big Pine Pauite Tribe of the Owens Valley

The Honorable Mike Jackson, Sr.
President
Quechan Tribe of the Fort Yuma Indian Reservation, California & Arizona

Ms. Clara Belle Jim
Tribal Representative
Pahrump Paiute Tribe
Mr. Gerald Kane
Tribal Representative
Bishop Paiute Indian Tribe

The Honorable Roland E. Johnson
Governor
Pueblo of Laguna, New Mexico

The Honorable Jason Johnson
Governor
Pueblo of Acoma, New Mexico

Ms. Lawanda Laffoon
Tribal Representative
Colorado River Indian Tribes

Mr. A. David Lester
Executive Director

The Honorable George R. Lewis
President
Ho-Chunk Nation of Wisconsin

The Honorable Maurice Lyons
Chairman
Morongo Band of Cahuilla Mission Indians of the Morongo Reservation, California

The Honorable Nora McDowell
Chairwoman
Fort Mojave Indian Tribe of Arizona, California & Nevada

The Honorable Dean Mike
Chairman
Twenty-Nine Palms Band of Mission Indians of California

The Honorable Richard M. Milanovich
Chairman
Agua Caliente Band of Cahuilla Indians

Mr. Armand Minthorn
Confederated Tribes of the Umatilla Indian Reservation

Ms. Gaylene Moose
Tribal Representative
Bishop Paiute Tribe

Mr. Wilfred Nabahe
Tribal Representative
Lone Pine Paiute-Shoshone Tribe

Mr. Willy Preacher
Tribal DOE Director
Shoshone-Bannock Tribe Fort Hall Business Council

The Honorable William R. Rhodes
Governor
Gila River Indian Community of the Gila River Indian Reservation, Arizona
The Honorable Ruby Sam
Chairwoman
Duckwater Shoshone Tribe

Ms. Gevene E. Savala
Tribal Representative

Council of Energy Resource Tribes

Ms. Cynthia V. Lynch
Tribal Representative
Pahrump Paiute Tribe

Ms. Dorena Martineau
Tribal Representative
Paiute Indian Tribes of Utah

The Honorable Arlan D. Melendez
Tribal Chair
Reno-Sparks Indian Tribe

Mr. Calvin Meyers
Tribal Representative
Moapa Band of Paiutes

Ms. Lalovi Miller
Tribal Representative
Moapa Band of Paiutes

The Honorable Antone Minthorn
Chairman, Board of Trustees
Confederated Tribes of the Umatilla Reservation, Oregon

The Honorable Alfreda L. Mitre
Chairwoman
Las Vegas Paiute Tribe

The Honorable Virgil Moose
Chairman
Big Pine Paiute Tribe of the Owens Valley

The Honorable Larry Nuckolls
Governor
Absentee Shawnee Tribe of Indians of Oklahoma

The Honorable Kay Rhoads
Principal Chief
Sac & Fox Nation, Oklahoma
The Honorable Tony Salazar
Chairman
Kickapoo Tribe of Oklahoma

The Honorable Joseph C. Saulque
Chairman

Kaibab Band of Southern Paiutes

The Honorable Ona Segundo
Chairwoman
Kaibab Band of Southern Paiutes

The Honorable Joe Shirley, Jr.
President
Navajo Nation, Arizona, New Mexico & Utah

The Honorable Ivan L. Sidney
Chairman
Hopi Tribe of Arizona

Mr. Philbert Swain
Moapa Band of Paiutes

Ms. Theresa A. Stone-Yanez
Tribal Historic Preservation Officer
Bishop Paiute Indian Tribe

Mr. Reginald Thorp
Emergency Management & Response Director
Shoshone-Bannock Tribe Fort Hall Business Council

Mr. Roger Tungovia
Emergency Management Services Coordinator
Hopi Tribal Council

The Honorable Glenn Wasson
Chairperson
Lovelock Tribal Council

The Honorable Lee Watterson
Chairman
Bishop Paiute Indian Tribe

The Honorable Leona L. Williams
Chairwoman
Pinoleville Rancheria of Pomo Indians of California

The Honorable Marjianne Yonge
Chairwoman
Lone Pine Paiute-Shoshone Tribe

Benton Paiute Indian Tribe

The Honorable George Scott
Town King
Thlopthlocco Tribal Town, Oklahoma

The Honorable Arturo Senclair
Governor
Ysleta Del Sur Pueblo of Texas

Mr. Herman Shorty
Navajo Nation

The Honorable Barry E. Snyder, Sr.
President
Seneca Nation of New York

The Honorable Ronald Suppah
Chairman
Confederated Tribes of the Warm Springs Reservation

Ms. Eleanor Tom
Tribal Representative
Paiute Indian Tribes of Utah

The Honorable Lora E. Tom
Chairwoman
Paiute Indian Tribe of Utah

Ms. Rebecca Van Lieshout
Coordinator, Tribal EPA
Forest County Potawatomi Community of Wisconsin

Mr. Ken Watteron
Timbisha Shoshone Tribe

Mr. Richard Wilder
Tribal Representative
Fort Independence
The Honorable Charles Wood
Chairman
Chemehuevi Indian Tribe
Genia Williams
Tribal Chairperson
Walker River Paiute Tribe

N.6 Environmental and Public Interest Groups

Ms. Beth Gallegos
Citizens Against Contamination

Mr. Robert Holden
Director
National Congress of American Indians (NCAI)
Emergency Management & Radioactive Programs

Mr. Toney Johnson
Citizens Against Nuclear Trash

Mr. David Albright
President
Institute for Science and International Security

Ms. Kathryn Landreth
State Director
Nevada Field Office
The Nature Conservancy

Mr. Thomas A. Schatz
President
Council for Citizens Against Government Waste

Mr. David Beckman
Natural Resources Defense Council
Los Angeles Office

Ms. Joan B. Claybrook
President
Public Citizen

Mr. John Flicker
Chief Executive Officer
National Audubon Society

Dave Lochbaum, Ph.D.
Sr. Nuclear Safety Engineer
Union of Concerned Scientists

Mr. Paul R. Portney
President & Senior Fellow
Resources for the Future

Mr. John Tanner

Mr. Jim Riccio
Greenpeace International

Ms. Meg Power
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National Community Action Foundation

Mr. Fred Krupp
President
National Headquarters
Environmental Defense

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Mr. Mark Wenzler
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Mr. John H. Adams
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National Audubon Society

Mr. Larry Fahn
President, Board of Directors
Sierra Club

Mr. Pete Litster
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Shundahai Network

Mr. Steven J. McCormick
President & Chief Executive Officer
The Nature Conservancy

Ms. Sara Szynelski
Program Manager
Energy Communities Alliance

Ms. Joni Arends

Coalition 21

Mr. John M. Bailey
Institute for Local Self-Reliance

Ms. Mavis Belisle
Director
Peace Farm

Mr. David Bradley
Executive Director
National Community Action Foundation

Mr. Jim C. Bridgman
Program Director
Alliance for Nuclear Accountability

Mr. David Brunner
Chief Operating Officer
National Fish & Wildlife Foundation

Ms. Jodi Dart
Alliance for Nuclear Accountability

Ms. Anna M. Frazier
Coordinator
Dine CARE

Mr. Tom Goldtooth
Executive Director
Indigenous Environmental Network

Ms. Lisa Gover
Program Director
National Tribal Environmental Council (NTEC)

Ms. Thea Harvey
Executive Director
Economists for Peace & Security at the Levy Institute

Mr. Daniel Hirsch
President
Committee to Bridge the Gap
Ms. Traci Laird
Regional Coordinator
Sierra Club
Southern Plains Regional Field Office

Executive Director
Concerned Citizens for Nuclear Safety (CCNS)

Mr. Chuck Broscious
Executive Director
Environmental Defense Institute

Dr. Robert D. Bullard
Director
Clark Atlanta University
Environmental Justice Resource Center

Ms. Kateri Callahan
President
Alliance to Save Energy

Ms. Laura Carlsen
Director, Americas Program
International Relations Center

Mrs. Nina Carter
Executive Director, Washington State Office
National Audubon Society

Mr. Thomas Cassidy
Director of Federal Programs
The Nature Conservancy

Ms. Christine Chandler
Responsible Environment Action League

Ms. Janet Feldman
Sierra Club

Mr. Bob Fulkerson
Progressive Leadership Alliance of Nevada

Ms. Susan Gordon
Director
Alliance for Nuclear Accountability

Ms. Nicole Graysmith
Legal Aid of North Carolina
Environmental Poverty Law Project

Ms. Janet Greenwald
Citizens for Alternatives to Radioactive Dumping (CARD)

Mr. Don Hancock

Reverend Mac Legerton
Center for Community Action

Mr. Jim Lyon
Senior Director for Congressional & Federal Affairs
National Wildlife Foundation

Mr. Michael McCally
Physicians for Social Responsibility

Ms. Elizabeth Merritt
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National Trust for Historic Preservation

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Consultant on Radiation Health Issues
Rocky Mountain Peace & Justice Center

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Vice President for Governmental Affairs
Trout Unlimited

Ms. Martez Norris
Administrator
Nuclear Waste Strategy Coalition

Mr. Daniel R. Patterson
Desert Ecologist
Center for Biological Diversity

Mr. Roger Rivera
President
National Hispanic Environmental Council

Nick Roth
Nuclear Age Peace Foundation

Mr. Paul Schwartz
National Campaign Director
Clean Water Action

Ms. Alice Slater
President
Global Resource Action Center for the Environment

Director, Nuclear Waste Safety Program & SRIC Administrator
Southwest Research & Information Center

Ms. Amelia Hellman
State Director
The Nature Conservancy
Nevada Field Office

Ms. Marylia Kelley
Tri-Valley CAREs

Ms. Tonya Kleuskens
President
STAND, Inc.

Mr. Ronald Lamb
Coalition for Health Concern

Mr. Lloyd Leonard
League of Women Voters

Mr. Kevin Martin
Executive Director
Peace Action Education Fund

Dr. Mildred McClain
Executive Director
Harambee House, Inc.
Projects: ACA-Net & Citizens for Environmental Justice

Mr. Allen Metscher
Citizens Advisory Council

Mr. Richard Moore
Executive Director
Southwest Network for Environmental & Economic Justice

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Executive Director and CEO
Physicians for Social Responsibility
Mr. Ehrich Pica
Friends of the Earth
Ms. Laura Raicovich
Dia Art Foundation

Ms. Susan Shaer
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Mr. Gerald Pollet
Executive Director
Heart of America Northwest

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The Wilderness Society
Ecology & Economics Research Department

Ms. Kassie Siegel
Air Climate and Energy Director
Center for Biological Diversity

Jennifer Olaranna Viereck
Healing Ourselves & Mother Earth

Women's Action for New Directions

Ms. Gail Small
Executive Director
Native Action

Mr. Derek Stack
Executive Director
Great Lakes United

Ms. Peggy Maze Johnson, Executive Director
Citizens Alert

N.7 Other Groups and Individuals

Mr. Ralph Anderson
Project Manager, Plant Support
Nuclear Energy Institute

Mr. & Mrs. Dirk and Marta Agee
Commissioner
Tempiute Grazing Association

Mr. Steven Kerekes
Director, Media Relations
Nuclear Energy Institute

Mr. William Ramsey
Executive Director
Troutman Sanders

Dr. Budhi Sagar
Technical Director
Southwest Research Institute
Center for Nuclear Waste Regulatory Analyses

Dr. Stephen Wells
President
Desert Research Institute

Ms. Barbara Bauman Tyran
Director, Washington Relations
Electric Power Research Institute
Ms. Anna Aurilio
Director, Washington, DC Office
U.S. Public Interest Research Group

Thomas B. Cochran, Ph.D.

Donald H. Baepler, Ph.D.
Executive Director
University of Nevada, Las Vegas
Harry Reid Center

Ms. Jill Kennay
Assistant Director
Natural Land Institute

Ms. Abigail C. Johnson
Consultant
Abigail C. Johnson Consulting

Ms. Mary Olson
Radioactive Waste Project & NIX MOX Campaign
Nuclear Information & Resource Service

Dr. Klaus Stetzenbach
Director
University of Nevada, Las Vegas
Harry Reid Center for Environmental Studies

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Executive Director
Western States Legal Foundation

Ms. Amy Greer
Natural Resources Defense Council
Public Education

Admiral, Retired Frank L. "Skip" Bowman

Director, Nuclear Programs
Natural Resources Defense Council, Inc.
Washington Office

Mr. David Hawkins
Director, Climate Center
Natural Resources Defense Council
Washington Office

Mr. Ace Robison
Consultant

Dr. David Shafer
Executive Director
CERM, Desert Research Institute
Center for Environmental Remediation & Monitoring

Mr. Robert A. Beck
Executive Vice President
National Coal Council

Mr. W. Scott Field
Policy Analyst
Western Interstate Energy Board (WIEB)

Ms. Angelina S. Howard
Executive Vice President
Nuclear Energy Institute

Mr. Steven P. Kraft
Director, Spent Nuclear Fuel Management
Nuclear Energy Institute

Mr. Richard M. Loughery
Director, Environmental Activities
Edison Electric Institute

Mr. Robert Robinson
Senior Economist
Center for Applied Research

President & Chief Executive Officer
Nuclear Energy Institute

Mr. Tom Barry
Senior Policy Analyst & Co-founder
International Relations Center

Mr. Kevin Kamps
Nuclear Information & Resource Service

Mr. Paul Leventhal
Founding President
Nuclear Control Institute

Arjun Makhijani, Ph.D.
President
Institute for Energy & Environmental Research (IEER)

Mr. Rod McCullum
Nuclear Energy Institute

Mr. Robert J. Moran
Washington Representative
American Petroleum Institute

Mr. Vincent Scoccia
Nye Regional Medical Center

Mr. Richard Bryan, Chairman
Nevada Commission on Nuclear Projects

Ms. Paula Cotter, Esq.
Senior Environmental Counsel
National Association of Attorneys General (NAAG)

Mr. Patrick Cummins
Air Quality Project Manager
Western Regional Air Partnership

Ms. Kara Colton
National Governors' Association (NGA)
Environment, Energy & Natural Resources Division

Mr. Robert E. Fronczak
Assistant Vice President, Environment & Hazardous Materials
Association of American Railroads (AAR)

Ms. Shauna Larsen
Government Relations Representative
American Public Power Assoc.

Mr. Edward W. Lent, III
Region III President
International Association of Emergency Managers
c/o General Physics Corporation

Mr. Robert E. Marvin
Director
FRA/State Rail Safety Participation Program
c/o Transportation Division
Ohio Public Utilities Commission

Mr. William T. Pound
Executive Director
National Conference of State Legislatures

Mr. Jim B. Reed
Transportation Program Director
National Conference of State Legislators (NCSL)

Ms. Lisa R. Sattler
Senior Policy Analyst
Council of State Governments-Midwest Office (CSG/MW)

Ms. Diane Shea
Director, Natural Resources Committee
National Governors' Association

Mr. Joe Strolin
Western Interstate Energy Board
Mr. Robert Thompson
Energy Communities Alliance

Mr. Dave Trebisacci, CSP
Senior Fire Service Specialist
National Fire Protection Association (NFPA)

Mr. Chris Turner
Training Coordinator
International Association of Fire Fighters (IAFF)
Hazardous Materials Training Department
Safety & Operations Dept.

Mr. Walter Isaacson
President & CEO
The Aspen Institute
Program on Energy, the Environment & the Economy

Mr. Douglas Larson
Executive Director
Western Interstate Energy Board (WIEB)

Mr. William Mackie
Program Manager
Western Governors' Association

Mr. Brian J. O'Connell
Director, Nuclear Waste Program
National Assoc. of Regulatory Utility Commissioners (NARUC)

Mr. Duane Parde
Executive Director
American Legislative Exchange Council (ALEC)

Mr. Randy Rawson
President
American Boiler Manufacturers Association

Ms. Eileen Supko
Senior Consultant
Energy Resources International, Inc.

Mr. James S. Tulenko
President
American Nuclear Society

Mr. George D. Turner
President & Chief Executive Officer
American Nuclear Insurers

Arden L. Bement, Ph.D.
Director
National Science Foundation
Mr. Anthony DeSouza
Director, Board on Earth Studies & Natural Sciences
National Academy of Sciences

Ms. Julie Ufner
Associate Legislative Director
National Association of Counties (NACo)

N.8 Reading Rooms and Libraries

Esmeralda County Yucca Mountain Oversight Office
Goldfield, NV

Nye County Department of Natural Resources and Federal Facilities
Pahrump, NV
U.S. Department of Energy Headquarters Office Public Reading Room
Washington, D.C.

Ms. Susan Beard
Librarian
Northern Arizona University
Cline Library

Ms. Michelle Born
Librarian
Clark County Library
Main Branch
Reference Department

Mr. Bert Chapman
Purdue University
Hesse Library - Documents Department

Ms. Pauline Conner
Administrator
Savannah River Operations
University of South Carolina-Aiken, Gregg-Graniteville Library
Public Reading Room

Ms. Kathy Edwards
Nevada State Library & Archives

Lincoln County Nuclear Waste Project Office
Caliente, NV

Pahrump Yucca Mountain Information Center
Pahrump, NV

The University of Nevada Libraries
Business and Government Information Center
Reno, NV

Mr. Dan Barkley
University of New Mexico
Zimmerman Library

Ms. Jan Bennett
Public Affairs Representative
Entergy Nuclear Vermont Yankee

Ms. Carol Brown
Office of Intergovernmental Affairs
City of Chicago

Mr. Hui Hua Chua
Michigan State University

Ms. Kay Collins
University of California, Irvine
Langson Library

Ms. Sherry DeDecker
University of California, Santa Barbara
Davidson Library - Government Information Center

Ms. Amy Sue Goodin
Associate Director of Research
University of New Mexico
Institute for Public Policy

Ms. Heather Elliott
Clearinghouse Coordinator, Nevada State Clearinghouse
Department of Administration
State of Nevada

Ms. Sandra Groleau
Bates College Library

Ms. Paige Harper
University of Florida
Documents Department

Ms. Deanna Harvey
Strategic Petroleum Reserve Project
Management Office
SPRPMO/Reading Room

Mr. John Horst
National Renewable Energy Lab
Public Reading Room

Librarian, Government Documents
University of New Hampshire
Dimond Library

Librarian
San Jose State University
Martin Luther King, Jr. Library
Government Publications Department

Librarian
University of Colorado, Boulder
Library - Government Publications

Librarian
University Library, California State University
Government Documents

Librarian
Susanville District Library

Librarian
Sparks Branch Library

Librarian
Fishlake Branch Library

Librarian
Carson City Library
Reference Department
Librarian
Laughlin Branch Library

Librarian
Needles Library

Public Reading Room

Ms. Verna Graybill
Librarian
Northwestern Oklahoma State University
J.W. Martin Library Depository

Mr. Michele Hayslett
North Carolina State University Libraries
Government Information Services – RISD

Mr. Mark Holt
Library of Congress

Ms. Alisa Huckle
Mr. Brent Jacobson
Idaho Operations Office
INEEL Technical Library
U.S. DOE Public Reading Room

Mr. Walter Jones
University of Utah
Marriott Library, Special Collections

Librarian
University of Notre Dame
Hesburgh Library - Government Documents
Center

Librarian
University of California, Riverside
Rivera Library - Government Publications
Department

Librarian
U.S. Geological Survey
Serial Records Unit
National Center

Librarian
Spring Valley Library

Librarian
Billinghurst Middle School Library

Librarian
Inyo County Free Library

Librarian
New Mexico State University

Librarian
Round Mountain Public Library

Librarian
University of Wisconsin, Madison
Wendt Library - Technical Reports Center

Librarian
University of Texas, San Antonio
Library - Government Documents Department

Mrs. Pat Loper
Great Basin College Library

Mr. Joseph Milazzo
Southern Methodist University
Fondren Library East
Government Information

Ms. Janice Parthree
U.S. Department of Energy
Richland Operations Center
Public Reading Room
Mr. Tim D. Petrosky
Public Affairs Director
Consumer Energy
Big Rock Point

Mr. William H. Schalk
Communications Manager
American Electric Power Company
Cook Visitor Information Center

Ms. Susie Skarl
Head, Government Publications
University of Nevada, Las Vegas
Lied Library

Ms. Barbara Sullivan
Center for Health, Environment and Justice
CHEJ Library

Ms. T. Twyford
Librarian
Tecopa Library

Mr. John Walters
Branson Library - Documents

Librarian
North Las Vegas Public Library
Librarian
Brainerd Memorial Library

Librarian
University of Rhode Island
Library - Government Publications Office

Librarian
University of Maryland, Baltimore County
Albin O. Kuhn Library and Gallery -
Government Documents

Mr. David Mienke
Alliant Utilities, Inc.
Duane Arnold Energy Center

Mr. Gary Morell
College Hill Library
Rocky Flats Field Office

Mr. Walter Perry
U.S. Department of Energy Information Center
Oak Ridge Operations Office

Ms. Angela Riley
Community Relations Representative
TXU Electric & Gas
Comanche Peak Visitors Center

Mr. John Shuler
Richard J. Daley Library
Documents, Maps and Microforms Department
University of Illinois at Chicago

Mr. Bobby St. John
Media Coordinator
Washington TRU Solutions

Mr. Tim Sutherland
Indiana University
Northwest Library, Documents Department
Mr. Carl E. Unger
Senior Communications Representative
Public Information Center
Arizona Public Service Company
Palo Verde Nuclear Generating Station

Utah State University
Merrill Library

Ms. Judy Weiss
U.S. Department of Energy
Oakland Operations Office

Mr. Joel Yudken
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Mr. Robert A. Apel
Newcrest Resources, Inc.

W. A. Armstrong
Preservation Capital Corp

Mr. Gerald W. Baughman
Nevada Eagle Resources, LLC

Mr. Jonathan M. Brown
Nevada Mining Association

Mr. Paul J. Burkett
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New Mexico Energy Minerals & Natural Resources Dept.

Mr. John M. Engler
President
National Association of Manufacturers

Mr. Michael Govan
Dia Art Foundation

Ms. Arlene Grider
President
Independence Chamber of Commerce

Ms. Sharon Kerrick
Manager
American Nuclear Society (ANS)
Outreach & Volunteer Dept.

Ms. Elaine Watson
Boise State University
Library - Government Documents

Ms. Beryl A. Zundel
Sunrise Library

Mr. Bill Zimmerman
U.S. Department of Energy
Bonneville Power Administration
BPA-CILL-1

Mr. David Blee
Executive Director
U.S. Transport Council

Mr. Dennis P. Bryan
Converse Consultants

Mr. John J. Castellani
President
Business Roundtable

Mr. Thomas Donohue
President and CEO
U.S. Chamber of Commerce

Mr. Glenn L. English, Jr.
Chief Executive Officer
National Rural Electric Cooperative Assoc.

Mr. Irwin Forman
Formarts Corp.

Mr. Robert Alan Kemp
NV Central, Great Basin, NV Northern Railroads

Mr. Thomas R. Kuhn
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Mr. Michael McKloskey
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Mr. Alan H. Richardson
President and CEO

Mr. Scott Palmer
Brotherhood of Locomotive Engineers & Trainment

Mr. Cort Richardson
Project Director
Council of State Governments - Eastern Regional Conference (CSG/ERC)

Mr. Steven Specker
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American Public Power Association

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National Conference of State Legislatures (NCSL)

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Transportation Trade Dept

Mr. Gary Vine
Sr. Washington Representative
Electric Power Research Institute (EPRI)

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